AEROSPACE INFORMATION REPORT

AIR4844™	REV. D
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(R) Composites and Metal Bonding Glossary

RATIONALE

AIR4844 is a comprehensive list of terms, acronyms, and their definitions and abbreviations used in the composite and metal material, fabrication, and repair industry. Revision D is a full revision of content and editorial structure; therefore, no change bars are provided.

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1. SCOPE

The following terminology has been generated by the ATA/IATA/SAE Commercial Aircraft Composite Repair Committee (CACRC) and provides terminology for design, fabrication, and repair of composite and bonded metal structures.

1.1 Purpose

The purpose of this SAE Aerospace Information Report (AIR) is to provide terminology that should be used when developing CACRC repair documents or repair documents produced by airlines or airframe and engine manufacturers.

2. APPLICABLE DOCUMENTS

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AIR5431 Repair Tooling

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D1002 Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)

ASTM D1876 Standard Test Method for Peel Resistance of Adhesives (T-Peel Test)

ASTM D2339 Standard Test Method for Strength Properties of Adhesives in Two-Ply Wood Construction in Shear by Tension Loading

ASTM D3165 Standard Test Method for Strength Properties of Adhesives in Shear by Tension Loading of Single-Lap-Joint Laminated Assemblies

ASTM D4896 Standard Guide for Use of Adhesive-Bonded Single Lap-Joint Specimen Test Results

ASTM D7905 Standard Test Method for Determination of the Mode II Interlaminar Fracture Toughness of Unidirectional Fiber-Reinforced Polymer Matrix Composites

2.3 EASA Publications

Available from European Union Aviation Safety Agency, Konrad-Adenauer-Ufer 3, D-50668 Cologne, Germany, Tel: +49 221 8999 000, www.easa.europa.eu.

AMC 20-29 Composite Aircraft Structure

EASA AMC 145.A.30 Personnel Requirements

International Maintenance Review Board Policy Board (IMRBPB) Issue Paper (IP) 122: “Clarification of Definitions for General Visual (GVI), Detailed (DET), and Special Detailed (SDI) Inspections”

2.4 FAA Publications

Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591, Tel: 866-835-5322, www.faa.gov.

AC 20-107 Composite Aircraft Structure

2.5 ISO Publications

Copies of these documents are available online at https://webstore.ansi.org/.

ISO 10354:1992 Adhesives - Characterization of durability of structural-adhesive-bonded assemblies - Wedge rupture test

3. COMPOSITES AND METAL BONDING GLOSSARY

The acronyms and contractions that can be found in this document are the examples of some of the terms mentioned in the CACRC documents, composite materials industry publications, meetings, or conversations. Some acronyms and contractions have become common words in the English and/or aerospace technical language (Radome, flaperon, mil, and micron are examples), and are pronounced phonetically. Some acronyms and contractions remain uppercase in their spelling, but are also spoken phonetically (EASA, FAR, HIRF, PACS, and PEEK are examples).

Where the abbreviations ES, ET, RT, and UT are shown in brackets, they indicate the type of non-destructive test (inspection) in which the term is normally used. Some of these definitions have applications outside NDI/NDT. The use of these acronyms does not mean that they only apply to NDI/ NDT applications.

3.1 A

A-BASIS: The “A” mechanical property value is the value above which at least 99% of the population of values is expected to fall, with a confidence of 95%. Also known as A-allowable. See B-BASIS, S-BASIS, and TYPICAL BASIS.

ABHESIVE: A material that resists adhesion. A film or coating applied to surfaces to prevent sticking, heat sealing, etc.; for example, a PARTING AGENT or MOLD RELEASE AGENT.

ABL BOTTLE: An internal pressure test vessel used to determine the quality and properties of the filament-wound material in the vessel.

ABLATION: The degradation, decomposition, and erosion of a material caused by high temperature, pressure, time, percent oxidizing species, and velocity of gas flow. A controlled loss of material to protect the underlying structure.

ABLATIVE PLASTIC: A material that absorbs heat (with low material loss and char rate) through a decomposition process (pyrolysis) that takes place at or near the surface exposed to the heat. This mechanism essentially provides thermal protection (insulation) of the subsurface materials and components by sacrificing the surface layer.

ABRADED YARN: A filament yarn in which filaments have been cut or broken to simulate the surface character of spurn yarns. Abraded yarns are usually plied or twisted with other yarns before use.

ABRASION: The wearing a way of a portion of the surface by either natural (rain, wind, etc.), mechanical (misfit, etc.), or man-made (over sanding, etc.) means; penetrates only the surface finish. In a composite, does not damage the first ply.

ABRASIVE WATERJET: Similar to a conventional waterjet except that a fine grit (usually garnet) is mixed into the high-pressure water stream. Useful for cutting cured organic–matrix and metal-matrix composite materials. The main cutting action is an accelerated erosion process.

ABRASIVES: Special hard mineral ingredients employed to impart abrasive power to rubber articles used for abrading, grinding, or polishing such as rubber erasers or hard or soft rubber grinding wheels. Also used with paper or fabric backings and as abrasive discs or flapper wheels. Pumice, silica, tripoli sand, carborundum, silicon carbide, cerium oxide, and diamond powder may be used as abrasives. The surface finish in microinches (µin) can be related directly to the grit size of the abrasive.

ABSOLUTE HUMIDITY: Weight of water vapor present in a unit volume of air, such as grams per cubic foot or grams per cubic meter. The amount of water vapor is also reported in terms of weight per unit weight of dry air, such as grams per pound of dry air, but this value differs from values calculated on a volume basis, which should not be referred to as absolute humidity. It is designated as humidity ratio, specific humidity, or moisture content.

ABSOLUTE VISCOSITY: Of a fluid adhesive, the tangential force on unit area of either of two parallel plates at unit distance apart when the space between the plates is filled with the fluid in question and one of the plates moves with unit differential velocity in its own plane. The unit of measurement is the centipoise.

ABSORBATE: A material which is absorbed by another.

ABSORBED MOISTURE: Water is absorbed by the resin and fibers at a molecular level. The amount of water absorbed is dependent on the temperature and humidity of the surrounding air and the time of exposure. The water absorbed is not visible. Under test conditions, absorbed moisture is measured by weight gain. In the case of a honeycomb panel, water can also penetrate non-metallic honeycomb core material.

ABSORBENT: A material that takes in or absorbs another.

ABSORPTION: (i) The penetration into the mass of one substance by another. (ii) The process whereby energy is dissipated within a specimen placed in a field of radiant energy. (iii) The capillary or cellular attraction of adherent surfaces to draw off the liquid adhesive film into the substrate. (iv) A process in which one material (the absorbent) takes in or absorbs another (the adsorbate).

ACCELERATED TEST: A test procedure in which conditions are increased in magnitude to reduce the time required to obtain a result. To reproduce in a short time the deteriorating effect obtained under normal service conditions.

ACCELERATOR: A material that, when mixed with a catalyst or a resin, will speed up the chemical reaction between the catalyst and the resin either in polymerizing of resins or vulcanization of rubbers. Also known as promoter.

ACCEPTANCE TEST: A test or series of tests, called out in a material specification, conducted by the supplier, procuring agency, or an agent thereof, to determine whether an individual lot of material conforms to the purchase order or contract or to determine the degree of uniformity of the material supplied by the vendor or both. Note that specifications usually state sampling techniques, test procedures, and minimum requirements for acceptance.

ACCREDITING AGENCY: The organization issuing the certificate.

ACCURACY: The degree of conformity of a measured or calculated value to some recognized standard or specified value. Accuracy involves the systematic error of an operation.

ACETAL PLASTICS: Plastics based on polymers having a predominance of acetal linkages in the main chain.

ACETONE: Commonly used wipe solvent. Also known as 2-propanone and di-methyl ketone. Used for cleaning composite surfaces prior to bonding and also metal surfaces prior to other treatments. Can also be used to remove uncured epoxy resin from tools and other items. Classed as “Seriously Flammable” with a flash point of -4 °F (-20 °C). Has a high evaporation rate.

ACID: A chemical compound containing one or more hydrogen atoms available for reaction with active metals or alkaline solutions.

ACOUSTIC EMISSION: A measure of integrity of a material, as determined by sound emission when a material is stressed. Ideally, emissions can be correlated with defects and/or incipient failure.

ACOUSTIC IMPEDANCE [UT]: Resistance to the flow of ultrasonic energy in a medium. Impedance is a product of wave velocity and material density.

ACRYLIC PLASTIC: Any of a family of synthetic resins made by the polymerization of esters of acrylic acid and its derivatives. See POLY METHYL METH ACRYLATE.

ACTIVATION: The (usually) chemical process of making a surface more receptive to bonding to a coating or an encapsulating material.

ACTIVATOR: An additive used to promote the curing of matrix resins and reduce curing time. See ACCELERATOR.

ADDITION POLYMERIZATION: A chemical reaction in which simple molecules (monomers) are added to each other to form long-chain molecules (polymers) without forming by-products. The small molecules, monomers, add together to form the polymer molecule. The polymer is usually linear.

ADDITIVE: Any substance added to another substance, usually to improve properties, such as plasticizers, initiators, light stabilizers, and flame retardants.See FILLER and FIRE-RETARDANT ADDITIVES.

ADDITIVE MANUFACTURING: Any process that involves adding material by joining, fusing, or selectively melting layer-by-layer to make objects from 3D model data.

ADHERE: To cause two surfaces to be held together by adhesion.

ADHEREND: A body that is held to another body, usually by an adhesive. A detail or part prepared for bonding.

ADHESION: The state in which two surfaces are held together at an interface by mechanical or chemical forces or interlocking action or both.

ADHESION FAILURE: Rupture of an adhesive bond such that the separation appears to be at the adhesive-adherent interface.

ADHESION PROMOTER: A coating applied to a substrate before it is coated with an adhesive, to improve the adhesion of the adhesive. Also known as PRIMER. A primer may and should improve the durability of a joint in the long-term but does not always increase joint strength.

ADHESION, MECHANICAL: Adhesion due to valence forces at the adhesive-substrate surface interface. Such valence forces are of the same type that give rise to cohesion.

ADHESIVE: A substance capable of holding two materials together by surface attachment. Adhesive can be in film, liquid, or paste form. In this context, the term is used to denote structural adhesives; i.e., those which create attachments capable of transmitting significant structural loads.

ADHESIVE AGE: The age of the material from the date of shipment by the manufacturer to the present date.

ADHESIVE BATCH: One production mixture of adhesive by a manufacturer with the batch number assigned by the manufacturer.

ADHESIVE BONDING: A material joining process in which an adhesive, placed between facing surfaces, solidifies to bond the surfaces together.

ADHESIVE FILM: A synthetic resin adhesive, with or without a carrier fabric, usually of the thermosetting type, in the form of a thin film of resin, used under heat and pressure in the production of bonded structures. A convenient form of adhesive for production or repair because it is easy to handle and already mixed. Requires refrigerated storage.

ADHESIVE FLASH: The cured adhesive squeezed out around the edges of doublers, at butt splices and at the ends of the assembly.

ADHESIVE JOINT: The location at which two adherents or substrates are held together with a layer of adhesive. The general area of contact for a bonded structure.

ADHESIVE LOT: One batch of adhesive or a portion of one batch, submitted for acceptance at one time. The adhesive lot number is assigned by the manufacturer.

ADHESIVE ROLL: Adhesive material including suitable protection film(s) or foil(s) according to the process control document (PCD) contained on one support tube.

ADHESIVE STRENGTH: Strength of a bond between an adhesive and an adherent.

ADHESIVE SYSTEM: A compatible primer and film adhesive for system bonding metal-to-metal assemblies and a primer, pour coat, and film adhesive for bonding sandwich assemblies.

ADHESIVE, INTERMEDIATE TEMPERATURE SETTING: See INTERMEDIATE TEMPERATURE SETTING ADHESIVE.

ADHESIVE, SUPPORTED: An adhesive film which has a woven or nonwoven carrier cloth.

ADHESIVE, UNSUPPORTED: A film adhesive which has no carrier cloth.

ADIABATIC EXTRUSION: A method of extrusion in which, after the extrusion apparatus has been heated sufficiently by conventional means to plastify the material, the extrusion process can be continued with the sole source of heat being the conversion of the drive energy, through viscous resistance of the plastic mass in the extruder.

ADK: Notation used for the k-sample Anderson-Darling statistic, which is used to test the hypothesis that k batches have the same distribution.

ADMIXTURE: The addition and homogeneous dispersion of discrete components before cure.

ADSORPTION: The adhesion of the molecules of gases, dissolved substances, or liquids in concentrated form, to the surfaces of solids or liquids with which they are in contact. A concentration of a substance at a surface or interface of another substance.

ADVANCED CERAMICS: Ceramic materials that exhibit superior mechanical properties, corrosion/oxidation resistance, or electrical, optical, and/or magnetic properties.

ADVANCED COMPOSITES: Composite materials applicable to aerospace or other high-performance component construction and made by imbedding high-strength and/or high-modulus fibers within an essentially homogeneous matrix. See FILAMENTARY COMPOSITES.

ADVANCED FILAMENTS: Continuous filaments made from high-strength, high-modulus materials for use as constituents of advanced composites.

AFTERBAKE: See POSTCURE.

AGING: The effect on materials of exposure to an environment for an interval of time. The process of exposing materials to an environment for an interval of time (or AGING).

AGGLOMERATION: The act or condition whereby minute particles dispersed in a liquid or viscous medium become united into larger groups.

AGGREGATE: A hard, coarse material usually of mineral origin used with an epoxy binder (or other resin) in plastic tools. Also used in flooring or as a surface medium.

AIR BUBBLE VOID: Air entrapment within and between the plies of reinforcement or within a bond line or encapsulated area localized, non-interconnected, spherical in shape.

AIR DRYING: A material is said to be air drying when it can be dried at ordinary room temperature without the use of artificial heat.

AIR ENTRAPMENT: An internal condition, observable as small bubbles (lighter colored spots). Does not refer to surface conditions.

AIR LOCKS: Surface depressions on a molded part, caused by trapped air between the mold surface and the plastic.

AIR VENT: Small outlet to prevent entrapment of gases in a molding or tooling fixture.

ALCOHOL: A hydrocarbon derivative in which one or more hydroxyl (OH) groups have replaced a corresponding number of hydrogen atoms. Some are produced by fermentation and others synthetically. Ethyl grain is the best known and is described as “alcohol.” Commercial alcohol generally contains a denaturant to render it unfit for human consumption and exempt from taxation. This solvent group is relatively expensive and is usually considered to be among the more harmless industrial solvents.

ALDEHYDE: (i) Acetaldehyde CH_3-CHO reacts with aniline to give an accelerator. One of the first known antioxidants. (ii) Aldehydes are volatile liquids with sharp, penetrating odors that are slightly less soluble in water than are corresponding alcohols. (iii) A broad class of organic compounds having the generic formula RCHO and characterized by an unsaturated carbonyl group (C=O).They are formed from alcohols by either dehydrogenation or oxidation, and thus occupy an intermediate position between primary alcohols and the acids obtained from them by further oxidation.

ALIPHATIC: Organic compounds (hydrocarbons) in which carbon atoms are arranged in an open or straight chain. More commonly known as naphtha’s, they are prepared by straight-run, overhead distillation of petroleum. Familiar examples include gasoline, kerosene, paraffin, and natural gas. Of the common solvents, they are the lowest in price and the least toxic.

ALIQUOT: A small, representative portion of a larger sample.

ALKALI: Substance that neutralizes acids to form a salt and water. Yields hydroxyl (OH^-) ions in water solution. Proton acceptor. Turns litmus paper blue.

ALKALINITY: The condition of having or containing hydroxyl (OH^-) ions. Containing alkaline substances. The opposite of acidic. The property of turning red litmus paper blue and of neutralizing acids to form salts.

ALKYD PLASTIC: Thermoset plastic based on resins composed principally of polymeric esters, in which the recurring ester groups are an integral part of the main polymer chain, and in which ester groups occur in most cross-links that may be present between chains.

ALLOTROPY: The existence of a substance and especially an element in two or more forms (as in crystals). See GRAPHITE.

ALLOWABLE DAMAGE LIMITS (ADL): The maximum dimension of unrepaired, removed, or reworked material that is permitted for returning the structure to a serviceable condition. Refer to the specific OEM manuals allowable damage limits (ADL) section, service bulletin, or other approved engineering data for the ADL.

ALLOWABLES: Material values that are determined from test data at the laminate or lamina level on a probability basis (e.g., A- or B-basis values, with 99% probability and 95% confidence, or 90% probability and 95% confidence, respectively). The amount of data required to derive these values is governed by the statistical significance (or basis) needed. See A-BASIS, B-BASIS, S BASIS, and TYPICAL BASIS.

ALLOY: In plastics, a blend of polymers or copolymers with other polymers or elastomers under selected conditions for example, styrene-acrylonitrile. Also known as polymer blend. In metals, a substance having metallic properties and being composed of two or more chemical elements of which at least one is a metal.

ALLYL PLASTIC: A thermoset plastic based on resins made by addition polymerization of monomers containing allyl groups for example, diallyl phthalate (DAP).

ALODINE: Is a liquid chemical used to produce a protective coating on aluminum or aluminum-alloys. The coating provides protection for aluminum and is an excellent bond for any sort of adhesive that needs a metal bond preparation. It is also known as BONDERITE (a trademark of Henkel). See IRIDITE and CHEMICAL CONVERSION COATING.

ALTERNATING STRESS: (i) A stress varying between two maximum values which are equal but with opposite signs, according to a law determined in terms of time. (ii) This term is sometimes used to define changes between stresses of different levels; i.e., not necessarily equal levels. It can also be used for stresses alternating between two levels of tension only or two levels of compression only.

ALTERNATING STRESS AMPLITUDE: A test parameter of a dynamic fatigue test one-half the algebraic difference between the maximum and minimum stress in one cycle.

ALUMINIZED GLASS: Electrically conductive aluminum coated glass fiber added to the exposed surface of a composite laminate as part of the LIGHTNING STRIKE PROTECTION.

ALUMINUM COATED GLASS FABRIC: An aluminum coated glass fabric ply is applied to non-conducting composite panels to provide lightning protection or electromagnetic shielding to electronic components mounted behind the part.

ALUMINUM FLAME SPRAY COATING: Method of applying an aluminum coating to non-conducting composite panels to provide lightning protection or electromagnetic shielding to electronic components mounted behind the part.

ALUMINUM MESH: See MESH.

AMBIENT: The surrounding environmental conditions, such as pressure, temperature, or relative humidity.

AMINE RESIN: A synthetic resin derived from the reaction of urea, thiourea, melamine or allied compounds with aldehydes, particularly formaldehyde. See AMINO.

AMINO: Indicates the presence of an NH_2 or NH group.

AMINO PLASTICS: Plastics based on resins made by the condensations of amines, such as urea and melamine, with aldehydes. See AMINE RESIN.

AMINO-SILANE FINISH: Applied to glass fibers to give a good bond to epoxide, phenolic and melamine resins. Must be used in glass-fiber for use with wet lay-up phenolic resins.

AMM: Aircraft maintenance manual provided by aircraft manufacturers. Sometimes referred to as “MM” or “OEM MM.”

AMORPHOUS PLASTIC: A plastic that has no crystalline component. There is no order or pattern to the distribution of the molecules. It is also known as AMORPHOUS PHASE.

AMPHOTERIC: Having the property of behaving as an acid or a base according to the condition of the reaction. Zinc hydroxide is a well-known example. It dissolves in alkalis as well as in acids. Albumen is an example of an amphoteric organic colloid.

AMPLITUDE [UT]: The extent of vibratory movement measured from a mean position to an extreme; the maximum departure of alternating current or voltage from the average value; indicated by vertical height on an “A” scan presentation.

ANAEROBIC ADHESIVE: An adhesive that cures only in the absence of air after being confined between assembled parts (absence of oxygen).

ANELASTICITY: A characteristic exhibited by certain materials in which strain is a function of both stress and time, such that while no permanent deformations are involved, a finite time is required to establish equilibrium between stress and strain in both the loading and unloading directions.

ANGLE WRAP: Tape fabric wrapped on a starter dam mandrel at an angle to the centerline.

ANGLE-PLY LAMINATE: (i) A laminate having fibers of adjacent plies oriented at alternating angles. Any filamentary laminate which is not uniaxial. (ii) A laminate built from orthotropic plies that is symmetrical with respect to the laminate mid-plane and the ply orientations of adjacent plies are alternating. Such laminates have a special stress/strain behavior.

ANGSTROM UNIT: The unit used to define the short wavelengths of the electromagnetic spectrum such as visible light, ultraviolet light and X-rays. One angstrom unit is 10^{-10} m or 1/250000000 inch.

ANHYDRIDE: Usually an acid from which water has been removed, practically or theoretically (e.g., acetic anhydride).

ANHYDROUS: Describes a compound or mixture which has lost all its water, in particular, water of crystallization or absorbed water.

ANION: In solutions of electrolytes, the negatively charged ion which, during electrolysis, travels towards the positive electrode or anode. When rubber is deposited from aqueous solutions, the colloidal rubber particles behave as anions and deposit at the anode.

ANISOTROPIC: Having mechanical and/or physical properties which vary with direction relative to natural reference axes inherent in the material. See ANISOTROPY OF LAMINATES.

ANISOTROPIC LAMINATE: One in which the properties are different in different directions along the laminate plane.

ANISOTROPY OF LAMINATES: The difference of the properties along the directions parallel to the length or width of the lamination planes and perpendicular to the lamination.

ANNEALING: In plastics, heating to a temperature at which the molecules have significant mobility, permitting them to reorient to a configuration having less residual stress.

ANODE: The positive anode in a solution of electrolytes (or in a vacuum tube) at which electrons leave the solution and at which oxidation occurs. It is also the positive pole of a battery.

ANODIZING: The application of a protective oxide film on aluminum, magnesium, and other light metals by passing an electric current through an acid bath in which the metal is suspended. The metal serves as the anode. The most common acids used are sulfuric, chromic and phosphoric.

ANTIOXIDANT: A substance that, when added in small quantities to the resin during mixing, prevents its oxidative degradation and contributes to the maintenance of its properties.

ANTISTATIC AGENTS: Agents that, when added to a molding material or applied to the surface of the molded object, hinder the fixation of dust or the buildup of electrical charge.

ANTISYMMETRIC LAMINATE: (i) A special laminate type that is balanced but unsymmetrical; i.e., (+θ, -θ, +θ, -θ) where $A_{16} = A_{26} = D_{16} = D_{26} = 0$ and $B_{ij} \neq 0$. (ii) A laminate is said to be antisymmetric when for a given ply configuration (that is a ply with certain elastic properties and thickness) in the lower half of a laminate there is an identical ply configuration in the upper half, but with an alternating ply angle. Note that for an antisymmetric laminate, the corresponding plies in the lower and upper half of the laminate do not have to be placed at their corresponding equal distances from the laminate midplane. Antisymmetric laminates, by definition, are possible only with orthotropic plies. It is not possible to have an antisymmetric laminate made from isotropic plies as there are no directional properties in the isotropic plies. An antisymmetric laminate made from special orthotropic plies is called a cross-ply, whereas one made from generally orthotropic plies is known as an angle-ply.

AQUEOUS: Water-containing or water-based.

ARAMID: The name is a shortened form of “aromatic polyamide.” A type of highly oriented organic material derived from polyamide (nylon) but incorporating aromatic ring structure. Used primarily as a heat- and impact-resistant, high-strength, high-modulus fiber. Kevlar and Nomex (registered trademarks of DuPont) are examples of aramids. Also known as Aramid Fiber-Reinforced Plastic (AFRP or ARP).

ARC RESISTANCE: Ability to withstand exposure to an electric voltage. The total time in seconds that an intermittent arc may play across a plastic surface without rendering the surface conductive.

AREAL WEIGHT: The weight of fiber per unit area (width X length) of tape or fabric.

ARMALON: Polytetrafluoroethylene (PTFE) coated fiberglass used as a vacuum bag aid to prevent resin adherence. A trademark of DuPont.

AROMATIC: Unsaturated hydrocarbon with one or more benzene ring structures in the molecule.

ARRESTED GROWTH APPROACH: A method that requires demonstration that the structure, with defined flaws present, is able to withstand appropriate repeated loads with flaw growth which is either mechanically arrested or terminated before becoming critical (residual static strength reduced to limit load). This is to be associated with appropriate inspection intervals and damage detectability.

ARTIFICIAL WEATHERING: The exposure of plastics to cyclic laboratory conditions, consisting of high and low temperatures, high and low relative humidity, and ultraviolet radiant energy, with or without direct water spray and moving air (wind), in an attempt to produce changes in their properties similar to those observed in long-term continuous exposure outdoors. The laboratory exposure conditions are usually intensified beyond those encountered in actual outdoor exposure, in an attempt to achieve an accelerated effect. Also known as accelerated/artificial aging.

A-SCAN [UT]: Presentation display of the ultrasonic signal in which the X-axis represents the time and the Y-axis the amplitude.

ASH CONTENT: Proportion of the solid residue remaining after a reinforcing substance has been incinerated (charred or intensely heated).

ASPECT RATIO: (i) The ratio of length to diameter of a fiber. (ii) In an essentially two-dimensional rectangular structure (e.g., a panel), the ratio of the long dimension to the short dimension. (iii) In compression loading, it is sometimes considered to be the ratio of the load direction dimension to the transverse dimension. (iv) In aircraft design it is the ratio of the wingspan to the chord (or width) of the wing.

ASSEMBLY: A group of materials or parts, including adhesives, which has been placed together for bonding or which has been bonded in place.

ASSEMBLY JIG (AJ): When assembling fittings, leading edge skins, latches, or any other part that requires alignment to a theoretical datum, such as a hinge axis or a contour line, an assembly jig may be necessary equipment during accomplishment of a repair.

ASSEMBLY MANDREL (AM): An AM is any intermediate tool used during original manufacture or during repair to structure that does not have critical effect on the integrity of the final assembly or any of its subcomponent details.

ASSEMBLY TIME: The time interval between the spreading of the adhesive on the adherent and the application of pressure and/or heat to the assembly.

ASSESSMENT: An accurate onsite evaluation of damage or loss caused by an accident or natural event before filing a formal claim or disaster declaration. Damage assessment records the extent of damage, what can be replaced, restored, or salvaged, and time required for their execution.

A-STAGE: The initial state of the resin as produced by the manufacturer. An early stage in the polymerization reaction of certain thermosetting resins (especially phenolic) in which the material is still linear in structure, soluble in some liquids and fusible. Usually considered to be a point where little or no reaction has occurred. Prepreg in this condition would be extremely sticky, lumpy, and have little integrity. Also known as resole. See B-STAGE and C-STAGE.

ATACTIC: A molecular chain in which the methyl groups are more or less in random order.

ATTENUATION: The diminution of vibrations or energy over time or distance. The process of making thin and slender, as applied to the formation of fiber from molten glass.

ATTENUATION [UT]: Loss of energy caused by scattering of the sound beam within a material or at an interface or an electronic device in or attached to the instrument.

AUDREY: Di-electrometer (a tradename of Tetrahedron Associates). Equipment used for dynamic dielectric analysis (DDA).

AUTOCLAVE: A closed vessel for producing an environment of fluid pressure, with or without heat, to an enclosed object while it undergoes a chemical reaction or other process.

AUTOCLAVE ASSISTED REPAIR: A repair cured in an autoclave that uses the autoclave only to provide pressure to the repair during cure. A heat blanket is used as the heat source. This process is referred to as an “autoclave-assisted” cure.

AUTOCLAVE MOLDING: A process in which, after lay-up, winding, or wrapping, an entire assembly is placed in a heated autoclave, usually at 340 to 1380 kPa (50 to 200 psi). Additional pressure permits higher density and improved removal of volatiles from the resin. Lay-up is usually vacuum bagged with a bleeder and release cloth. The vacuum bag is normally vented to atmosphere, after establishing that it does not leak.

AUTOMATED FIBER PLACEMENT (AFP): A process that uses computer-guided robotics to lay one or several layers of fiber tape or tows onto a mold to create a part or structure. Also known as AUTOMATED TAPE LAYING (ATL).

AUTOMATED TAPE LAYING (ATL): A process that uses computer-guided robotics to lay one or several layers of fiber tape or tows onto a mold to create a part or structure. Also known as AUTOMATED FIBER PLACEMENT (AFP).

AUTOMATIC MOLD: A mold for injection or compression molding that repeatedly goes through the entire cycle, including ejection, without human assistance.

AUTOMATIC PRESS: An hydraulic press for compression molding or an injection machine that operates continuously, being controlled mechanically, electrically, hydraulically, or by a combination of any of these methods.

AVERAGE: The sum of a group of test values divided by the total number of test values. Also known as arithmetic mean.

AXIAL STRAIN: A linear strain in a plane parallel to the longitudinal axis of the specimen.

AXIAL WINDING: In filament-wound reinforced plastics, a winding with the filaments parallel or at a small angle to the axis (0-degree helix angle). See POLAR WINDING.

AXIS OF BRAIDING: The direction in which the braided form progresses.

3.2 B

BACK DRAFT: An area of interference in an otherwise smooth-drafted encasement; an obstruction in the taper which would interfere with the withdrawal of the model from the mold.

BACK PRESSURE: (i) Resistance of a material because of its viscosity, to continued flow when mold is closing. (ii) In autoclave molding, the positive pressure under the vacuum bag after the bag has been vented to atmosphere and the autoclave is at operating pressure.

BACK REFLECTION [UT]: Signal from the far boundary of the test part.

BACKING MATERIAL: Material used to support and protect film adhesives and prepreg during storage and kitting prior to layup. Backing materials may be release-coated paper products or plastic films. Backing materials provide a barrier to prevent the adhesive and prepreg from adhering to itself during storage and protect and support the adhesive and prepreg during handling. Also known as backing paper, backing film, separator sheet, carrier sheet, or release film.

BACKGROUND NOISE [UT]: Extraneous signals caused by signal sources within the ultrasonic testing system, including the material in test.

BACKUP PLATE: A smooth non-metallic or metal plate used in close contact with the opposite side surface of non-metallic layup or metal during the drilling or cutting process to prevent the tool exit side damage; e.g., fiber breaks at holes in composites unless a protective material is used on the exit side.

BADGE: Bisphenol “A” diglycidylether. See DGEBA.

BAG MOLDING: A process in which the consolidation of the material in the mold is affected by the application of fluid or gas pressure through a flexible membrane.

BAG SIDE: The side of the part that is cured against the vacuum bag during the manufacture of the part.

BAG SIDE SURFACE: The side of a composite part which was cured against the vacuum bag. The bag side surface usually has a slightly rough texture, unlike the smooth, tool side surface of the part.

BAGGING: Applying an impermeable layer of film over an uncured part and sealing edges so that a vacuum can be drawn.

BAGGING FILM: An impervious plastic film such as polyamide (nylon) or polyvinyl fluoride that covers the repaired area or completely envelopes the entire assembly that can withstand elevated cure temperatures and is sealed at the edges so that a vacuum can be drawn. The bagging film most typically used is 0.002 to 0.004 inch (0.05 to 0.1 mm) in thickness. Using a thicker gage of film allows less opportunity for punctures on complex shapes.

BAKE: An oven heat cycle that does not fully cure the primer (Type I) material.

BALANCED CONSTRUCTION: Equal parts of warp and fill in fiber fabric. Construction in which reactions to tension and compression loads result in extension or compression deformations only and in which flexural loads produce pure bending of equal magnitude in axial and lateral directions.

BALANCED DESIGN: In filament-wound reinforced plastics, a winding pattern so designed that the stresses in all filaments are equal.

BALANCED FABRIC: Fabric with the same number of yarns in both the warp and weft directions. Also known as balanced weave.

BALANCED LAMINATE: A composite laminate in which all the laminate at angles, other than 0 and 90 degrees, occur only in plus and minus pairs (not necessarily adjacent) and are symmetrical around the centerline. This type of laminate will have the least tendency to bow after cure. See SYMMETRICAL LAMINATE. A laminate may be balanced but not symmetrical or symmetrical but not balanced.

BALANCED TWIST: An arrangement of twists in a combination of two or more strands that does not cause kinking or twisting on themselves when the yarn produced is held in the form of an open loop.

BALANCED-IN-PLANE CONTOUR: In a filament-wound part, a head contour in which the filaments are oriented within a plane and the radii of curvature are adjusted to balance the stresses along the filaments with the pressure loading.

BALLISTIC DAMAGE: Damage resulting from armament projectile strikes.

BAND DENSITY: In filament winding, the quantity of fiberglass reinforcement per inch of bandwidth, expressed as strands (or filaments) per inch or per centimeter.

BAND THICKNESS: In filament winding, the thickness of the reinforcement as it is applied to the mandrel.

BAND WIDTH: In filament winding, the width of the reinforcement as it is applied to the mandrel.

BANDPASS FILTER [UT]: An electronic circuit that allows flow of signals of a specific frequency range but suppresses signals of higher and/or lower frequency.

BANDWIDTH [UT]: The range or band of frequencies contained in a signal; the number of hertz between the maximum frequency of the range and the minimum frequency of the range, usually measured between points of equal and stated amplitude levels.

BARCOL HARDNESS: A hardness value obtained by measuring the resistance to penetration of a sharp steel point under a spring load. The instrument, called the Barcol impressor, gives a direct reading on a 0 to 100 scale. The hardness value is often used as a measure of the degree of cure of a plastic.

BARE GLASS: Glass, such as yarns, rovings, and fabrics, from which the sizing or finish has been removed. Also, such glass before the application of sizing or finish.

BARELY VISIBLE IMPACT DAMAGE (BVID): The smallest visible damage size that can be reliably detected by general visual inspection.

BARRIER COAT: An exterior coating applied to a composite wound structure to provide protection.

BARRIER FILM: The layer of film used to permit removal of air and volatiles from a composite lay-up during cure while minimizing resin loss.

BARRIER PLASTICS: A general term applied to a group of lightweight, transparent, impact-resistant plastics, usually rigid copolymers of high acrylonitrile content. Barrier plastics are generally characterized by gas, aroma, and flavor barrier characteristics approaching those of metal and glass.

BASE: (i) The reinforcing material (glass fiber, paper, cotton, asbestos, etc.) that is impregnated with resin in the forming of laminates. (ii) The hydroxide of a metal. (iii) Increases the hydroxide concentration in an aqueaous solution. (iv) One of the constituents in a two-parts resin system. To be combined with a curing agent.

BASELINE [UT]: The horizontal trace across the A-scan cathode ray tube display; represents distance or time.

BASIC COMPOSITE REPAIR: Simple laminated repairs using elementary methods in the field area of the component. See FIELD AREA.

BASKET WEAVE: Woven fibers or reinforcement where two or more warp threads go over and under two or more fill threads in a repeating pattern (typically); less stable than the plain weave but produces a flatter, stronger, and more pliable weave.

BATCH: A quantity of material formed during the same process or in one continuous process and having identical characteristics throughout. Using a discrete quantity of material with a total commonality of raw materials and process history. Also known as LOT.

BATT: Felted fabrics. Structures built by the interlocking action of compressing fibers, without spinning, weaving, or knitting.

B-BASIS: The “B” mechanical property value is the value above which at least 90% of the population of values is expected to fall, with a confidence of 95%. See A-BASIS, S-BASIS, and TYPICAL BASIS.

BEAD BLASTING: See GRIT BLASTING.

BEAM SPREAD [UT]: Divergence of a sound beam as it travels through a material.

BEARING AREA: The diameter of the hole times the thickness of the material. The cross-section area of the bearing load member on the sample.

BEARING LOAD: A compressive load on an interface.

BEARING STRAIN: The ratio of the deformation of the bearing hole, in the direction of the applied force, to the pin diameter. Also, the stretch or deformation strain for a sample under bearing load.

BEARING STRENGTH: The maximum bearing stress that can be sustained. Also, the bearing stress at that point on the stress-strain curve where the tangent is equal to the bearing stress divided by n% of the bearing hole diameter.

BEARING STRESS: The applied load divided by the bearing area. Maximum bearing stress is the maximum load sustained by the specimen during the test, divided by the original bearing area.

BEARING YIELD STRENGTH: The bearing stress at which a material exhibits a specified limiting deviation from the proportionality of bearing stress to bearing strain. Usually obtained using an offset.

BEND TEST: A test of ductility by bending or folding, usually with steadily applied forces. In some instances the test may involve blows to a specimen having a cross section that is essentially uniform over a length several times as great as the largest dimension of the cross section.

BENDING STIFFNESS: The sandwich or laminate property that resists bending deflections.

BENDING-TWISTING COUPLING: A property of certain classes of laminates that exhibit twisting curvatures when subjected to bending moments. Also occurs with in-plane loading in certain laminates.

BENZENE: A hydrocarbon of the composition C6H6; the initial member of the benzene or aromatic series. Its molecular structure is conceived as a six-sided ring with double linkages between each alternating pair of the carbon atoms and a hydrogen atom attached to each carbon atom. It is produced commercially by the distillation of the light oils produced from coal tar. It is considered to be very toxic. Benzol is an industrial (less pure) grade of benzene. Toluene and xylene are related, less toxic compounds.

BENZENE RING: The basic structure of benzene, the most important aromatic chemical. It is an unsaturated, resonant, six carbon ring, having three double bonds. One or more of the six hydrogen atoms of benzene may be replaced by other atoms or groups.

BIAS FABRIC: Warp and fill fibers at an angle to the length of the fabric.

BIAXIAL BRAID: Braided fabric with two-yarn systems, one running in the +θ direction, the other in the -θ direction as measured from the axis of braiding.

BIAXIAL LOAD: A loading condition in which a laminate is stressed in two perpendicular directions. A loading condition of a pressure vessel under internal pressure and with unrestrained ends.

BIAXIAL WINDING: In filament winding, a type of winding in which the helical band is laid in sequence, side by side, with crossover of the fibers eliminated.

BIDIRECTIONAL LAMINATE: A reinforced plastic laminate with the fibers oriented in two directions in its plane. A cross laminate. See UNIDIRECTIONAL LAMINATE.

BILLET: A small ingot of nonferrous metal.

BINDER: (i) The resin or cementing constituent (of a plastic compound) that holds the other components together. (ii) The agent applied to fiber mat or preforms to bond fibers before laminating or molding.

BINOMIAL RANDOM VARIABLE: The number of successes in independent trials where the probability of success is the same for each trial.

BIREFRINGENCE: The difference between the two principal refractive indices (of a fiber) or the ratio between the retardation and thickness of a material at a given point.

BISECTED CORE: A honeycomb core whose hexagonal-shaped cells are reinforced by a diagonal node-to-node sheet to enhance its strength and rigidity.

BISMALEIMIDE (BMI): A type of polyimide that cures by an addition rather than a condensation reaction, thus avoiding problems with volatiles formation, and which is produced by a vinyl-type polymerization of a pre-polymer terminated with two maleimide groups. Intermediate in temperature capability between epoxy and polyimide.

BISPHENOL A (BPA): A condensation product formed by the reaction of two molecules of phenol with acetone. This polyhydric phenol is the standard intermediate resin that is reacted with epichlorohydrin in the production of epoxy resins. Unsaturated polyester resins are used for their chemical resistance and are suitable for high-temperature water, acid, and salt solutions and medium-temperature alkali solutions.

BLANKET: Fiber or fabric plies that have been laid up in a complete assembly and placed on or in the mold all at one time (flexible bag process).See HEAT BLANKET.

BLEED: (i) To remove gases, vapors, and excess resins or adhesives. (ii) To give up color when brought into contact with water or solvents.

BLEEDER: A nonstructural layer of woven or nonwoven material used in the manufacture or repair of composite parts to allow the escape of gases, vapors, and excess resins or adhesives. Also known as bleeder cloth.

BLEEDING: (i) The removal of gases, vapors, and excess resins or adhesives. (ii) The diffusion of color out of a plastic part into the surrounding surface or part.

BLEEDOUT: The spread of resins or adhesives away from the bond area.

BLIND FASTENER: A fastener that is installed with access from one side only.

BLISTER: Debond of paint or other coating from part surface. Undesirable rounded elevation of the surface of a plastic with boundaries that are more or less sharply defined, resembling in shape a blister on the human skin. The blister may burst and become flattened.

BLOCKING: Unintentional adhesion between plastic films or between a film and another surface.

BLOOM: A visible local exudation or finish change on the surface of a plastic. Bloom can be caused by a lubricant or plasticizer or by atmospheric contamination.

BLOW MOLDING: A method of fabrication in which a heated parison is forced into the shape of a mold cavity by internal gas pressure.

BLOWING AGENT: A substance used to cause expansion in the manufacture of hollow or cellular articles.

BLOWN CORE CELLS: Undesirable tearing of honeycomb core cell walls, usually the result of a leak in a vacuum bag.

BOBBIN: All yarn contained on one spool.

BODY PUTTY: A paste like mixture of plastic resin (polyester or epoxy) and talc used in repair of metal surfaces, such as auto bodies.

BOEGEL: A non-chromate, water-based sol gel (a type of complex inorganic polymer). An adhesion promoter used to prepare a metal surface for application of a primer. A tradename of the Boeing Company. See SOL GEL.

BOILING POINT: The temperature at which the vapor pressure of a liquid is equal to the pressure of the atmosphere.

BOLTED JOINT: A structure which utilizes a fastener to transfer load between the elements.

BOLTED TYPE REPAIR: A repair attached with mechanical fasteners. The fasteners may be rivets or bolts of various types and the repair plate and/or angled sections may be either of pre-cured composite construction or made from sheet metal or extrusions. The parts used in the repair may additionally be adhesively bonded.

BOND: (i) The adhesion of one surface to another, with or without the use of an adhesive as a bonding agent. (ii) To join together with an adhesive and/or by fusing the resins of pre-impregnated materials.

BOND ASSEMBLY: Any part made up of prepreg and other materials such as adhesive, honeycomb core, and pre-cured details, cured and/or bonded together as one detail part.

BOND FACE: The part or surface of an adherend that serves as a substrate for an adhesive. Also known as bond surface.

BOND LINE: The layer of adhesive that attaches two adherends. Synonym for glue line.

BOND LINE FLAW: A discontinuity in the adhesively bonded mating surface between two parts after the cure.

BOND PLY: The ply of a prepreg material that is placed against the fluted core of a radome.

BOND STRENGTH: The unit load applied in tension, compression, flexure, peel, and impact or shear required to break an adhesively bonded assembly with the failure occurring either within the adhesive or at the adhesive/adherend interface. See ADHESION and BOND.

BONDED ASSEMBLY JIG (BAJ): Tooling used to define and/or maintain appropriate contour of the part being manufactured or repaired during high pressure and temperature cycles (autoclave or vacuum assisted oven cure).

BONDED JOINT: The part of a structure at which two adherend are held together with a layer of adhesive by bonding. The point in a structure at which two parts are bonded together.

BONDED PART: (i) See BONDED STRUCTURE. (ii) See COMPOSITE PART.

BONDED STRUCTURE: The structure resulting when a combination of parts is assembled and intimately attached to each other by applying a structural adhesive to the faying surfaces, followed by curing of the adhesives by pressure, heat, or both.

BONDERITE: See ALODINE.

BONDLINE CRACKS: Cracking in the adhesive layer as a result of strain.

BONDTESTER: An electronic device used for testing the integrity of an adhesive bond.

BORON FIBER: A fiber produced by vapor deposition of elemental boron, usually on to a tungsten filament core, to impart strength and stiffness.

BOSS: Small projection from surface of a part designed to add strength, facilitate alignment with another part during assembly, or permit attachment to another part.

BOTTOM PLATE: A steel plate fixed to the lower section of a mold, often used to join the lower section of the mold to the platen of the press.

BOUNDARY ECHO [UT]: A reflection of an ultrasonic wave from an interface.

BOW WAVE: Undesirable ply wrinkles in panel skin plies that occur around the periphery of co-cured or co bonded stiffeners.

BOYER-BEAMAN RULE: A statement of the relationship between the glass transition temperature (Tg) and the melting temperature (Tm) of a polymer. The ratio of Tg/Tm (with T expressed in degrees Kelvin) usually lies between 0.5 and 0.7. For symmetrical polymers (e.g., polyethylene), Tg/Tm is close to 0.5. The ratio is near 0.7 for unsymmetrical polymers such as polystyrene and polyisprene.

BRAID: A fabric structure made by interlacing textile yarns in such a manner that all yarns lie at an angle other than 0 degrees or 90 degrees to the length direction of the fabric. There are different types of braids.

BRAID ANGLE: The acute angle measured from the axis of braiding.

BRAID COUNT: The number of braiding yarn crossings per inch measured along the axis of a braided fabric.

BRAIDING: Weaving of fibers into a tubular shape instead of a flat fabric, as for graphite fiber-reinforced golf club shafts.

BRANCHED POLYMER: In molecular structure of polymers, a main chain with attached side chains, in contrast to a linear polymer.

BREAKING EXTENSION: The elongation necessary to cause rupture of a test specimen. The tensile strain at the moment of rupture.

BREAKING FACTOR: The breaking load divided by the original width of a test specimen, expressed in pounds per inch (lb/in).

BREAKING LENGTH: A measure of the breaking strength of yarn. The length of a specimen whose weight is equal to the breaking load.

BREAKOUT: Fiber separation or break on surface plies at drilled or machined edges.

BREATHER: A single or multiple layer of woven fabric or non-woven mat or similar non-contaminating materials that are placed inside the vacuum bag to provide a continuous vacuum path. It also provides thermal insulation. Also known as breather cloth.

BREATHING: (i) The opening and closing of a mold to allow gas to escape early in the molding cycle. Also called degassing; sometimes called bumping in phenolic molding. (ii) Permeability to air of plastic sheeting. (iii) The removal of air or gases from an assembly during autoclave molding by use of a breather.

BRIDGING: Condition in which fibers do not move into or conform to negative radii and corners during molding, resulting in voids and dimensional control problems.

BRISTLE: A relatively thick, short section cut from a monofilament.

BROADBANDED [UT]: Having a relatively large bandwidth; used to describe instruments having an initial pulse with a relatively wide bandwidth and an amplifier with response to a relatively wide range of frequencies; opposite of narrow-banded or tuned.

BROADGOODS: (i) Fiber woven to form fabric up to 1270 mm (50 inches) wide. It may or may not be impregnated with resin and is usually furnished in rolls of 25 to 140 kg (50 to 300 pounds). (ii) A term loosely applied to prepreg material greater than about 304.8 mm (12 inches) in width usually furnished by suppliers in continuous rolls. The term is currently used to designate both collimated uniaxial tape and woven fabric prepregs.

BROKEN FIBERS: Fractured fibers in a fiber-reinforced plastic caused by a gouge, puncture, or excessive bending or bearing load. Broken fiber damage in a composite structure can look similar to a crack in a metal structure.

BROKEN WARP or FILL: A single warp or fill yarn which has been severed or broken.

BRONZE MESH (BM): See MESH.

B-SCAN [UT]: Presentation image of the results of an ultrasonic examination showing a cross section of the test object perpendicular to the scanning surface and parallel to a reference direction.

B-STAGE: An intermediate stage in the reaction of certain thermosetting resins in which the material (plastic or fusible) softens when heated but may not entirely dissolve or fuse. This stage helps facilitate handling and processing. Also called “resitol.” The resin in an uncured pre-impregnated (prepreg) is usually in this stage. See A-STAGE and C-STAGE.

BUBBLE: A spherical internal void: globule of air or other gas trapped in a composite material.

BUBBLER [UT]: A device used to couple a transducer to a surface with trapped water. See WATER DELAY COLUMN.

BUCKLE LINE: A line of collapsed honeycomb cells, two to three cells wide with undistorted cells on either side. These lines generally appear on the inner radius of the formed core.

BUCKLING: (i) Crimping of fibers in a composite material, often occurring in glass-reinforced thermoset due to resin shrinkage during cure. (ii) A mode of failure generally characterized by an unstable lateral material deflection due to compressive action on the structural element involved. In advanced composites, buckling may take the form not only of conventional general instability and local instability, but also a micro-instability of individual fibers.

BUCKLING, CORE: A line of collapsed cells, two to three cells wide with undistorted cells on either side. Buckle lines generally appear on the inner radius of formed core parallel to the axis of forming.

BUILD-UP: An area within a laminate made thicker by addition of more plies or layers of material. Also called a pad-up.

BULK DENSITY: The density of a molding material in loose form (granular, nodular, etc.), expressed as a ratio of weight to volume.

BULK FACTOR: The ratio of the volume of a raw molding compound or powdered plastic to the volume of the finished solid piece produced therefrom. The ratio of the density of the solid plastic object to the apparent or bulk density of the loose molding powder.

BULK MODULUS: The ratio of the hydrostatic pressure to the volume strain.

BULK MOLDING COMPOUND (BMC): Thermosetting resin mixed with strand reinforcement, fillers, and so on, into a viscous compound for compression or injection molding. See PREMIX and SHEET MOLDING COMPOUND.

BUNDLE: A general term for a collection of essentially parallel filaments or fibers.

BURNED: Showing evidence of thermal decomposition or charring through some discoloration, distortion, destruction, or conversion of the surface of the plastic, sometimes to a carbonaceous char.

BURST STRENGTH: Measure of the ability of a material to withstand internal hydrostatic or gas dynamic pressure without rupture. Hydraulic pressure required to burst a vessel of given thickness. Commonly used in testing filament-wound composite structures. Also known as BURSTING STRENGTH.

BUSHING: (i) An electrically heated alloy container encased in insulating material, used for melting and feeding glass in the forming of individual fibers or filaments. (ii) Load-carrying cylinder inserted in bolt or pin holes between the fastener or pin and the structure.

BUTT JOINT: A type of edge joint in which the edge faces of the two adherend are a right angle to the other faces of the adherend. See BUTT SPLICE.

BUTT SPLICE: Connection of two pieces of material, such as slit tape tows, fabric, adhesive, foil, etc., by the means of placing the material ends together with no overlap. See BUTT JOINT.

BUTT WRAP: Tape wrapped around an object in an edge-to-edge fashion.

3.3 C

CAB-O-SIL: Fumed silica which imparts significant increase in viscosity in liquid systems, free flow of powders and reinforcement of silicone, organic rubbers, epoxy, vinyl ester, polyester and phenolic resin systems, paint systems etc. A trademark of the Cabot Corporation.

CALENDER: To produce a smooth finish and a desired dimensional thickness for sheet material by passing it between sets of pressure rollers.

CALIBRATION: (i) The standardization of an instrument, prior to test, to a known reference value. (ii) The periodic adjustment of an instrument to an external standard.

CALIBRATION STANDARD: See REFERENCE STANDARD.

CAP PLIES: A stack-up of plies that is placed on top C-shaped web plies; e.g., in I-stiffeners.

CARBON: The element that provides the backbone for all organic polymers. Graphite is a more ordered form of carbon. Diamond is the densest crystalline form of carbon.

CARBON FIBER: Fiber produced by the pyrolysis of organic precursor fibers, such as rayon, poly acryl nitrile, and pitch in an inert environment. The term is often used interchangeably with the term “graphite” however, carbon fibers and graphite fibers differ. The basic differences lie in the temperature at which the fibers are made and heat treated, and in the amount of elemental carbon produced. Carbon fibers typically are carbonized in the region of 2400 °F (1315 °C) and assay at 93 to 95% carbon, while graphite fibers are graphitized at 3450 to 4500 °F (1900 to 2480 °C) and assay at more than 99% elemental carbon. See PYROLYSIS (of fibers).

CARBON FIBER BATCH: Bobbins produced in one continuous manufacturing operation that conforms to a fixed manufacturing process in accordance with the Process Control Document and is made of one creel set of precursors. A continuous manufacturing operation is defined as one in which the process is not interrupted for more than 24 hours or by a different production run.

CARBON-CARBON: A composite material consisting of carbon or graphite fibers in a carbon or graphite matrix.

CARBONIZATION: The process of pyrolyzation in an inert atmosphere at temperatures ranging from 1470 to 2910 °F (800 to 1600 °C) and higher, usually at about 2400 °F (1315 °C). Range is influenced by precursor, individual manufacturer’s process, and properties desired.

CARRIER: See SCRIM.

CARTRIDGE HEATER: Cylindrical-bodied, electrical heater for providing heat for injection, compression, and transfer molds; injection nozzles; runnerless mold system; hot stamping dies; sealing; etc.

CAST: To form material into a certain shape by pouring it into a mold and letting it harden without applying external pressure.

CASTING RESIN: A two-part resin system (resin and hardener) in liquid form that can be poured or otherwise introduced into a mold and shaped without pressure into solid articles.

CATALYST: (i) A substance that changes the rate of a chemical reaction without itself undergoing permanent change in composition or becoming a part of the molecular structure of the product. (ii) A substance that markedly speeds up the cure of a compound when added in minor quantity as compared to the amounts of primary reactants. See ACCELERATOR, CURING AGENT, HARDENER, INHIBITOR, and PROMOTER.

CATASTROPHIC FAILURES: (i) Totally unpredictable failures of a mechanical, thermal, or electrical nature causing total failure/malfunction of the part, component, or system. (ii) Failures causing loss of life or serious financial loss or secondary damage.

CATEGORY OF DAMAGE: One of five categories of damage based on residual strength capability, required load level, detectability, inspection interval, damage threat and whether (or not) the event creating damage is self-evident. For category definitions, refer to AC 20-107B (FAA) or AMC 20-29 (EASA), as applicable. See Figure 1.

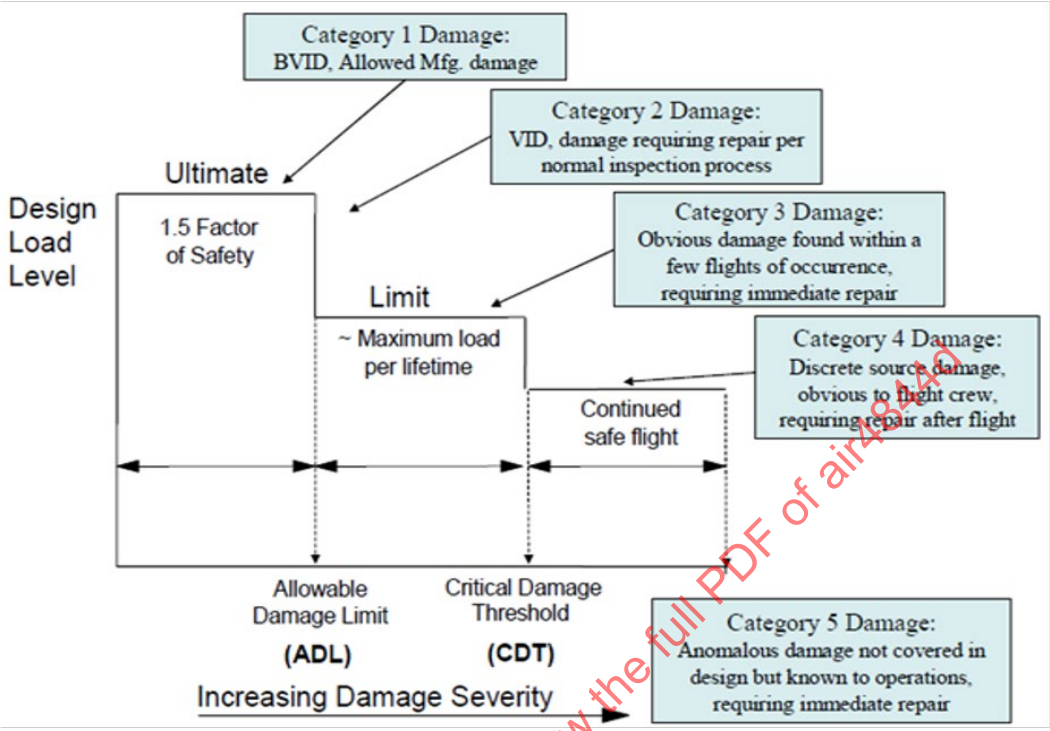

Figure 1 - Schematic diagram of design load levels versus categories of damage severity

CATENARY: (i) A measure of the difference in length of the strands in a specified length of roving as a result of unequal tension. (ii) The tendency of some strands in a taut horizontal roving to sag more than the others. (iii) Curve formed by a uniform chain hanging freely from two points not in one vertical line. (iv) Name given to the curve assumed by a perfectly flexible string suspended at each end and hanging under the action of gravity.

CAUL PLATES: A smooth metal or composite plate, free from surface defects, used in close contact with the lay-up during the curing process to transmit even pressure and temperature, and to provide a smooth surface on the finished part.

CAVITY: The space inside a mold in which a resin or molding compound is poured or injected. Molds are designated as single cavity or multiple cavities.

CELL: In honeycomb core, a cell is a single honeycomb unit.

CELL MARK OFF: The appearance of the honeycomb core cell outline on the surface of sandwich structures.

CELL SIZE: The diameter of an inscribed circle within a cell of honeycomb core.

CELLULAR PLASTIC: An expanded or foamed plastic whose density is reduced by the presence of numerous small cavities (cells), interconnecting or not, dispersed throughout the mass.

CENSORING: Data is right (or left) censored at M, if, whenever an observation is less than or equal to M (or greater than or equal to M), the actual value of the observation is recorded. If the observation exceeds (or is less than) M, the observation is recorded as M.

CENTRIFUGAL CASTING: A production technique for fabricating cylindrical composites, such as pipes, in which composite material is positioned inside a hollow mandrel designed to be heated and rotated as resin is cured.

CERAMIC: A rigid, frequently brittle material made from clay and other inorganic, nonmetallic substances and fabricated into articles by forming followed by sintering or densification of the article at high temperature.

CERAMIC MATRIX COMPOSITES (CMC): Composites consisting of ceramic or carbon fibers (or whiskers) as reinforcement in a ceramic material matrix.

CERMET: Composite materials consisting of two constituents, one being either an oxide, carbide, boride, or similar inorganic compound, and the other a metallic binder.

CERTIFICATION: Written testimony by an accreditation agency that the individual has met the requirements of the accepted standard.

C-GLASS: A glass with a soda-lime-borosilicate composition that is used for its chemical stability in corrosive environments.

CHAIN GROWTH POLYMERIZATION: A chemical reaction in which polymer formation is initiated by a reactive species produced from some compound termed an initiator. The reactive species may be a free radical, cation or anion. The reactive center, once produced, adds monomer units in a chain reaction and grows rapidly to a large size. High molecular weight polymer forms immediately with the molecular weight changing slightly, if at all, as the monomer concentration decreases steadily during the reaction.

CHAIN LENGTH: The length of the stretched linear macromolecule most often expressed by the number of identical links.

CHALKING: Dry, chalk-like appearance of deposit on the surface of a plastic.

CHANGEOVER EFFECT [UT]: In ultrasonic inspection, when scanning from a good area onto a delaminated area, the back-reflection signal will reduce in amplitude and will disappear completely as the delamination signal rises.

CHARGE: The measurement or weight of material (liquid, preformed, or powder) used to load a mold at one time or during one cycle.

CHARPY IMPACT TEST: A test for shock loading in which a centrally notched sample bar is held at both ends and broken by striking the back face in the same plane as the notch.

CHARRING: The heating of a composite in air to reduce the polymer matrix to ash, allowing the fiber content to be determined by weight.

CHEMICAL ATTACK: Damage to the resin matrix by accidental contact with, or unauthorized use of chemical products.

CHEMICAL CONVERSION COATING: A surface passivation that, when applied to aluminum surface, protects the metal from more oxidation. The natural aluminum oxide (Al_2O_3) on the surface is converted to a thicker oxide containing chromium (Cr_2O_3). Trademarked names ALODINE® or IRIDITE®.

CHEMICAL VAPOR DEPOSITED (CVD): Carbon deposited on a substrate by pyrolysis of a hydrocarbon, such as methane.

CHEMICAL VAPOR DEPOSITION: Process used in manufacture of several composite reinforcements, especially boron and silicon carbide, in which desired reinforcement material is deposited from vapor phase on to a continuous core, for example, boron on tungsten wire (core).

CHEMICALLY FOAMED PLASTIC: A cellular plastic in which the cells are formed by gases generated from thermal decomposition or chemical reaction of the constituents.

CHOPPED FIBERS: Fibers usually of glass or carbon that are chopped into the lengths from 0.5 to 3.0 inches (13 to 76 mm). The most common use of chopped fibers is for the manufacture of Chopped Strand Mat. Chopped fibers are also added to resins as a three-dimensional reinforcement. Resins with chopped fibers added may be used to repair dough molded parts. They are rarely used in exterior aerospace applications but find limited applications in interior repairs. Up to 25% by weight of chopped fibers are added for most applications. See CHOPPED STRANDS and CHOPPED STRAND MAT.

CHOPPED STRAND MAT (CSM): A mat formed of strands cut to a short length, randomly distributed, without intentional orientation, and held together by a binder. Usually used with polyester resin in wet lay-up construction of small boats and light aircraft. See CHOPPED FIBERS and CHOPPED STRANDS.

CHOPPED STRANDS: Short strands cut from continuous filament strands, not held together by any means. See CHOPPED FIBERS.

CHORD MODULUS: The slope of the chord drawn between any two specified points on the stress-strain curve.

CHROMATOGRAM: A plot of detector response against peak volume of solution (eluate) emerging from the system for each of the constituents which have been separated.

CHROMATOGRAPHY: See THIN-LAYER CHROMATOGRAPHY.

CHROME FINISH: A fiber sizing or a coupling agent to improve adhesion.

CHROMIC ACID ANODIZE (CAA): A chemical treatment applied to aluminium substrate to prevent corrosion.

CIRCUIT: In filament winding, one complete traverse of a winding band from one arbitrary point along the winding path to another point on a plane through the starting point and perpendicular to the axis. One complete traverse of the fiber-feed mechanism of a winding machine.

CIRCUIT BOARD: A sheet of insulating material laminated to foil that is etched to produce a circuit pattern on one or both sides. Also known as PRINTED CIRCUIT BOARD or PRINTED WIRING BOARD.

CIRCUMFERENTIAL WINDING: In filament-wound reinforced plastics, a winding with the filaments essentially perpendicular to the axis (90 degree or level winding).

CLAMP TONNAGE: Rated clamping capacity of an injection or transfer molding machine.

CLAMPING AREA: Largest molding area an injection molding machine can hold closed under full pressure.

CLAMPING PLATE: A mold plate fitted to the mold and used to fasten the mold to the machine.

CLAMPING PRESSURE: (i) In injection molding and transfer molding, the pressure that is applied to the mold to keep it closed, in opposition to the fluid pressure of the compressed molding material. (ii) May also refer to the pressure on two plates in a bolted joint after the bolts are tightened either to a specific torque loading or generally. (iii) May also refer to the pressure applied when clamps are used instead of a press or vacuum to apply pressure to a composite or bonded joint or repair during curing.

CLASSICAL LAMINATE THEORY (CLT): A commonly used simplified analytical method using matrix equations. It determines the stiffness matrix of a composite laminate by transforming local stiffnesses of each ply into the global stiffnesses of the laminate. It predicts the global deformation (mid-thickness strains, curvatures) of the laminate under in-plane and out-of-plane loads (mid-thickness forces, moments). The global deformation can be used to predict the local stresses in each ply. It is also referred as CLASSICAL LAMINATED PLATE THEORY (CLPT).

CLASSICAL LAMINATED PLATE THEORY (CLPT): A common approach used to provide simplified predictions for composite laminate strains using a set of equations that relate laminate mid-thickness loads and moments to mid-thickness strains and curvatures. It is also referred as CLASSICAL LAMINATE THEORY (CLT).

CLEAN ROOM: A special room where composite or bonded metal components are assembled prior to bonding in a clinical atmosphere. The room is sealed as far as possible, always kept scrupulously clean, temperature and humidity controlled and has a positive air pressure inside so that airflow is always outwards to minimize contamination. Operators wear clean overalls, clean gloves and caps, and visitors are generally discouraged. When allowed into a clean room they also have to wear clean outer garments to prevent contamination. No cutting, drilling, or sanding operations are permitted in a clean room, it is for the assembly of clean, dry components and materials only, immediately prior to bonding.

CLIMBING DRUM PEEL TEST (CDP): This test is used where the bonded members are not flexible enough to be peeled in a more usual manner. The less rigid of the two members is peeled by winding it round a rigid cylinder—the “climbing drum.” This is a practical test used to assess the quality of adhesive bonds between thin skins and honeycomb or other core materials for lightweight sandwich panels and also for testing adhesives by peeling a thin sheet from a much thicker one.

CLOSED CELL: A cell totally enclosed by its walls and hence no interconnecting with other cells.

CLOSED-CELL CELLULAR PLASTIC: A cellular plastic in which almost all the cells are not interconnecting.

CLOSURE: The complete coverage of a mandrel with one layer (two plies) of fiber. When the last tape circuit that completes mandrel, coverage lays down adjacent to the first without gaps or overlaps, the wind pattern is said to have “closed.”

CLOTH: See WOVEN FABRIC and NONWOVEN FABRIC.

CO-BONDING: The curing together of two or more elements, of which at least one has already been fully cured and at least one is uncured. This requires film adhesive between any precured and uncured interface.

CO-CONSOLIDATION: A processing step where two or more thermoplastic preformed parts are joined by properly locating in a fixture or tool and reheating to melt under pressure.

CO-CURING: The simultaneous curing together of two or more uncured elements.

COEFFICIENT OF ELASTICITY: The reciprocal of Young’s modulus in a tension test. See COMPLIANCE.

COEFFICIENT OF EXPANSION: A measure of the change in length or volume of an object, specifically measured by the increase in length or volume of an object per unit length or volume.

COEFFICIENT OF FRICTION: A measure of the resistance to sliding of one surface in contact with another surface. The coefficient of friction f = F/W, where F is the force to cause sliding and W is the weight being moved. Each material has its own value of coefficient f.

COEFFICIENT OF THERMAL EXPANSION (CTE): The change in length or volume per unit length or volume produced by a one unit rise in temperature.

COEFFICIENT OF VARIATION: The ratio of the population (or sample) standard deviation to the population (or sample) mean.

CO-FAB: Fabrication process where close-outs and inserts are bonded into the panel at the same time as the facings are bonded to the core.

COHESION: The propensity of a single substance to adhere to itself. The internal attraction of molecular particles toward each other. The ability to resist partition of itself. The force holding a single substance together.

COHESION FAILURE: Failure of an adhesive joint occurring primarily in an adhesive layer.

COHESIVE STRENGTH: Intrinsic strength of an adhesive.

COIN TEST: Test procedure using a coin detecting accoustical variations indicating disbonds or damages on thin skinned composite or metal bonded structures. Can also be used to test for debonding of thin bonded parts. See TAP TEST.

COKE: Carbonaceous residue resulting from the pyrolysis of pitch.

COLD BOND: Fiber-reinforced wet lay-up applied to a composite part which will cure to its full properties at room temperature. Heat may be applied, however, to shorten the cure cycle. See COLD WRAP.

COLD FLOW: The distortion that takes place in materials under continuous load at temperatures within the working range of the material without a phase or chemical change. See CREEP.

COLD WRAP: A cold bond applied around the edge of a part.

COLD-SETTING ADHESIVE: An adhesive capable of hardening at normal room temperature in the presence of a hardener.

COLLET: (i) A rigid, lateral container for the mold-forming material. A dam, a restriction box. (ii) The drive wheel that pulls glass fibers from the bushing. A forming tube is placed on the collet, and a package of strands is wound up on the tube. (iii) A metal band, ferrule, collar, or flange often used to hold a tool or workpiece.

COLLIMATED: Rendered parallel.

COLLIMATED ROVING: Roving that has been made using a special process (usually parallel wound), so that the strands are more parallel than in standard roving.

COLLOID: State of matter in which it is divided or “dispersed” generally in a liquid, into molecular aggregates small enough to pass ordinary filters but not the pores of animal membranes through which truly dissolved substances pass.

COLLOIDAL: A state of suspension in a liquid medium in which extremely small particles are suspended and dispersed but not dissolved.

CO-MINGLED FIBER FABRIC: Thermoplastic and reinforcing fibers precisely intermingled in a single yarn which can be woven into fabrics that are easy to handle and can drape over and into complex molds.

CO-MINGLED YARN: A hybrid yarn made with two types of materials intermingled in a single yarn; for example, thermoplastic filaments intermingled with carbon filaments to form a single yarn.

COMMINGLING: The random mixing of fibers of different materials.

COMPACTION: See DEBULKING.

COMPATIBILITY: (i) The ability of two or more substances combined with one another to form a homogeneous composition of useful plastic properties; for example, the suitability of a sizing or finish for use with certain general resin types. (ii) Compatibility is a measure of the ability of two substances to mix. (iii) On the principle that “like generally dissolves like,” solubility parameters are often used to predict the compatibility of solvents and plastics. (iv) The ability of different resin systems to be processed in contact with each other without degradation of end product properties. (v) Non-reactivity or negligible reactivity between materials in contact. In this case compatibility means that the two materials in contact DO NOT react with each other. In the other four cases, it means that they DO REACT with each other.

COMPLEX CURVATURE: Describing a surface which curves in more than one direction, such as a saddle or spherical shape. The surface may have both concave and convex areas. May also be described as “double curvature,” e.g., Radome structure.

COMPLEX DIELECTRIC CONSTANT: The vectorial sum of the dielectric constant and the loss factor.

COMPLEX SHEAR MODULUS: The vectorial sum of the shear modulus and the loss modulus.

COMPLEX YOUNG’S MODULUS: The vectorial sum of Young’s modulus and the loss modulus. Analogous to the complex dielectric constant.

COMPLIANCE: Tensile compliance: the reciprocal of Young’s modulus. Shear compliance: the reciprocal of Young’s modulus. Shear compliance: the reciprocal of shear modulus. Also, a term used in the evaluation of stiffness and deflection.

COMPONENT MAINTENANCE MANUAL (CMM): Document which details the way in which maintenance tasks shall be accomplished for a specified component (provided by aircraft and/or component manufacturers)

COMPOSITE: See COMPOSITE MATERIAL.

COMPOSITE CLASS: A major subdivision of fibrous composite materials in which a class is defined by the geometric characteristic of the fiber arrangement. Examples of composite classes are filamentary laminates (q.v.), random chopped-fiber composites, whisker composites, and woven fabric.

COMPOSITE MATERIAL: A combination of two or more materials (reinforcing elements, fillers, and composite matrix binder), differing in form or composition on a macro-scale. The constituents retain their identities; that is, they do not dissolve or merge completely into one another although they act in concert. Normally, the components can be physically identified and exhibit an interface between one another.

COMPOSITE PART: (i) An inseparable assembly of composite materials cured, consolidated, cobonded or secondary bonded together, alone or in combination with other composite or non-composite parts. (ii) An uncured assembly of composite materials that have been stacked up and compacted together alone or in combination with other composite or non-composite parts.

COMPOUND: The intimate admixture of a polymer with other ingredients, such as fillers, softeners, plasticizers, reinforcement, catalysts, pigments, or dyes. A thermoset compound usually contains all the ingredients necessary for the finished product, while a thermoplastic compound may require subsequent addition of pigments, blowing agents, etc.

COMPOUND CURVATURE: See COMPLEX CURVATURE.

COMPRESSION AFTER IMPACT (CAI) STRENGTH: (i) The compression strength of a laminate when tested after impact damage (primarily delamination's) has been cause by a controlled impact. (ii) The actual compression strength of a component in service after impact of unknown severity has occurred. The purpose of the testing in (i) is to assess this from the damage size and type.

COMPRESSION MOLD: A mold that is open when the material is introduced and that shapes the material by the pressure of closing and by heat.

COMPRESSION MOLDING PRESSURE: The unit pressure applied to the molding material in the mold.

COMPRESSION TEST: Compressive properties of unidirectional or cross ply fiber-resin composites. This gives two methods, one using a specially designed fixture to give true compressive failure and the other using a sandwich beam specimen.

COMPRESSIONAL WAVE [UT]: Waves in which the particle motion or vibration is in the same direction as the propagation of the waves. See LONGITUDINAL WAVE.

COMPRESSIVE MODULUS: Ratio of compressive stress to compressive strain below the proportional limit. Theoretically equal to Young's modulus determined from tensile experiments.

COMPRESSIVE STRENGTH: The ability of a material to resist a force that tends to crush or buckle. The maximum compressive load sustained by a specimen divided by the original cross-sectional area of the specimen.

COMPRESSIVE STRESS: The normal stress caused by forces directed toward the plane on which they act. The compressive load per unit area of original cross section carried by the specimen during the compression tests.

COMPUTER-AIDED DESIGN (CAD): The use of a computer to develop the design of a product to be manufactured. The use of a computer to develop the design and necessary NC programs for use by the manufacturing equipment which will produce a product.

COMPUTER-AIDED MANUFACTURING (CAM): The use of software and computer-controlled equipment to manufacture parts.

CONDENSATION POLYMERIZATION: A chemical reaction in which two or more molecules combine, with the separation of water or some other simple substance. If a polymer is formed, the process is called polycondensation. See POLYMERIZATION.

CONDENSATION REACTION: A chemical reaction in which two different molecules react to form a new compound of greater complexity, with the formation of water, alcohol, ammonia, etc., as a byproduct.

CONDITIONING: Subjecting a material to a prescribed environmental and/or stress history before testing.

CONDUCTING COATING: Application of a material or finish on the surface of a unit to transfer heat or electric current from one section to another section.

CONDUCTIVITY: Reciprocal of volume resistivity. The measure of the ability of a material to transfer heat or electrical current of a unit cube of any material (conductivity per unit volume).

CONSISTENCY: That property of a liquid adhesive by virtue of which it tends to resist deformation. Consistency is not a fundamental property but is composed of viscosity, plasticity, and other phenomena. See VISCOSITY.

CONSOLIDATION: (i) In metal matrix or thermoplastic composites, a processing step in which fiber and matrix are compressed by one of several methods to reduce voids and achieve desired density. (ii) The joining together under heat and pressure of multiple plies of thermoplastic composite materials, which may be resoftened without undergoing a chemical change when heated. This is a reversible process with some limitations on the number of reprocessing cycles possible, depending on the thermoplastic. (iii) A process that fuses each ply together by tacking and flowing the matrix between the plies. Usually involves heat and pressure.

CONSTITUENT: In general, an element of a larger grouping. In advanced composites, the principal constituents are the fibers and the matrix.

CONTACT ADHESIVE: An adhesive that is apparently dry to the touch and which will adhere to itself simultaneously upon contact. An adhesive applied to both adherend and allowed to become dry, which develops a bond when the adherend are brought together without sustained pressure.

CONTACT ANGLE: When a drop of liquid is placed on a surface it will either retract into a ball, like a drop of mercury, or spread out like water on a clean, high energy surface. The contact angle is the angle made between the surface and a tangent to the surface of the drop at the point of contact with the surface. Low contact angles mean good “wetting” of a surface and high contact angles mean poor “wetting.” A major purpose of surface treatments prior to adhesive bonding is to ensure good “wetting” of the bonding faces when the adhesive is applied.

CONTACT METHOD [UT]: The inspection method in which the search unit face makes direct contact with the test part and ultrasonic energy is transmitted through a thin film of couplant.

CONTACT MOLDING: A process for molding reinforced plastics in which reinforcement and resin are placed on a mold. Cure is either at room temperature using a catalyst-promoter system or by heating in an oven, without additional pressure.

CONTACT PRESSURE MOLDING: A method of molding or laminating in which the pressure, usually less than 70 kPa (10 psi), is only slightly more than necessary to hold the materials together during the molding operation.

CONTACT PRESSURE RESINS: Liquid resins that thicken or polymerize on heating, and, when used for bonding laminates, require little or no pressure.

CONTACT TESTING [UT]: Testing with a transducer assembly in direct contact with material through a thin film of couplant.

CONTACT TRANSDUCER [UT]: A transducer which is coupled to a test surface either directly or through a thin film of couplant.

CONTACT USE MATERIALS: The expendable materials that are permitted to contact the prepreg, adhesive, wet layup, dry fibers, etc., materials during the layup and cure operations of the repair.

CONTAMINANT: An impurity or foreign substance present in a material or environment that affects one or more properties of the material, particularly adhesion.

CONTINUOUS FIBER CERAMIC COMPOSITE (CFCC): A ceramic-matrix composite in which the reinforcing phase(s) consists of continuous filaments, fibers, yarn, or knitted or woven fabrics.

CONTINUOUS FILAMENT: (i) An individual flexible rod of small diameter of great or indefinite length. (ii) A yarn or strand in which the individual filaments are substantially the same length as the strand.

CONTINUOUS FILAMENT YARN: Yarn formed by twisting two or more continuous filaments into a single, continuous strand.

CONTINUOUS MATERIAL MANUFACTURING OPERATION: A continuous material manufacturing operation is defined as one in which the process is not interrupted for more than 72 continuous hours, during which time the materials shall be stored according to the certified production procedure.Any interruption shall not contain a different product run.The total production time, interruptions included, shall not exceed five days (this limit does not apply to the manufacture of carbon fiber batches), unless otherwise stated in the relevant individual product sheet (IPS).

CONTINUOUS ROVING: Parallel filaments coated with a sizing (finish), gathered together into single or multiple strands. It may be used to provide continuous reinforcement in woven roving, filament winding, pultrusion, prepreg, or high-strength molding compounds, or it may be used chopped.

CONTRAST, RADIOGRAPHIC [RT]: The difference in density between two adjacent image areas on a radiograph.

CONTROL: A product of known characteristics which is included in a series of similar service or bench tests to provide A-basis for evaluation of one or more unknown products (e.g., a carefully stored specimen for comparison with other specimens that have been subjected to environmental exposure).

CONTROL THERMOCOUPLE: The thermocouple which the hot bond machine uses for controlling the temperature of the heat blanket.

CONTROLLED ATMOSPHERIC PRESSURE RESIN INFUSION (CAPRI): A resin infusion process where the pressure from the atmosphere is controlled for making composite parts wherein evacuating the resin feed source to a pressure below atmospheric pressure forcing resin to flow into a preform contained within a vacuum bag upon on a mold surface. Controlling the pressure differential between the resin feed source and the preform maintains a net compaction pressure upon the previously compacted preform, and will retain that compaction at the desired level throughout the infusion of the resin into the preform, thereby allowing manufacture of a composite part of repeatable quality.

CONTROLLED CONTAMINATION AREA (CCA): An area that ensures levels of dirt, dust, oils, lubricants, and other containments are controlled for acceptable structural bonding.

COOLING FIXTURE: A fixture used to maintain the shape or dimensional accuracy of a molding or casting after it is removed from the mold and until the material is cool enough to hold its own shape.

COOLING TIME: In molding, the time interval from the start of forward screw movement until the mold starts to open.

COPPER MESH: See MESH.

COPOLYMER: A long-chain molecule formed by the reaction of two or more dissimilar monomers.

COPOLYMERIZATION: Polymerization in which a copolymer is formed.

CORE: (i) The central member, usually foam or honeycomb, of a sandwich construction to which the faces of the sandwich are attached or bonded. (ii) The central member of a plywood assembly. (iii) A channel in a mold for circulation of heat transfer media. (iv) Part of a complex mold that forms undercut parts. (v) A device on which prepreg is wound.

CORE CORROSION: Oxidation or other chemical or electrolytic attack that adversely affects the core.

CORE CRUSH: A collapse, distortion, or compression of the core.

CORE DEPRESSION: A localized indentation or gouge in the core.

CORE DISTORTION: A condition that causes the shape of the core cells to change from a normal shape to a skewed shape.

CORE MOVEMENT: A sideways movement of the core resulting in distorted core cell or the core detail shape no longer within initial tolerances.

CORE NODE SEPARATION: A partial or complete breaking of the core node bond.

CORE NODES: The points at which honeycomb cells are bonded to each other.

CORE ORIENTATION: Used on a honeycomb core to line up the ribbon direction, thickness of the cell depth, cell size, and transverse direction.

CORE RESTORATION: A repair method restoring the structural integrity of the damaged or contaminated honeycomb sandwich part and load carrying capability of the core, in general, either by stiffening the core with potting or replacing it completely or partially (on thick parts) with a repair core plug.

CORE RIBBON DIRECTION: The direction parallel to the bond line of the adjacent cells of a honeycomb core. See RIBBON DIRECTION and L-DIRECTION.

CORE SPLICE: The joint of several segments of core. In case of repairs, see CORE RESTORATION.

CORE SPLICE ADHESIVE: An adhesive that is used to connect the segments of core to make a bond.

CORE STABILIZATION: A process to rigidize honeycomb core materials to prevent distortion during machining.

CORED MOLD: A mold incorporating passages for electrical heating elements, steam, or water.

CORONA RESISTANCE: Resistance to an ionizing process. When an electric current passes through a conductor, it induces a surrounding electrostatic field. When voids exist in the insulation near the conductor, the high voltage electrostatic field may ionize and rapidly accelerate some of the air molecules in the void. These ions can then collide with the other molecules and ionize them, thereby eating a hole in the insulation. Resistance to this process is called corona resistance.

CORROSION: The deterioration of a metal by chemical or electrochemical reaction resulting from exposure to weathering, moisture, chemicals or other agents or media.

CORROSION RESISTANCE: The ability of a material to withstand contact with ambient natural factors or those of a particular artificially created atmosphere, without degradation or change in properties. For metals, this could be pitting, general surface corrosion; or, in the case of iron and steel, rusting.

CORROSION-INHIBITING COMPOUND (CIC): Nonvolatile base material typically dispersed in petroleum solvent in order to form a fluid formulation that is sprayed or brushed on finished metallic structure. Its purpose is to improve corrosion protection by keeping moisture or water from entering crevices, cavities, between fasteners and holes, or to displace water from open surface areas where the surface protection scheme is damaged. There are different grades of CPC/CIC, such as soft film (oily or waxy protection layer) and hard film (laquer-type of protection layer) compounds, depending on the specific application. Refer to OEM manual to determine the appropriate grade to be applied. While CPC/CIC improve the corrosion protection, they are not a permanent substitution for the original finish (e.g., primer/paint system). Also known corrosion-preventing compound (CPC).

COSMETIC IRREGULARITIES: Surface conditions that do not affect the integrity of the component and require further action only if improvement of the appearance is required.

COUNT: For fabric, number of warp and filling yarns per inch in woven cloth. For yarn the size based on relation of length and weight. Basic unit is tex.

COUPLANT: See LIQUID COUPLANT.

COUPLANT [UT]: A substance (usually a viscous liquid) used between the search unit and the test part to permit or improve transmission of ultrasonic energy into the test part.

COUPLING: A side mechanical behavior of a structure under loading that would otherwise cause only the predicted behavior(s). For example, A16 and A26 matrix elements represent shear-extension coupling while Bij matrix is representing coupling between bending and extension and D16 and D26 elements are representing bend-twist coupling at the laminate level.

COUPLING AGENT: A double-ended molecule, one end of which bonds to the substrate and the other to the resin or adhesive to assist both strength and especially the durability of bonding; e.g., silane coatings on fiber glass.

COUPON: A small test specimen (e.g., usually a flat laminate) for evaluation of basic lamina or laminate properties or properties of generic structural features (e.g., bonded or mechanically fastened joints).

CO-WOVEN FABRIC: A reinforcement fabric woven with two different types of fibers in separate yarns; for example, thermoplastic fibers woven side by side with carbon fibers.

CRACK: (i) Fractures in either matrix or both matrix and fibers. An actual separation of material. Does not necessarily extend through the thickness of the composite but can be stopped by differently oriented plies. (ii) A discontinuity which has a relatively large cross section in one direction and a small or negligible cross section when viewed in a direction perpendicular to the first.

CRACK GROWTH: Rate of propagation of a crack through a material due to a static or dynamic (cyclic) applied load.

CRAZING: Region of ultrafine cracks, which may extend in a network on or under the surface of a resin or plastic material. May appear as a white band. Often found in a filament-wound pressure vessel or bottle. In plastics, crazing occurs where a crack is bridged by fibrils that still carry significant load. Crazing becomes cracking when the fibrils break, and no load is transmitted. Crazing appears as cracking to the naked eye. A craze is a narrow zone of highly deformed and voided polymer resembling a true crack. Crazing occurs at a critical strain, or stress and these can be greatly reduced in the presence of active environments (notably organic solvents in the case of polymeric glasses).

CREASE: A break or line in a fabric usually caused by a sharp fold.

CREEL: A device for holding the required number of roving balls (spools) or supply packages in desired position for unwinding on to the next processing step, that is, weaving, braiding, or filament winding.

CREEP: The change in dimension of a material under load over a period of time, not including the initial instantaneous elastic deformation. (Creep at room temperature is called cold flow.) The time- dependent part of strain resulting from an applied stress.

CREEP, RATE OF: The slope of the creep-time curve at a given time. Deflection with time under a given static load.

CRIMP: The waviness of a fiber of fabric, which determines the capacity of fibers to cohere under light pressure. Measured by the number of crimps or waves per unit length or by the percent increase in length of the fiber on removal of the crimp.

CRIMPED FIBERS: A condition of the prepreg where fiber tows form into curls or waves.

CRITICAL LENGTH: The minimum fiber length required for shear loading to its ultimate strength by the matrix.

CRITICAL LONGITUDINAL STRESS: (i) Applied to fibers, the longitudinal stress necessary to cause internal slippage and separation of a spun yarn. (ii) The stress necessary to overcome the inter fiber friction developed as a result of twist.

CRITICAL SIZE: The established flaw size deemed to be detrimental to the serviceability criteria of the product. The acceptance/rejection levels established by design engineering required limits to meet design performance.

CRITICAL STRAIN: The strain at the yield point.

CRITICAL STRUCTURE: A load bearing structure/element whose integrity is essential in maintaining the overall flight safety of the aircraft. See PRINCIPAL STRUCTURAL ELEMENTS.

CROSS LAMINATED: Material laminated so that some of the layers are oriented at various angles to the other layers with respect to the laminate reference axis. A cross-ply laminate usually has plies oriented only at 0 degrees and 90 degrees.

CROSS PLY: The laminae are at right angles to each other.

CROSS-LINK: To form multiple intermolecular covalent or ionic bonds between polymer chains.

CROSS-LINKING: Applied to polymer molecules, the setting-up of chemical links between the molecular chains. When extensive, as in most thermosetting resins, cross-linking makes one infusible super molecule of all the chains.

CROSS-LINKING AGENT: A substance that promotes or regulates intermolecular covalent or ionic bonding between polymer chains.

CROSS-LINKING INDEX: The average number of cross-linked units per primary polymer molecule in the system as a whole.

CROSS-PLY LAMINATE: (i) A laminate with plies usually oriented at 0 degrees and 90 degrees only. (ii) A laminate built from orthotropic plies that is symmetrical with respect to the laminate mid-plane and the ply orientation is either 0 degrees or 90 degrees. Such laminates have a special stress/strain behavior.

CROSSTALK [UT]: The signal leakage (acoustical or electrical) across an intended barrier, such as signal leakage between the transmitting and receiving transducer elements of a dual search unit.

CROSSWISE DIRECTION: Crosswise refers to the cutting of specimens and to the application of load. For rods and tubes, crosswise is any direction perpendicular to the long axis. For other shapes or materials that are stronger in one direction than in another, crosswise is the direction that is weaker. For materials that are equally strong in both directions, crosswise is an arbitrarily designated direction at right angles to the lengthwise direction.

CRUSH SPLICING: The joining of segments of core by overlapping each segment two to four cells and then driving them together. Also known as CORE SPLICING.

CRYSTALLINE PLASTIC: A polymeric material having an internal structure in which the atoms are arranged in an orderly three-dimensional configuration.

CRYSTALLINITY: In polymers, a microstructure in which the linear molecular chains are arranged in an orderly fashion. Branched or network polymers are not crystalline but have pockets of order within their bulk. They are, therefore, said to be “semi-crystalline.”

C-SCAN [UT]: C-scan presentation, image of the results of an ultrasonic examination showing a cross section of the test object parallel to the scanning surface.

C-STAGE: The final stage in the reaction of certain thermosetting resins in which the material is practically insoluble and infusible. Sometimes referred to as “resite.” The resin in a fully cured thermoset molding is in this stage. See A-STAGE and B-STAGE.

CULL: Material remaining in a transfer chamber after the mold has been filled. (Unless there is a slight excess in the charge, the operator cannot be sure that the cavity has been filled.)

CUMULATIVE GAP: The sum of the intra-band gaps of slit tape tow in any 12-inch length measured perpendicular to the fiber direction.

CURE: To irreversibly change the properties of a thermosetting resin by chemical reaction, that is condensation, ring opening, or addition. Cure may be accomplished by addition of curing (cross-linking) agents, with or without heat and pressure. To permanently change the state of an epoxy material from the B-stage to the C-stage by the controlled action of heat and pressure.

CURE CYCLE: The time/temperature/pressure cycle used to cure a thermosetting resin system or prepreg.

CURE MONITORING, ELECTRICAL: Use of electrical techniques to detect changes in the electrical properties and/or mobility of the resin molecules during cure. A measuring of resin cure.

CURE PERIOD: The specified time that a part stays at the cure temperature.

CURE STRESS: A residual internal stress produced during the curing cycle of composite structures. Normally, these stresses originate when different components of a lay-up have different thermal coefficients of expansion.

CURE TIME: The period that a reacting thermosetting material is exposed to specific conditions to reach a specified property level.

CURING AGENT: A catalytic or reactive agent that, when added to a resin, causes polymerization. Also known as HARDENER.

CURING TEMPERATURE: Temperature at which a cast, molded or extruded product, a resin-impregnated reinforcement, an adhesive, etc., is subjected to curing. The temperature at which the chemical reaction required to cure a particular material will be activated and run to completion. In some cases, the cure temperature needs to be fairly closely controlled. See data sheet for each material.

CURING TIME: The period of time necessary for a part to be subjected to heat or pressure (or both) in order to fully cure a resin. The interval of time between the instant at which relative movement between the moving parts of a mold ceases and the instant pressure is released. Further cure may take place after removal of the assembly from the conditions of heat and pressure.

CUT END: The end resulting from tape being cut at any angle except parallel to the fibers (any cut which cuts individual carbon fibers creates cut ends).

CUT OR TEAR: Adjacent yarns which have been cut or broken.

CUT-OFF: The line where the two halves of a compression mold come together.

CUTTING TABLE: Table used for the preparation of adhesives, dry fabrics and prepreg materials. The table base used for cutting shall not be made of metal. Recommended base top materials are glass, composite laminates or polyurethane plates.

CUTTING TEMPLATE: Typically, a thin plate of transparent plastic or a polyester film used as a template to cut the repair plies.

CYANATE ESTER RESINS: Thermosetting resins that are derived from bisphenols or polyphenols, and are available as monomers, oligomers, blends, and solutions.

CYCLE: One full sequence in a molding operation, from a point in the process to the same point in the next sequence. The complete, repeating sequence of operations in a process or part of a process.

CYCLE TIME: In molding, the total time used to carry out a complete sequence of operations making up the molding cycle.

3.4 D

DAM: (i) Boundary support or ridge used to prevent excessive edge bleeding or resin runout of a laminate and to prevent crowning of the bag during cure. (ii) The term “dam” may also be applied to a ridge of sealant tape or other suitable material used to contain chemical surface treatment materials on metal surfaces.

DAMAGE: A structural anomaly caused by manufacturing (processing, fabrication, assembly or handling) or service usage.

DAMAGE ASSESSMENT: Preliminary but fairly accurate onsite evaluation of damage or loss caused by an accident or natural event before filing a formal claim or disaster declaration. Damage assessment records the extent of damage, what can be replaced, restored, or salvaged, and time required for their execution.

DAMAGE CLASSIFICATION: A process of determination of type of damage that has occurred to a structural member or to a structural material.

DAMAGE EVALUATION: A structural analysis process for each damage site to determine the nature of damage and the extent of repair or rework required, if necessary, in accordance with the limits, criteria, and other data specified in OEM documents after you do an initial inspection and cleaning procedure.

DAMAGE TOLERANCE (DT): (i) A design measure of crack growth rate in metallic structures. Cracks in damage tolerant designed structures are not permitted to grow to critical size during expected service life. (ii) The ability of a composite structure to withstand damage, as by impact, and still perform acceptably.

DAMPING: Limiting the duration and/or decreasing the amplitude of vibrations or oscillations in the motion of a body or in an electrical system subjected to influences which are capable of causing vibration or oscillation. Compare with attenuation.

DAMPING [UT]: Limiting the duration and/or decreasing the amplitude of vibrations, as in damping of a transducer element by mechanical or electrical means; also designates a bond inspection method in which good bonds are verified by damping ultrasonic energy transmitted to the back surface.

DATE OF MANUFACTURE (DOM): The date when the fiber reinforcement is impregnated with one batch of resin in one continuous operation.

DATE OF MIXING: The date when materials are mixed together and then stored in accordance with the storage instructions.

DATE OF RECEIPT (DOR): The date the material arrives at the purchaser’s facility or their designated storage facility. DOR is not the date the material is accepted by purchaser quality assurance after testing.

DATE OF SHIPMENT (DOS): The date the material leaves the supplier’s facility.

DAYLIGHT: The distance, in the open position, between the moving and fixed tables or the platens of a hydraulic press. In the case of a multiplate press, daylight is the distance between adjacent platens. Daylight provides space for removal of the molded part from the mold.

DEAD ZONE [UT]: Zone in the test part directly underneath the sound entry surface where discontinuities cannot be detected; caused by the finite length of the initial pulse, ringing time of the transducer element, and/or electronic characteristics of the instrument.

DEBOND: See DISBOND.

DEBULKING: Compacting of an uncured laminate under vacuum or mechanical pressure to remove gases and vapors, to compact the layup and to prevent wrinkles. Also known as COMPACTION. See VACUUM BAGGING.

DECANTING: Splitting one lot or batch of material into smaller lots. Similar to KITTING.

DECOMPOSITION: A chemical and physical material breakdown due to an excess exposure to heat and oxidation or due to the effects of bacterial contamination of the adhesive.

DEEP-DRAW MOLD: A mold having a core that is long in relation to the wall thickness.

DEFECT: (i) A discontinuity which interferes with the usefulness of a part (NDI). (ii) In mechanical or other terms, any fault which interferes with the usefulness or appearance of a part. A cosmetic defect does not normally affect the function of a part. See MANUFACTURING DEFECT.

DEFIBRILLATE: To divide longitudinally into fibers of smaller diameter.

DEFLASHING: A finishing technique used to remove the flash (excess, unwanted material) on a plastic molding.

DEFLECTION TEMPERATURE UNDER LOAD (DTUL): The temperature at which a simple cantilever beam deflects a given amount under load. Formerly called heat distortion temperature.

DEFORMATION UNDER LOAD: The dimensional change of a material under load for a specified time following the instantaneous elastic deformation caused by the initial application of the load. See COLD FLOW and CREEP.

DEGASSING: Removal of air or gases from an adhesive usually accomplished by subjecting the material to a vacuum.

DEGRADATION: A deleterious change in the chemical structure, physical properties, or appearance of a plastic adhesive or any other material.

DEGREASE: To remove oil and grease from adherend surfaces.

DEGREE OF POLYMERIZATION: Number of structural units, or mers, in the average polymer molecule in a sample measure of molecular weight. In most adhesives, the degree of polymerization must reach several thousand if worthwhile physical properties are to be obtained.

DEGREE OF CROSS-LINKING: The fraction of cross-linked polymeric units in the entire system.

DEHYDRATION: Removal of water as such from a substance, or after formation from a hydrogen and hydroxyl group in a compound, by heat or a dehydrating substance.

DEIONIZED WATER: In this process, anions and cations are removed by an ion exchange process. Ion exchange must compete with distillation for the production of high-purity water industrial water. The choice between the two processes depends largely on the total concentration of ionized and non-ionized substances in the water supply and whether sterile water is required from the process. Note that, for bonded metal structure and composite repairs, purified water used for final rinsing for adhesive bonding processes shall be discarded or re-treated when the conductivity reading exceeds 10 mS/m (milli-Siemens/meter) (100 micro-Siemens/cm) and/or when the silica content becomes greater than 5 ppm W/W (as SiO_2). See DISTILLED WATER.

DELAMINATE: To split a laminated plastic material along the plane of its layers.

DELAMINATION: Separation of the layers in a laminate.

DELAY LINE [UT]: Material (liquid or solid) placed in front of the search unit to cause a time delay between the initial pulse and front surface signal.

DELAYED SWEEP [UT]: An A-scan or B-scan presentation in which an initial part of the time scale is not displayed.

DELIQUESCENCE: The absorption of atmospheric water vapor by a crystalline solid until the crystal eventually dissolves into a saturated solution.

DENATURANT: A substance which renders alcohol unfit to use as a beverage.

DENIER: A yarn and filament numbering system in which the yarn number is numerically equal to the weight in grams of 9000 m. Used for continuous filaments. The lower the denier, the finer the yarn.

DENSIFICATION PROCESS: Consolidation of a loose or bulky material. Compaction of a complex assembly with the use of vacuum (minimum 22 in Hg) and heat (150 °F + 10 °F, rise rate 1 °F/min) for a specified time. Autoclave pressure of 25 psi ± 5 psi may be used to increase the amount of compaction.

DENSITY: Weight per unit of volume. Commonly expressed in grams per cubic centimeter (g/cm^3), pounds per cubic inch (lb/in^3), pounds per cubic foot (lb/ft^3), or kilograms per cubic meter (kg/m^3). Pounds per cubic foot and kilograms per cubic meter are usually used for sandwich filler materials, foams, and honeycomb core, while the other units are used more generally.

DENT: A concave depression which does not rupture plies or deboned the composite structure.

DEPOLYMERIZATION: Separation of a more complex molecule into two or more simpler molecules chemically similar to and having the same empirical composition as the original. Reverse of polymerization.

DEPOSITION: The process of applying a material to a base by means of vacuum, electrical, chemical, screening, or vapor methods, often with the assistance of a temperature and pressure container.

DESICCANT: Substance which can be used for drying purposes because of its affinity for water.

DESIGN ALLOWABLES: Material property allowable strengths, usually referring to stress or strain, for design purposes based on a sufficient number of tests to be statistically significant and to give values with specified levels of confidence. A limiting value for a material property that can be used to design a structural or mechanical system to a specified level of success. See A-BASIS, B-BASIS, S-BASIS, and TYPICAL BASIS.

DESIZING: The process of eliminating sizing, which is generally starch, from gray (also greige) goods before applying special finishes or bleaches (for yarn such as glass or cotton). Also, removing lubricant size following weaving of a cloth.

DESORPTION: A process in which an absorbed or adsorbed material is released from another material. Desorption is the reverse of absorption, adsorption, or both.

DESTRUCTIVE TESTS: Actual destruction of a bonded assembly or test pieces for the purpose of evaluating the bond properties. Destructive tests are usually made initially for qualification of materials and tools and periodically for tool, process and material control.

DETERIORATION: A permanent change in the physical properties of a plastic evidenced by impairment of these properties.

DEVIATION: Variation from a specified dimension or requirement, usually defining the upper and lower limits.

DEVITRIFICATION: The formation of crystals (seeds) in a glass melt, usually occurring when the melt is too cold. These crystals can appear as defects in glass fibers. Glasses behave as they do because, while they are cooling, they are so viscous that the molecules do not have time to sort themselves out into crystals and so cool glass is a solidified liquid, not a crystalline solid. However, the tendency to crystallize is there and given time some glasses will in fact crystallize. This is known as devitrification. The material can still be amorphous below the devitrification temperature. Devitrification occurs when the melt is maintained in the crystallization temperature range for too long.

DEVITRIFY: To deprive of vitreous quality. To make glass or vitreous rock opaque and crystalline.

DEW POINT: The temperature to which water vapor must be reduced to obtain saturation vapor pressure, that is, 100% relative humidity. As air is cooled the amount of water vapor it can hold decreases. If air is cooled sufficiently, the actual water vapor pressure becomes equal to the saturation water vapor pressure, and any further cooling normally results in the condensation of moisture.

D-GLASS: A high boron content glass made especially for laminates requiring a precisely controlled dielectric constant.

DIAGONAL BAND: A repeating diagonal band (of bias weave fabric) that is parallel to the warp direction of the fabric and extends across the fabric width. It is inherent to the manufacturing process and not considered a defect.

DIAMINODIPHENYL METHANE (DDM): An aromatic amine curing agent for epoxy resins. It is produced on industrial scale as a precursor to polyurethanes.

DIAMINODIPHENYL SULPHONE (DDS): An aromatic amine curing agent for epoxy resins. Used for preparation polyimide and epoxy resin material. Hardening agent in the curing of epoxy resins.

DIAMOND BRAID: Braided fabric with an over one, under one weave pattern (1 x 1).

DIAPHRAGM FORMING: A method of simultaneously consolidating and forming thermoplastic composites in which the lay-up is sandwiched between two heat-formable sheets (often superplastic aluminum sheets) and placed under gas pressure in a press to form and consolidate the desired shape.

DICYANDIAMIDE (DICY): A curing agent for epoxy resins. Used with 350°F (180 °C) curing systems and with an accelerator is also used with 250°F (120 °C) curing systems.

DIELECTRIC: A nonconductor of electricity. The ability of a material to resist the flow of an electrical current.

DIELECTRIC ANALYSIS (DEA): It measures dielectric properties (i.e., dielectric permittivity and loss factor that describes its conductive nature) of a material as a function of temperature, time, and frequency under a controlled atmosphere. DEA is useful in resin-curing studies because it readily detects the T_g, minimum viscosity (seen as maximum ionic mobility), resin cure, and vitrification.

DIELECTRIC CONSTANT: The ratio of the capacitance of an assembly of two electrodes separated solely by a plastic insulating material to its capacitance when the electrodes are separated by air. A measure of the electrical charge stored per unit volume at unit potential. See COMPLEX DIELECTRIC CONSTANT.

DIELECTRIC CURING: The curing of a synthetic thermosetting resin by the passage of an electric charge (produced from a high frequency generator) through the resin.

DIELECTRIC HEATING: The heating of materials by dielectric loss in a high-frequency electrostatic field.

DIELECTRIC LOSS: A loss of energy evidenced by the rise in heat of a dielectric placed in an alternating electric field. It is usually observed as a frequency-dependent conductivity.

DIELECTRIC LOSS ANGLE: The difference between 90 degrees and the dielectric phase angle. Also known as DIELECTRIC PHASE DIFFERENCE.

DIELECTRIC LOSS FACTOR: The product of the dielectric constant and the tangent of the dielectric loss angle for a material. Also called the dielectric loss index.

DIELECTRIC MONITORING: A means of tracking the cure of thermosets by changes in their electrical properties during material processing.

DIELECTRIC PHASE ANGLE: The angular difference in phase between the sinusoidal alternating potential difference applied to the dielectric and the component of the resulting alternating current having the same period as the potential difference.

DIELECTRIC PHASE DIFFERENCE: See DIELECTRIC LOSS ANGLE.

DIELECTRIC POWER FACTOR: The cosine of the dielectric phase angle (or sine of the dielectric loss angle).

DIELECTRIC STRENGTH: The property of an insulating material that enables it to withstand electric stress. The average potential per unit thickness at which failure of the dielectric material occurs.

DIELECTROMETRY: Use of electrical techniques to measure the changes in loss factor (dissipation) and in capacitance during cure of the resin in a laminate.

DIETHYLENE TRIAMINE (DETA): A curing agent for room temperature curing epoxies.

DIFFERENTIAL SCANNING CALORIMETRY (DSC): It is the most popular thermal technique for polymer characterization and to study thermodynamic processes and kinetic events such as cure and enthalpic relaxations associated with physical aging or stress. It is commonly used to measure the T_g of uncured prepregs and cured laminates, advancement in cured laminates, and also the degree of the final product, the heat of reaction during prepreg processing, and relative resin activity. See MODULATED DSC (MDSC).

DIFFERENTIAL THERMAL ANALYSIS (DTA): An experimental analysis technique in which a specimen and a control are heated simultaneously and the difference in their temperatures is monitored. The difference in temperature provides information on relative heat capacities, presence of solvents, changes in structure (that is, phase changes, such as melting of one component in a resin system), and chemical reactions. See DIFFERENTIAL SCANNING CALORIMETRY.

DIFFUSION: The movement of a material such as a gas or a liquid, in the body of a plastic. If the gas or liquid is absorbed on one side of a piece of plastic and given off on the other side, the phenomenon is called permeability. Diffusion and permeability are not due to holes or pores in the plastic but are caused and controlled by chemical mechanisms.

DIFFUSION COEFFICIENT: The rate of moisture or other fluid absorption of a material with time at a given temperature.

DILUENT: An ingredient usually added to an adhesive to reduce the concentration of bonding materials.A diluting agent, any liquid or solid which, when added to another liquid or solid, reduces the quantity per unit volume of the base material in the total volume. A reactive diluent may also take part in the curing action and is primarily used to reduce viscosity.

DIMENSIONAL STABILITY: Ability of a plastic part to retain the precise shape to which it was molded, cast, or otherwise fabricated.

DIPOLE MOMENT: In covalent molecules, where the bonding depends upon a sharing of electrons between atoms, the distribution of electron charge density may not be symmetrical. If the electronegativity of the atoms is significantly different then there will be a bias in this charge density towards the nucleus with the higher electronegativity. Thus, while the molecule will be overall electrically neutral, one end will carry a small negative charge (excess of electron density) and the other will carry a small positive charge (deficit of electron density). This situation is called “dipole” and the molecule is said to have a “dipole moment.”

DIRECTION OF TWIST: The direction of twist in yarns and other textile strands is indicated by the capital letters S and Z. Yarn has S twist if, when held in a vertical position, the visible spirals or helices around its central axis are in the direction of slope of the central portion of the letter S, and Z twist is in the other direction.

DISBOND: An area within a bonded interface between two adherends in which an adhesion failure or separation has occurred. Also known as DEBOND. Not to be confused with DELAMINATION.

DISCONTINUITY: An interruption in the normal physical structure or configuration of a part. A discontinuity may or may not affect the usefulness of a part. In some cases, such as a ply drop off in a composite lay-up, the edge of a doubler plate or a local area of potting compound, it is part of the design. See DEFECT.

DISCONTINUOUS FIBER-REINFORCED COMPOSITE: A ceramic-matrix composite material reinforced by chopped fibers.

DISCREPANCY: A manufacturing anomaly allowed and detected by the planned inspection procedure. They can be created by processing, fabrication, or assembly procedures.

DISPERSION: A heterogeneous system in which a finely divided material is distributed in another material.

DISPERSION FORCES: Often called Van der Waals forces, these are responsible for most of the adhesion forces involved in adhesive bonding.

DISPLACEMENT ANGLE: In filament winding, the advancement distance of the winding ribbon on the equator after one complete circuit.

DISSIPATION FACTOR: The distortion in phase of the alternating voltage caused by the material. It is computed from the difference in phase angle from the imposed voltage. Low values are preferred.

DISTILLED WATER: (i) Distillation is the time-honored method for preparing high-quality water. Both dissolved and suspended solids can be removed almost completely by this purely physical process of evaporation and condensation. The condensate from a water distillation unit with good steam separator equipment, and at normal evaporating rates, should contain no more than a few milligrams per liter (ppm) of dissolved solids and may contain only a fraction of 1 mg/L. In industries where only a few milligrams per liter of dissolved solids are allowable in the process water, either distillation or one of the de-ionizing processes can be used. Sterile water can be produced by heating to boiling point so distilled water should always be sterile, whereas de-ionized may not. Distilled water is the first choice, but de-ionized water may be used if it meets the criteria given below. Both types must meet the conductivity and other requirements for rinse waters prior to adhesive bonding. Note that, for bonded metal structure and composite repairs, purified water used for final rinsing shall be discarded or re-treated when the conductivity reading exceeds 10 mS/m (milli-Siemens per meter) (100 micro-Siemens/cm) and/or when the silica content becomes greater than 5 ppm W/W (as SiO_2). See DEIONIZED WATER.

DISTORTION: In fabric, the displacement of fill fiber from the 90-degree angle (right angle) relative to the warp fiber. In a laminate, the displacement of the fibers (especially at radii), relative to their idealized location, due to motion during lay-up and cure.

DISTRIBUTION: A formula which gives the probability that a value will fall within prescribed limits. See NORMAL, WEIBULL, and LOGNORMAL DISTRIBUTIONS.

DOCTOR BLADE OR BAR: A straight piece of material used to spread resin, as in application of a thin film of resin for use in hot melt prepreg or for use as an adhesive film. Also known as paste metering blade.

DOCTOR ROLL: A roller mechanism that is revolving at a different surface speed, or in an opposite direction, resulting in a wiping action for regulating the adhesive supplied to the spreader roll.

DOLLY: In filament winding, the planar reinforcement applied to a local area between windings to provide extra strength in an area where a cut-out is to be made, for example, port openings. Usually placed at the knuckle joints of cylinder to dome.

DOLPHICAM: A mobile, ultrasound camera system designed for inspection of a wide range of material types including composites, metals, and multi-materials. (A tradename of Dolphitech)

DOME: In filament winding, the portion of a cylindrical container that forms the spherical or elliptical shell ends of the container.

DOUBLE BACKED TAPE: This tape is a polyester film coated on both sides with a non- contaminating adhesive. It is used primarily to hold items in place in vacuum bag lay-ups, such as holding peel plies and breather cloths.

DOUBLE CANTILEVER BEAM TEST (DCB): Used to obtain more accurate values of Mode I adhesive fracture energy than those obtained from wedge tests. The tapered version can be made by tapering depth or width. The latter is favored for composite specimens. Both tapered versions are designed to give a constant value of fracture energy with increasing crack length.

DOUBLE CURVATURE: See COMPLEX CURVATURE.

DOUBLE SPREAD: The application of adhesive to both adherend in a joint.

DOUBLE VACUUM DEBULK (DVD): A process in which a stack of repair plies is subjected to vacuum and mild heating without being compacted by atmospheric pressure. The purpose is to minimize porosity in the repair plies by drawing air and other gases from between the repair plies while they are in an uncompact state.

DOUBLER: (i) Localized area of extra layers of reinforcement, usually to provide stiffness or strength for fastening or other abrupt load transfers. See TABS. (ii) An extra piece of facing attached to strengthen or stiffen the panel or to distribute the load more widely into the core.

DOUBLER PLY: Partial ply that extends from edge band to areas over/under honeycomb in sandwich structures.

DRAFT: The taper or slope of the vertical surfaces of a mold designed to facilitate removal of molded parts.

DRAFT ANGLE: The angle of a taper on a mandrel or mold that facilitates removal of the finished part. The angle between the tangent to the surface at that point and the direction of ejection.

DRAPE: The ability of a fabric or prepreg to conform to a contoured surface.

DRAW: To shape plastic by stretching or deforming through dies.

DRAWING: The mechanical operation of extending or stretching a synthetic fiber, filament, or sheet to orient the molecular structure.

DRAWING FILM: Typically, a polyester film, polyethylene film or nylon bagging film used to draw the outlines of the repair plies and to make templates. The film should readily allow lines to be drawn on it. The film thickness should be 0.003 inch (0.075 mm) or thicker.

DRAWN FIBER: Fiber with a certain amount of orientation imparted by the drawing process by which it was formed.

DRY COUPLED BONDTESTER: A bond tester which operates on the pitch-catch surface wave principle. Couplant is not required.

DRY FIBER AREA: Area of fiber not totally encapsulated by resin.

DRY ICE: Solid form of carbon dioxide, which has a temperature of -108°F (-78 °C) at atmospheric pressure. Should not be used without good ventilation because as it evaporates the proportion of carbon dioxide in the air may reach unsafe levels.

DRY JOINTS: Lack of adhesion due to insufficient adhesive or poor contact of mating surfaces.

DRY LAMINATE: A laminate containing insufficient resin for complete bonding of the reinforcement. See RESIN-STARVED AREA.

DRY LAY-UP: Construction of a laminate by the layering of pre-impregnated reinforcement (partly cured resin) in a female mold or on a male mold, usually followed by bag molding or autoclave molding.

DRY SPOT: Of a laminate, the area of incomplete surface film on laminated plastics. In laminated glass, an area over which the interlayer and the glass have not become bonded. See RESIN STARVED AREA.

DRY STRENGTH: The strength of an adhesive joint determined immediately after drying under specified conditions or after a period of conditioning in a standard laboratory atmosphere.

DRY WINDING: Filament winding using pre-impregnated roving, as differentiated from wet winding, where un-impregnated roving is pulled through a resin bath just before being wound on to a mandrel. See WET WINDING.

DRYING CYCLE: The removal of absorbed moisture from a part that has been in service using moderate heat or heat and vacuum.

DRYING OIL: One of the many natural, usually vegetable oils—the glyceryl esters of unsaturated fatty acids—that harden in air by oxidation to a resinous skin. Typical drying oils are linseed and Tung oils. Drying oils are the binding agents of oil paints and varnishes and some adhesive coatings.

DRYING TEMPERATURE: The temperature to which a component or material in any assembly, or the assembly itself, is subjected to drying.

DRYING TIME: (i) The time required to dry a component with absorbed moisture to a specified level that can be measured. (ii) The time specified for drying a component, which is considered sufficient to achieve an adequate condition for bonding, when measurement methods are not available.

DRYING TOWER: In prepreg via a solvent process, a conveyor belt carries the prepreg through a drying section which uses heated air to remove excess solvent from the prepreg. Usually this heated section is vertical, due to space limitations.

DUAL SEARCH UNIT [UT]: A single search unit containing two transducer elements, one used as a transmitter of ultrasonic energy, the other used as a receiver of ultrasonic energy.

DUCTILITY: The amount of plastic strain that a material can withstand before fracture. Also, the ability of a material to deform plastically before fracturing.

DUPLEX FILM: (i) An adhesive film that has two different adhesives separated by a scrim cloth that is manufactured into one film. (ii) Double sided tape with a scrim cloth as a backing liner with different properties in each side depending on the features of the adhesives used.

DWELL: (i) A pause in the application of pressure or temperature to a mold, made just before it is completely closed, to allow the escape of gas from the molding material. (ii) In filament winding, the time that the traverse mechanism is stationary while the mandrel continues to rotate to the appropriate point for the traverse to begin a new pass. (iii) In a standard autoclave cure cycle, an intermediate step in which the resin matrix is held at a temperature below the cure temperature for a specified period of time sufficient to produce a desired degree of staging used primarily to control resin flow.

DYNAMIC MECHANICAL ANALYSIS (DMA): It measures the stiffness (modulus) and damping of a material as a function of temperature, time, and frequency under a controlled atmosphere. DMA can detect some or all of the events in a thermoset curing cycle, including initial T_g of the uncured resin, the temperature of minimum viscosity, the onset of gelation, the cross-linking reaction, the cure completion, and the modulus of the fully cured material. Multiple clamping systems allow operation in a variety of measurement modes (single and dual cantilever, three-point bending, shear, compression, and tension) on a range of samples.

DYNAMIC MODULUS: The ratio of stress to strain under vibratory conditions (calculated from data obtained from either free or forced vibration tests, in shear, compression, or elongation).

DYNAMIC RANGE [UT]: The ratio of the largest to the smallest signals that can be measured or displayed at a constant gain setting.

3.5 E

EDDY CURRENT TESTING: A non-destructive testing method using electromagnetic induction to detect surface and sub-surface defects in conductive materials. An alternating current is used to generate a magnetic field. This changing magnetic field in close proximity of a part made from conductive material induces electrical currents (eddy currents) in that part. Surface and sub-surface discontinuities, for example cracks, change the flow path of the eddy currents, which in turn can be measured by the probe. High Frequency Eddy Current (HFEC) method is typically used to detect surface discontinuities, while with the Low Frequency Eddy Current (LFEC) method it can be possible to detect sub-surface discontinuities.

EDDY-SONIC [ES, ET, UT]: Describes a process in which sonic or ultrasonic energy is produced in a test part by a coil on or near the surface of the test part. The coil is used to produce eddy currents in the test part. Vibrations in the test part result from the interaction of the magnetic field from the eddy currents in the test part with the magnetic field of the coil. Can be used with composites and non-conducting materials if a steel washer is used.

EDDY-SONIC BONDTESTER: A dry coupled bond tester operating on the eddy-sonic principle.

EDGE BLEED: Removal of volatiles and excess resin through the edge of the laminate, as in matched die molding of a laminate. In autoclaved parts, edge bleeding is discouraged, since excess resin will only be removed from the area near an edge, resulting in uneven resin distribution. May also be called “squeeze out” or “horizontal bleed.” For small repairs work is going on to establish whether “squeeze out” is better than “vertical bleed” for reducing void content.

EDGE CLOSE-OUTS: Members placed around the panel sides to protect the sandwich from damage or to attach the panel to a support or other panel.

EDGE DELAMINATION: A separation of the detail parts along an edge after the assembly has been cured.

EDGE DISTANCE: The distance between the centerline of a hole and the edge or other feature of the part (sometimes referred to as EDGE MARGIN). Also defined as the distance from the edge of the fastener hole to the nearest edge of the part depending on OEM.

EDGE DISTANCE RATIO: The distance from the centerline of a hole to the edge of the specimen in the direction of the principal stress, divided by the diameter of the hole.

EDGE EROSION: Loss of paint, resin, and/or fibers along the outside surface, forward edge of a reinforced plastic (advanced composite) panel. Edge erosion is caused by the air, rain, snow, and ice that flow across the forward edge of the panel.

EDGE JOINT: A joint made by bonding the edge faces of two adherend.

EDGE MARGIN: The distance between the centerline of a hole and the edge or other feature of the part. Sometimes referred to as EDGE DISTANCE (depending on OEM).

EDGE OF PART (EOP): Acronym used to identify the edge of a part on engineering drawings.

EDGE VOID: An area where there is no adhesive along an edge after the cure.

EDGEWISE: Refers to cutting specimens and to the application of load. The load is applied edgewise when it is applied to the edge of the original sheet or specimen. For compression-molded specimens of square cross-section, the edge is the surface parallel to the direction of motion of the molding plunger. For injection molded specimens of square cross section, this surface is selected arbitrarily; for laminates the edge is the surface perpendicular to the laminae. See FLATWISE.

E-GLASS: A family of glasses with a calcium aluminoborosilicate composition and a maximum alkali content of 2.0%. A general purpose fiber that is most often used in reinforced plastics, and is suitable for electrical laminates because of its high resistivity. Also known as electric glass.

EJECTION: Removal of the molded part from the mold by mechanical means or with compressed air.

EJECTION RAM: A small hydraulic ram fitted to a press to operate the ejector pins.

ELASTIC DEFORMATION: The part of the total strain in a stressed body that disappears upon removal of the stress.

ELASTIC LIMIT: The greatest stress a material is capable of sustaining without permanent strain remaining after the complete release of the stress. A material is said to have passed its elastic limit when the load is sufficient to initiate plastic, or no recoverable, deformation.

ELASTIC RECOVERY: (i) The fraction of a given deformation that behaves elastically. (ii) A perfectly elastic material has an elastic recovery of 1; a perfectly plastic material has an elastic recovery of 0. (iii) Elastic extension divided by total extension.

ELASTIC RESERVOIR MOLDING (ERM): It is a molding process in which open cell foam and dry fabric reinforements are impregnated and consolidated using a heated tool.

ELASTICITY: That property of materials by virtue of which they tend to recover their original size and shape after removal of a force causing deformation. See VISCOELASTICITY.

ELASTOMER: A material that substantially recovers its original shape and size at room temperature after removal of a deforming force.

ELASTOMERIC MOLDING COMPOUND: Rubber or other elastomeric material used for molding operations.

ELASTOMERIC TOOLING: A tooling system that uses the pressure from the thermal expansion of rubber materials to form composite parts during cure.

ELECTRIC STRENGTH: See DIELECTRIC STRENGTH.

ELECTRICAL DISSIPATION FACTOR: The ratio of the power loss in a dielectric material to the total power transmitted through it; thus, the imperfection of the dielectric. Equal to the tangent of the loss angle.

ELECTROFORMED MOLDS: A mold made by electroplating metal on the reverse pattern of the cavity. Molten steel may then be sprayed on the back of the mold to increase its strength. Nickel is sometimes used for this purpose.

ELECTROLYTE: Any substance which, when dissolved in water or other suitable solvent, forms a solution that conducts electricity, the conductivity being due to ionic dissociation of the dissolved substance. Also a solution of an electrolyte.

ELECTROMAGNETIC EFFECTS (EME): The result (effect) of electromagnetic phenomenon. High-intensity radiated fields (HIRFs) and lightning are examples.

ELECTROMAGNETIC TESTING (ET). See EDDY CURRENT TESTING.

ELECTROSTATIC DISCHARGE (ED): A large electrical potential (4000 V or more) moving from one surface or substance to another. ESD is also an abbreviation for electrostatic dissipation.

ELEVATED TEMPERATURE REPAIR: A repair process that uses heat above ambient temperature to dry the substrates, cure resin systems or to accomplish a verifilm test. See HOT BOND REPAIR.

ELONGATION: Deformation caused by stretching. The fractional increase in length of a material stressed in tension. (When expressed as percentage of the original gage length, it is called percentage elongation.)

ELONGATION AT BREAK: Elongation recorded at the moment of rupture of the specimen, often expressed as a percentage of the original length.

ELUATE: The liquid emerging from a column (in liquid chromatography).

ELUENT: The mobile phase used to sweep or elute the sample (solute) components into, through, and out of the column.

EMBOSSING: A process for impressing a network of small channels into an adhesive film to allow the escape of air and volatiles during layup and cure.

EMISSIVITY: The ratio of the total heat radiating power of a surface to that of a black body of the same area and the same surface temperature.

EMULSIFIER: A material which, when added to a mixture of dissimilar materials such as oil and water, will produce a stable, homogeneous emulsion.

EMULSION: A suspension of fine particles or globules of a liquid within a liquid.

ENCAPSULATION: The enclosure of an item in plastic or other material. Sometimes used specifically in reference to the enclosure of capacitors or circuit board modules.

END: A strand of roving consisting of a given number of filaments gathered together. The group of filaments is considered an “end” or strand before twisting and a “yarn” after twist has been applied. An individual warp yarn, thread, fiber, or roving.

END COUNT: An exact number of ends supplied on a ball of roving.

END NOTCHED FLEXURE (ENF): Test method to evaluate the delamination toughness of composite laminates subjected to bending. Refer to ASTM D7905.

END OF LIFE (EOL): Term for TATS materials which have reached total allowed exposure units.

ENDOTHERMIC: A chemical reaction which absorbs heat energy is said to be endothermic. A compound, the formation of which absorbs heat, is an endothermic compound. Such compounds are less stable than exothermic compounds, many of them being explosive.

ENDURANCE LIMIT: See FATIGUE LIMIT.

ENTRAINED AIR: Air forced into liquid systems by the action of applicator mechanisms working in the mass. (Differentiated from foam particles in that the entrained air is not readily dissipated and tends to give false viscosity properties.)

ENVIRONMENT: The aggregate of all conditions (such as contamination, temperature, humidity, radiation, magnetic and electric fields, shock, and vibration) that externally influence the performance of an item.

ENVIRONMENTAL STRESS CRACKING (ESC): The susceptibility of a thermoplastic resin to crack or craze when in the presence of surface-active agents or other environments.

EPICHLOROHYDRIN: The basic epoxidizing resin intermediate in the production of epoxy resins. It contains an epoxy group and is highly reactive with polyhydric phenols such as bisphenol A.

EPOXIDE: Compound containing the oxirane structure, a three-member ring containing two carbon atoms and one oxygen atom. The most important members are ethylene oxide and propylene oxide.

EPOXIDE EQUIVALENT: The weight of a resin, in grams, which contains 1-g equivalent of epoxy.

EPOXY RESIN: A polymerizable thermoset polymer containing one or more epoxide groups and curable by reaction with amines, alcohols, phenols, carboxylic acids, acid anhydrides, and mercaptans. An important matrix resin in composites and structural adhesives.

EPOXY SILANE FINISH: A finish applied to glass fiber for printed circuit boards. Used on epoxy/glass prepreg.

EQUATOR: In filament winding, the line in a pressure vessel described by the junction of the cylindrical portion and the end dome. Also known as tangent line or point.

EQUILIBRIUM WATER UPTAKE: Point at which the rate of increase of water uptake is virtually nil.

EROSION: Destruction of metal or other material by the abrasive action of liquid or gas. Usually accelerated by the presence of solid particles of matter in suspension and sometimes by corrosion.

ESTER: The reaction product of an alcohol and an acid.

ETHYLENE CHLOROTRIFLUOROETHLYENE (POLYFLUOR) (ECTFE) is a partially fluorinated semicrystalline polymer developed for chemical resistance.

ETYLENE TETRA FLUORO ETHYLENE (ETFE): Plastic designed to have high corrosion resistance and strength over a wide temperature range.

EUTECTIC MIXTURE: A mixture of two or more substances in such a ratio that it has the lowest melting point of any combination.

EVALUATION: The process of deciding as to the severity of the condition after the indication has been interpreted. Evaluation leads to a decision as to whether the part must be rejected, salvaged, or may be accepted for use.

EVEN TENSION: The process whereby each end of roving is kept in the same degree of tension as the other ends making up that ball of roving. See CATENARY.

EXFOLIATION: A surface defect on composite parts where the resin appears scaled or flaky.

EXOTHERM: The liberation or evolution of heat during the curing of a plastic product or during any chemical reaction.

EXOTHERMIC REACTION: A reaction obtained when mixing certain substances together characterized by the evolution of heat. A reaction that gives off heat when certain substances are mixed together. The mixing of the two parts of an epoxy resin system produces an exothermic reaction. Exotherm can exceed curing temperature if uncontrolled.

EXPANDABLE TOOLING: Use of a hollow rubber mandrel which can be pressurized to form composite hardware during cure.

EXPANDED FOIL: A layer of metallic foil added to the exposed surface of a composite laminate as part of the LIGHTNING STRIKE PROTECTION.

EXPOSURE [RT]: The product of the X-ray intensity is measured by filament current in mill amperes and time in seconds for X-rays or the product of source strength in curies and time in seconds for gamma rays.

EXPOSURE TEMPERATURE: Temperature at which an uncured TATS material starts aging outside of controlled (usually refrigerated) storage. See TATS.

EXPOSURE UNITS (EU): Elapsed time that a TATS material has been exposed to a temperature greater than its specified storage temperature, used to calculate mechanical life and handling life. Typically, the higher the temperature an uncured material is exposed to, the shorter its remaining life. See OUT LIFE, OUT TIME, WORK LIFE, MECHANICAL LIFE, and HANDLING LIFE.

EXTEND: (i) To add fillers or low cost materials in an economy producing endeavor. (ii) To add inert materials to improve void-filling characteristics and reduce crazing.

EXTENDER: Low cost materials used to dilute or extend high cost resins without extensive lessening of properties. See FILLER.

EXTENSIBILITY: The ability of material to extend or elongate upon application of sufficient force, expressed as percent of the original length.

EXTENSIONAL-BENDING COUPLING: A property of certain classes of laminates that exhibit bending curvatures when subjected to extensional loading.

EXTENSIONAL-SHEAR COUPLING: A property of certain classes of laminates that exhibit shear strains when subjected to extensional loading.

EXTENSOMETER: A mechanical or optical device for measuring linear strain due to mechanical stress.

EXTRUDABILITY: The ability of material to extend or elongate upon application of sufficient force, expressed as percent of the original length.

3.6 F

FABRIC: (i) A material made of woven fibers or filaments. (ii) A planar textile also known as cloth.

FABRIC BATCH: Fabric woven from one warp loom setup with warp and fill yarns with traceability to individual yarn lots.

FABRIC DISTORTION: A deviation of a fabric yarn from a straight line.

FABRIC FILL FACE: That side of the woven fabric where the greatest number of the yarns are perpendicular to the selvage.

FABRIC NONWOVEN: See NONWOVEN FABRIC.

FABRIC PREPREG BATCH: Prepreg containing fabric from one fabric batch, impregnated with one batch of resin in one continuous operation.

FABRIC ROLL: Woven fabric contained on one support tube. The fabric on the roll shall originate from one single master roll of woven fabric.

FABRIC WARP FACE: That side of the fabric where the majority of the yarns are parallel to the selvage.

FABRIC WOVEN: See WOVEN FABRIC.

FACE DIMPLING: Waviness of the skin as a result of the void in the honeycomb substructure. Also known as TELEGRAPHING.

FACE SHEET: The skin that is bonded to the core in a sandwich construction. See FACINGS.

FACINGS: (i) Skins and doublers in any layup. (ii) The outermost layer or composite component of a sandwich construction, generally thin and of high density, which resists most of the edgewise loads and flatwise bending moments, synonymous with face, skin, and face sheet. See FACE SHEET.

FADEOMETER: An apparatus for determining the resistance of resins and other materials to fading. This device accelerates the fading by subjecting the article to high-intensity ultra-violet rays of approximately the same wavelength as sunlight.

FADING: Any lightening of an initial color possessed by any material. Measured by accelerating the process by subjecting the material to high-intensity ultraviolet rays of approximately the same wavelength as sunlight.

FAILURE: An event which occurs when a material, device, equipment or system ceases to perform its intended function acceptably.

FAIRING: A member or structure, the primary function of which is to streamline the flow of a fluid by producing a smooth outline and to reduce drag, as in aircraft frames and boat hulls.

FAN: In glass-fiber forming, the fan shape is made by the filaments between the bushing and the shoe.

FAR FIELD [UT]: Sound beam zone in which equal reflectors give signals of exponentially decreasing amplitude with increasing distance; zone beyond the near field. Also known as the Fraunhofer zone.

FATIGUE: (i) The failure or decay of mechanical properties after repeated applications of stress. Fatigue tests give information on the ability of a material to resist the development of cracks, which eventually bring about failure as a result of a large number of cycles. The phenomenon leading to fracture under repeated or fluctuating stresses (loads) having a maximum value less than the tensile strength of the material. Fatigue fractures are progressive, beginning as microscopic cracks that grow under the action of the fluctuating stress. (ii) In composites, the effect of cyclic damage (fatigue) is manifested in different ways to metals; e.g., splitting and delamination, matrix cracking, and eventually fiber breakage. Although the failure modes are different, the failure of composites under cyclic loading fits the basic definition of fatigue given in the first sentence of (i).

FATIGUE CRITICAL ALTERATION STRUCTURE (FCAS) means any FATIGUE CRITICAL STRUCTURE of an airplane introduced or affected by a change to its type design and that is not already listed as part of the FATIGUE CRITICAL BASELINE STRUCTURE. Fatigue critical alteration structure is a term used by FAA, and is equivalent to the term FATIGUE CRITICAL MODIFIED STRUCTURE which is used by EASA.

FATIGUE CRITICAL BASELINE STRUCTURE (FCBS) is the ‘as-delivered’ baseline structure of an airplane that is classified by the type certificate holder as a FATIGUE CRITICAL STRUCTURE.

FATIGUE CRITICAL MODIFIED STRUCTURE (FCMS) means any FATIGUE CRITICAL STRUCTURE of an airplane introduced or affected by a change to its type design and that is not already listed as part of the FATIGUE CRITICAL BASELINE STRUCTURE. Fatigue critical modified structure is a term used by EASA, and is equivalent to the term FATIGUE CRITICAL ALTERATION STRUCTURE which is used by FAA.

FATIGUE CRITICAL STRUCTURE (FCS): A structure of an airplane that is susceptible to fatigue cracking that could lead to a catastrophic failure of the aircraft. Determined by the design approval holder.

FATIGUE LIFE: The number of cycles of deformation required to bring about failures of the test specimen under a given set of oscillating conditions (stresses or strains).

FATIGUE LIMIT: The stress level below which a material can be stressed cyclically for an infinite number of times without failure.

FATIGUE RATIO: The ratio of fatigue strength to tensile strength. Mean stress and alternating stress must be stated.

FATIGUE STRENGTH: The maximum cyclical stresses a material can withstand for a given number of cycles before failure occurs. The residual strength after being subjected to fatigue.

FATTY ACID: An organic acid obtained by the hydrolysis (saponification) of natural fats and oils, for example stearic and palmitic acids.

FAYING REGION: The area of a cured part that will be mated to another part in a subsequent assembly. Faying region includes surface plies and internal plies. See FAYING SURFACE.

FAYING SURFACE: The surfaces of materials in contact with each other and joined or about to be joined.

FEATHERING: The tapering of an adherend on one side to form a wedge section, as used in a scarf joint.

FELL: The point of braid formation, which is defined as the point at which the yarns in braid system cease movement relative to each other.

FELT: A fibrous material made up of interlocked fibers by mechanical or chemical action, moisture, or heat. Made from fibers such as asbestos, cotton, glass, etc. See BATT.

FIBER: A general term used to refer to filamentary materials. Often fiber is used synonymously with filament. It is a general term for a filament with a finite length that is at least 100 times its diameter, which is typically 0.10 to 0.13 mm (0.004 to 0.005 inch). In most cases it is prepared by drawing from a molten bath, spinning, or deposition on a substrate. Fibers can be continuous or specific short lengths (discontinuous), normally no less than 3.2 mm (0.125 inch). Graphite, glass, and aramid are examples of fibers typically used in aerospace. See WHISKER.

FIBER AREAL WEIGHT (FAW): The weight of fiber per unit area in a prepreg (or dry cloth) material. The weight of resin, including finish on the fiber, is not included in this value. Typical units are grams per square meter (g/m^2).

FIBER BATCH: A fiber batch is a quantity of fibers, manufactured in one continuous operation and uniform production conditions.

FIBER BREAKOUT: A fiber separation or broken fibers on the surface plies at drilled holes or machined edges.

FIBER BUNDLE: Usually a bundle of filaments or fibers.

FIBER COMPOSITE MATERIAL: A material consisting of two or more discrete physical phases, in which a fibrous phase is dispersed in a continuous matrix phase. The fibrous phase may be macro, micro, or submicroscopic, but it must retain its physical identity so that it could conceivably be removed from the matrix intact.

FIBER CONTENT: The amount of fiber present in a composite. This is usually expressed as a percentage volume fraction or weight fraction of the composite.

FIBER COUNT: The number of fibers per unit width of ply present in a specified section of a composite.

FIBER DIAMETER: The measurement (expressed in hundred thousandths) of the diameter of individual filaments.

FIBER DIRECTION: The orientation or alignment of the longitudinal axis of the fiber with respect to a stated reference axis.

FIBER DISPERSION: The fine distribution of fibers.

FIBER ORIENTATION: Alignment of warp fibers in accordance with an engineering drawing. Can also mean fiber alignment in a nonwoven or mat laminate where the majority of fibers are in the same direction, resulting in a higher strength in that direction.

FIBER PATTERN: Visible fibers on the surface of laminates or molding. The thread size and weave of glass cloth.

FIBER PLACEMENT: In general, refers to how the plies are laid into their orientation; i.e., by hand, by a textile process, by tape layer, or by a filament winder. Tolerances and angles are specified.

FIBER PULLOUT: Fiber or resin pullout occurs when small pieces of resin or composite fibers are pulled away from the laminate during a cut or drill procedure. Also known as RESIN PULLOUT.

FIBER-REINFORCED PLASTIC (FRP): A general term for a composite that consists of a resin reinforced with cloth, tape, mat, or strands or any fiber form and using any type of fiber.

FIBER SHOW: Strands or bundles of fibers that are not covered by plastic and that are at or above the surface of a composite.

FIBER SYSTEM: The type and arrangement of fibrous material which comprises the fiber constituent of an advanced composite. Examples of fiber systems are collimated filaments or filament yarns, woven fabric, randomly oriented short-fiber ribbons, random fiber mats, whiskers, etc.

FIBER WASH: Splaying out of woven or nonwoven fibers from the general reinforcement direction. Fibers are carried along with bleeding resin during cure.

FIBERGLASS: An individual filament made by drawing molten glass. A continuous filament is a glass fiber of great or indefinite length. A staple fiber is a glass fiber of relatively short length, generally less than 430 mm (17 inches), and the length related to the forming or spinning process used. A general term having the same meaning as FIBERGLASS REINFORCEMENT.

FIBERGLASS REINFORCEMENT: Material used to reinforce a resin matrix using continuous or discontinuous glass fibers. Available as mat, roving, fabric, etc., it is incorporated into both thermosets and thermoplastics.

FIBER-MATRIX INTERFACE: The region separating the fiber and matrix phases, which differs from them chemically, physically and mechanically. In most composite materials, the interface has a finite thickness (nanometers to thousands of nanometers) because of diffusion or chemical reactions between the fiber and matrix. Thus, the interface can be more properly described by the term's "interphase" or "interfacial zone." When coatings are applied to the fibers or several chemical phases have well defined microscopic thicknesses, the interfacial zone may consist of several interfaces.

FIELD AREA: The region that makes up most of the area of the component and is away from edges, fittings, changes in cross section.

FILAMENT: The smallest unit of a fibrous material. The basic units formed during drawing and spinning, which are gathered into strands of fiber for use in composites. Filaments usually are of extreme length and very small diameter, usually less than 25 µm (0.001 inch). Normally, filaments are not used individually. Some textile filaments can function as a yarn when they are of sufficient strength and flexibility.

FILAMENT COUNT: Number of filaments in the cross-section of a fiber bundle.

FILAMENT WEIGHT RATIO: In a composite material, the ratio of filament weight to the total weight of the composite.

FILAMENT WINDING: A process for fabricating a composite structure in which continuous reinforcements (filament, wire, yarn, tape, or other), either previously impregnated with a matrix material or impregnated during the winding, are placed over a rotating and removable form or mandrel in a prescribed way to meet certain stress conditions. Generally, the shape is a surface of revolution and may or may not include end closures. When the required number of layers is applied, the wound form is cured and the mandrel removed.

FILAMENT WOUND: Pertaining to an object created by the filament winding method of fabrication.

FILAMENTARY COMPOSITES: A major form of advanced composites in which the fiber constituent consists of continuous filaments. Filamentary composites are defined here as composite materials composed of laminae in which the continuous filaments are in nonwoven, parallel, uniaxial arrays. Individual uniaxial laminae are combined into specifically oriented multiaxial laminates for application to specific envelopes of strength and stiffness requirements.

FILL: Yarn oriented at right angles to the warp in a woven fabric. Also known as WEFT or WOOF.

FILL DIRECTION: See WEFT DIRECTION.

FILLER: A relatively inert substance added to a material to alter its physical, mechanical, thermal, electrical, and other properties or to lower cost or density. Sometimes the term is used specifically to mean particulate additives. See INERT FILLER.

FILLER PLY: Partial plies of a lay-up, usually located on honeycomb sandwich edge bands, which do not extend on to any portion of the honeycomb surface. Partial plies of a lay-up which run up to, but not on to a honeycomb sandwich assembly. Used to thicken the edge for countersunk screws or bolts. A partial ply used to stabilize or fill a local area. See PLY (NON-STRUCTURAL).

FILLET: A rounded filling of adhesive that fills the corner or angle where two adherend are joined.

FILLING YARN: The transverse threads of fibers in a woven fabric. Those fibers running perpendicular to the warp. Also known as WEFT.

FILM: A thin plane product of arbitrarily limited maximum thickness in which the thickness is very small in proportion to length and width, generally supplied in roll form.

FILM ADHESIVE: A synthetic resin adhesive, usually of the thermosetting type, in the form of a thin, dry film of resin with or without a paper, glass, or other carrier.

FILM ADHESIVE BATCH: A film adhesive batch is produced in one continuous manufacturing operation using one batch of resin and suitable carrier with traceability to the individual batches of resin and carrier used.

FILM FOCAL DISTANCE (FFD) [RT]: Distance between film and tube target.

FILTERS [UT, ET]: Filters are electrical circuits designed to eliminate various frequencies from a circuit output or input. Filter may be low pass (high frequencies suppressed), high pass (low frequencies suppressed), or band pass (frequencies outside a specified range suppressed).

FINISH: Chemical finish (coating) applied to glass fibers to facilitate resin wetting, resin bonding and good environmental performance of a cured laminate. Also improves fabric handling. A dilute epoxy finish is sometimes used on carbon fiber before prepregging. A number of finishes are used on glass-fiber fabrics and tapes depending on the resin system to be used. In order to ensure a good, durable bond, it is absolutely essential that the glass to be used has been treated with a finish compatible with the chosen resin system; i.e., polyester, epoxy, phenolic, or other resin. Tables of resins and suitable glass finishes are supplied by glass-fiber manufacturers.

FIR TREE DELAMINATION: Delamination of multiple plies, which increases in area as it propagates through the thickness of successive individual plies.

FIRE RETARDANT ADDITIVES: While resins such as phenolic and halogenated resins are naturally more fire resistant than others, additives are also used to enhance fire resistance. Additives such as aluminum trihydrate are used with a variety of resins while antimony and ferrous oxides are synergists with halogenated resins. These are specialized additives added by the resin formulator and comprehensive testing of a particular formulation is required. The OEM should be contacted if the need for these additives is envisioned.

FIRING: Heating a ceramic to an elevated temperature to consolidate it and bond it together.

FIRST ARTICLE: The first unit or batch of units produced in either a repair or manufacture environment that are fabricated for the first time by either a supplier or the repair station performing a repair.

FIRST ARTICLE INSPECTION (FAI): The first time a repair part is fabricated by a particular supplier, an first article inspection should determine if the product meets acceptance requirements and quality control requirements. Key characteristics should be identified, in advance, by engineering, prior to accomplishing an FAI.

FIRST PLY FAILURE (FPF): The load at which the first lamina failure occurs in a laminate.

FISH EYE: Small globular mass that has not blended completely into the surrounding material. See GEL.

FIXTURES: See TOOLING.

FLAME RESISTANCE: Ability of a material to extinguish flame once the source of heat is removed. See SELF-EXTINGUISHING RESIN.

FLAME RETARDANTS: Certain chemicals that are used to reduce or eliminate the tendency of a resin to burn.

FLAME RETARDED RESIN: A resin compounded with certain chemicals to reduce or eliminate its tendency to burn.

FLAME SPRAYING: (i) Method of applying an aluminum coating to nonconducting composite panels to provide lightning protection or electromagnetic shielding to electronic components mounted behind the part. (ii) A method of applying a plastic coating in which finely powdered fragments of a plastic, together with suitable fluxes, are projected through a cone of flame on to a surface.

FLAMMABILITY: Measure of the extent to which a material will support combustion.

FLAMMABLE: A volatile liquid or gas which has a flash point of 30 °F (-1 °C) or lower. Flammable is synonymous with inflammable.

FLASH: That portion of the charge which flows from or is extruded from the mold cavity during the molding. Extra plastic attached to a molding along the parting line, which must be removed before the part is considered finished.

FLASH MOLD: A mold designed to permit the escape of excess molding material; such a mold relies on back pressure to seal the mold and put the piece under pressure.

FLASH POINT: The temperature to which a liquid must be heated before its vapors will flash or burn momentarily when a small flame is applied. This ignition will not take place unless there is also a spark or open flame. There are several standard methods of determining flash point, most of which are classified as “open cup” or “closed cup.”

FLASH RESISTANT: Not susceptible to burning violently when ignited.

FLASHBREAKER TAPE: (i) This is a tape used around the edge of a bonded joint so that any adhesive that spews out of the joint during curing can be easily removed. A spew or fillet can be beneficial to bond strength so it should be left in place if removal is not essential for cosmetic or other reasons. (ii) Nylon or polyester one-sided non-contaminating adhesive coated film tape used for easy removal of cured or excess materials after the repair materials are cured. Flash breaker tapes are used for a variety of applications in composite bond fabrication processes, such as securing thermocouple wires around the repair area.

FLAT BRAID: A narrow bias woven tape wherein each yarn is continuous and is intertwined with every other yarn in the system without being intertwined with itself.

FLAT LAY: (i) The property of no warping in laminating adhesives. (ii) An adhesive material with good no curling and no distension characteristics.

FLATWISE: Refers to cutting specimens and the application of load. The load is applied flatwise when it is applied to the face of the original sheet or specimen.

FLAW: An imperfection in an item or material which may or may not be harmful.

FLEX CORE: Honeycomb core whose bell-shaped cells allow three dimensional flexibility.

FLEXIBILIZER: An additive that makes a finished plastic more flexible. See PLASTICIZER.

FLEXIBLE MOLDS: Molds made of rubber or elastomeric plastics, used for casting plastics. They can be stretched to remove cured pieces with undercuts.

FLEXURAL MODULUS: The ratio, within the elastic limit, of the applied stress on a test specimen in flexure to the corresponding strain in the outermost fibers of the specimen.

FLEXURAL RIGIDITY: The quantity E x I is known as the flexural rigidity of a beam and is the Young's modulus of the material multiplied by the moment of inertia of the cross section of the beam.

FLEXURAL STRENGTH: The maximum stress that can be borne by the surface fibers in a beam in bending. The flexural strength is the unit resistance to the maximum load before failure by bending, usually expressed in force per unit area.

FLOAT: A place in the fabric where a warp or filling yarn extends unbound over the yarns with which it should be interlaced.

FLOATING ROLLER PEEL TEST: The purpose of this test method is to provide for the determination of the metal-to-metal peel strength of adhesives by a method that will provide good reproducibility at low, as well as at high, strength levels and yet allow for a simple method of test specimen preparation and testing. It provides for the determination of relative peel resistance of adhesive bonds between one rigid adherend and one flexible adherend. This method provides a fixed peel angle, whereas in the "T" peel test, even when adherend are of the same material and equal thickness, the angle of peel may vary.

FLOCCULATION: Process by which colloidal or very fine suspended material in a liquid collects together in loose aggregates of many particles called flocks.

FLOCK: Very short cut fibers usually having a length with in the range 0.5 to 0.6 mm (0.020 to 0.240 inch).

FLOW: (i) The movement of resin under pressure, allowing it to fill all parts of a mold. (ii) The gradual but continuous distortion of a material under continued load, usually at high temperatures. Also known as CREEP. (iii) A qualitative description of the fluidity of an adhesive material during the process of bonding, before the adhesive is set.

FLOW LINE: A mark on a molded piece made by the meeting of two flow fronts during molding. Also known as WELD MAKE or WELD LINE.

FLOW MARKS: Wavy surface appearance of an object molded from thermoplastic resins, caused by improper flow of the resin into the mold.

FLUID: A visible liquid such as water, deicing fluid, solvent, oil, or hydraulic fluid that is inside of a composite panel.

FLUORINATED ETHYLENE PROPYLENE (FEP): A parting agent used with films to create a non-stick release surface that is capable of performing at high temperatures without degradation.

FLUOROPLASTICS: Polyolefin polymers in which fluorine, fluorinated alkyl groups, or other halogens replace hydrogen atoms in the carbon chain. This structure has outstanding electrical properties, excellent resistance to chemical attack, low coefficient of friction, excellent fire resistance, exceptionally good performance at high and low temperatures, low moisture absorption, and outstanding weatherability. Fluoroplastics include PTFE, FEP, PFA, CTFE, ECTFE, ETFE, and PVDF. Strength is low to moderate. Cost is high.

FLUTED CORE: An integrally woven reinforcement material consisting of ribs between two skins in a unitized sandwich construction. Fluted core radomes consist of two fiberglass, or other non-conducting skins, separated by square fiberglass tubes. The tubes are impregnated with resin and laid side by side as an alternative to honeycomb core. The shape of the tubes is maintained by a wax mandrel which is melted out after the resin has cured. The advantage of this method is that any water penetrating the skin is automatically drained away. Other varieties of fluted core are also available.

FLUTES ORIENTATION: Direction of flutes, which are in direct contact with the skins.

FOAM: See CELLULAR PLASTIC.

FOAM CORE: Core made from expanded or foamed plastic. A plastic core whose density is reduced by the presence of numerous small cavities (cells), interconnecting or not, dispersed throughout the mass.

FOAM IN PLACE: The deposition of foams when the foaming machine must be brought to the work that is “in place,” as opposed to bringing the work to the foaming machine. Also, foam mixed in a container and poured into a mold, where it rises to fill the cavity.

FOAMED PLASTICS: Resins in sponge form, flexible or rigid, with cells closed or interconnected and density over a range from that of the solid parent resin to 0.030 g/cm^3. Compressive strength of rigid foams is fair, making them useful as core materials for sandwich constructions. Also, a chemical cellular plastic, the structure of which is produced by gases generated from the chemical interaction of its constituents.

FOAMING AGENT: Chemicals added to plastics and rubbers that generate inert gases on heating, causing the resin to assume a cellular structure.

FOAMING FILM ADHESIVE: An adhesive film used to join honeycomb core in bonded assemblies. Contains a foaming agent that produces an expansion ratio, usually between 2% and 3%, during the cure.

FOCUSED TRANSDUCER [UT]: A transducer with a concave face which converges the acoustic beam to a focal point or line at a defined distance from the face. Also known as a focused search unit.

FOLD: A condition in which the prepreg is laid back over itself.

FOLDED TOW: Slit tape tow that folds onto itself resulting in a reduction of its width.

FORCE: The male half of the mold that enters the cavity, exerting pressure on the resin and causing it to flow. Also known as punch.

FOREIGN MATERIALS: See INCLUSIONS.

FOREIGN OBJECT: Any object that causes damage to an aircraft; e.g., stones or other materials from a runway, tools left in an engine intake or other material sucked in by the airflow. Hail impact and bird strikes are usually considered separately and metallic or nonmetallic particles in an adhesive which are not part of its formulation.

FORMER PLATE: A die attached to abrading machine which helps to locate the fell.

FOURIER TRANSFORM INFRARED (FTIR): A technique used to obtain an infrared spectrum of absorption or emission of a solid, liquid or gas. An FTIR spectrometer collects high-resolution spectral data over a wide spectral range. Used in composites to detect surface contamination and degree of cure of the surface of the composite.

FP FIBER: Polycrystalline alumina fiber (AL_2O_3). A ceramic fiber useful for high-temperature (2500 to 3000 °F or 1370 to 1650 °C) composites.

FRACTURE: The separation of a body. Defined both as rupture of the surface without complete separation of laminate and as complete separation of a body because of external or internal forces.

FRACTURE DUCTILITY: The true plastic strain at fracture.

FRACTURE STRESS: The true, normal stress on the minimum cross-sectional area at the beginning of fracture.

FRACTURE TOUGHNESS: (i) G_C is a measure of the damage tolerance of a material containing initial flaws or cracks. Used in aircraft structural design and analysis. (ii) G_{IC} is opening Mode I interlaminar fracture toughness. (iii) G_{IIC} is Mode II interlaminar fracture toughness.

FRAME HOLDER: A supporting frame that is used to store horizontally rolls of dry fabric, film adhesive, and prepreg.

FRAYED: Broken or loose fibers occurring at machined edges.

FREE RADICAL: Compound which contains at least one unpaired electron in place of the more normal and more stable bond consisting of shared electrons.

FREE RADICAL POLYMERIZATION: A type of polymerization in which the propagating species is a long-chain free radical initiated by the introduction of free radicals from thermal or photochemical decomposition.

FREE WALL: The portion of a honeycomb cell wall that is not connected to another cell.

FREEZER: The equipment or room used to store prepreg, adhesives, and epoxy resins and must have a cooling capability which is adequate to maintain the material specific storage conditions given by the manufacturer or the OEM. For most materials, the frozen storage temperature is at or below 0 °F (-18 °C).

FREKOTE®: Water-based mold-release agent (a Henkel Company trademark).

FREQUENCY: Frequency in uniform circular motion or in any periodic motion is the number of revolutions or cycles completed in unit time. The International System of Units expresses frequency in Hertz (1 Hz = 1 cycle per second).

FULL PLY: Any ply that covers the entire part surface to all net edges.

FUMED SILICA: Silica powder used as filler in epoxy resins. See CAB-O-SIL.

FUNDAMENTAL FREQUENCY [UT]: In resonance testing, the frequency at which the wavelength is twice the thickness of the examined material.

FUNGUS RESISTANCE: The resistance of a material to attack by fungi in conditions promoting their growth.

FURANE PLASTICS: Dark colored thermosetting resins obtained primarily by the condensation polymerization of furfuryl alcohol in the presence of strong acids, sometimes in combination with formaldehyde or furfuryl aldehyde. The term also includes resins made by condensing phenol with furfuryl alcohol or furfuryl and furfuryl ketone polymers. The resins are available as liquids ranging from low viscosity fluids to thick, heavy syrups which cure to highly cross-linked, brittle substances. Also spelled “furan.”

FURFURAL RESIN: A synthetic resin of the thermosetting type obtained by the condensation of furfural with phenol or its homologs.

FUSIBLE: Capable of being melted and formed into a continuous adhesive film. The property of adhesive melting in combination with substrate melting to form a homogeneous mass at the interface.

FUZZ: Accumulation of short broken filaments after passing glass strands, yarns, or roving's over a contact point. Often weighted and used as an inverse measure of abrasion resistance.

FUZZBALL: Loose or frayed fibers that have formed into a ball and are entwined either with the fabric or on the surface. A minor fuzz ball is loose or frayed fibers which are not raised above the fabric surface.

3.7 G

GAGE LENGTH: Length over which deformation is measured for a tensile or compressive test specimen. The deformation over the gage length divided by the gage length determines the strain.

GALVANIC CELL: A cell made up of two dissimilar conductors in contact with an electrolyte or two similar conductors in contact with dissimilar electrolytes. More generally a galvanic cell converts energy liberated by a spontaneous chemical reaction directly into electrical energy.

GALVANIC SERIES: A list of metals, but including graphite, starting with the least noble (magnesium) and ending with the most noble (platinum).

GAP: In filament winding, the space between successive windings, which windings are usually intended to lay next to each other. Separations between fibers within a filament winding band. The distance between adjacent plies in a lay-up of unidirectional tape materials.

GATE: In injection and transfer molding, the channel or orifice through which material is injected from the sprue (or runner in a multi-cavity mold) into a mold cavity.

GATE [UT]: Electronic device to monitor signals in a defined time region (corresponding to a defined depth range) on an A-scan display.

G_c: See FRACTURE TOUGHNESS.

GEL: (i) The initial jellylike solid phase that develops during the formation of a resin from a liquid. (ii) A semisolid system consisting of a network of solid aggregates in which liquid is held.

GEL COAT: A quick setting resin applied to the surface of a mold and gelled before lay-up. The gel coat becomes an integral part of the finished laminate, and is usually used to improve surface appearance and bonding.

GEL PERMEATION CHROMATOGRAPHY (GPC): A form of liquid chromatography in which the polymer molecules are separated by their ability or inability to penetrate the material in the separation column.

GEL POINT: The stage at which a liquid begins to exhibit pseudo elastic properties. This stage may be conveniently observed from the inflection point on a viscosity time plot. The point in a cure beyond which the material will no longer flow without breaking down the matrix network formed to that point. The point at which the matrix transition from a fluid to a solid state takes place.

GELATION: The point in a resin cure when the resin viscosity has increased to a point such that it barely moves when probed with a sharp instrument.

GELATION TIME: That interval of time, in connection with the use of synthetic thermosetting resins, extending from the introduction of a catalyst into a liquid adhesive system until the start of gel formation. Also, the time under application of a specified temperature for a resin to reach a solid state.

GENERALLY ORTHOTROPIC PLY: (i) An orthotropic ply where the loads are not in the direction of the principal plane of elastic symmetry. (ii) The reference coordinate system does not coincide with the ply axis of an orthotropic ply. In this system the stress/strain relation appears anisotropic.

GEODESIC: The shortest distance between two points on a surface. Also known as geodetic.

GEODESIC ISOTENSOID: Constant stress level in any given filament at all points in its path.

GEODESIC OVALOID: A contour for end domes, the fibers forming a geodesic line. The shortest distance between two points on a surface of revolution. The forces exerted by the filaments are proportioned to meet hoop and meridional stresses at any point.

GEODESIC-ISOTENSOID CONTOUR: In filament wound reinforced plastic pressure vessels, a dome contour in which the filaments are placed on geodesic paths so that the filaments will exhibit uniform tensions throughout their length under pressure loading.

GERBER CUTTER: A computer controlled reciprocating knife process for cutting, kitting, and labelling prepreg fabric and tape plies. A tradename of Gerber Technology.

GHOST [UT]: An indication which has no direct relation to reflected pulses from discontinuities in the materials being tested.

G_{Ic}: See FRACTURE TOUGHNESS.

G_{IIc}: See FRACTURE TOUGHNESS.

GLARE: Glass-reinforced fiber metal laminate, made of several alternating, very thin layers of metal (usually aluminum) with one or more layers of GFRP between each layer of metal.

GLASS: An inorganic product of fusion that has cooled to a rigid condition without crystallizing. Glass is typically hard and relatively brittle and has a conchoidal fracture. Any rigid no crystalline solid, applied more commonly to no crystalline inorganic oxides than to no crystalline polymers.

GLASS CLOTH: Conventionally woven glass fiber material. See SCRIM.

GLASS FIBER: A fiber spun from an inorganic product of fusion that has cooled to a rigid condition without crystallizing. A glass filament that has been cut to a measurable length. Staple fibers of relatively short length are suitable for spinning into yarn.

GLASS FILAMENT: A form of glass that has been drawn to a smaller diameter and extreme length. Most filaments are less than 0.15 mm (0.005 inch) in diameter.

GLASS FILAMENT BUSHING: The unit through which molten glass is drawn in making glass filaments.

GLASS FINISH: A material applied to the surface of a glass reinforcement to improve the bond between the glass and the plastic resin matrix.

GLASS FLAKE: Thin, irregularly shaped flakes of glass, typically made by shattering a thin-walled tube of glass.

GLASS FORMER: An oxide that forms a glass easily. Also, one which contributes to the network of silica glass when added to it.

GLASS MAT THERMOPLASTIC (GMT): A semi-finished resin-fiber combination supplied as blanks for compression molding. Also known as GMT.

GLASS PERCENT BY VOLUME: The product of the specific gravity of a laminate and the percent glass by weight, divided by the specific gravity of the glass.

GLASS STRESS: In a filament-wound part, usually a pressure vessel, the stress calculated using the load and the cross-sectional area of the reinforcement only.

GLASS TRANSITION: The reversible change in an amorphous polymer or in amorphous regions of a partially crystalline polymer from, or to, a viscous or rubbery condition to, or from, a hard and relatively brittle one.

GLASS TRANSITION TEMPERATURE: The approximate midpoint of the temperature range over which the glass transition takes place. The temperature at which increased molecular mobility results in significant changes in the properties of a cured matrix resin system or plastic fiber. The symbol is T_g.

GLOSS: The shine, sheen, or luster of a dried film.

GORE: An individual flattened plane of material that can be assembled as a sector of a curved surface with little distortion after being put into place.For example, multiple overlapping gores may form a grid enabling construction of a radome.

GOUGE: A damaged area where the result is a cross-sectional change caused by a sharp object and gives a continuous, sharp or smooth groove in the material.

GRAPHITE: The crystalline allotropic form of carbon.

GRAPHITE FIBER: A fiber made from a precursor by oxidation, carbonization, and graphitization process (which provides a graphitic structure). See CARBON FIBER.

GRAPHITIZATION: The process of pyrolyzation in an inert atmosphere at temperatures in excess of 3500 °F (1925 °C), usually as high as 4500 °F (2480 °C), and sometimes as high as 4890 °F (2700 °C), converting carbon to its crystalline allotropic form. Temperature depends on precursor and properties desired.

GREEN STRENGTH: The ability of the material (such as a urethane elastomer), while not completely cured, to undergo removal from the mold and handling without tearing or permanent distortion.

GREENSTICK FRACTURE: Fracture where the crack does not go right through the material but is deflected part-way through, allowing the remainder of the cross section to deform elastically.

GREIGE GOODS: Any fabric before finishing, as well as any yarn or fiber, in grey (or gray) color, before bleaching or dyeing; therefore, fabric with no finish or size.

GREX: A system of measuring the fineness of yarn and fibers. Grex number is numerically equal to the weight, in grams, of 10 km of yarn. The lower the Grex number, the finer the yarn.

GRIT BLASTING: Unsuspended hard particles used as blasting abrasive for removal of the surface finish. Example ingredients can include aluminum oxide, wheat starch, dry ice pellets, glass beads, or plastic pellets. It is also known as BEAD BLASTING.

GRIT STRIP: A tooling component that consists of a textured strip, typically made of dimpled sheet metal that is used to restrain ply edges in sandwich parts, helping to prevent crushing of the core. Individual plies are laid down in a staggered fashion so that they each can contact the textured strip.

GROUND HANDLING EQUIPMENT (GHE): Also known as ground service equipment.

GROUND SERVICE EQUIPMENT (GSE): Also known as ground handling equipment.

GUNK: A premixed charge for premix molding which contains all of the ingredients for molding, usually chopped roving, resin, pigment, filler, and catalyst.

GUSSET: A piece used to give added size or strength in a particular location of an object; the folded- in portion of a flattened tubular film.

3.8 H

HACKLES: Raised strips or striations on a fracture surface caused by an array of small cracks produced during a shear failure.

HALF WAVE RECTIFICATION [UT]: Modification of an ultrasonic signal so that only one half (either positive or negative going) of the RF waveform is displayed.

HAND: The softness of a piece of fabric, as determined by the touch (individual judgment).

HAND FITUP: The application of hand pressure to induce a change in the periphery of an oversize or undersize honeycomb core detail during panel layup.

HAND LAY-UP: The process of placing (and working) successive plies of reinforcing material or resin-impregnated reinforcement in position on a mold by hand prior to cure to the formed shape.

HANDLING LIFE: The total out-of-refrigeration time over which a material retains its handle-ability prior to final compaction. See WORK LIFE.

HANDLING STRENGTH: A low level of strength initially obtained by an adhesive that allows specimens to be handled, moved, or unclamped without causing disruption of the curing process or affecting bond strength.

HANG PICK: A pick (fill yarn) caught on a warp yarn knot producing a triangular shaped hole in the fabric. Also known as Hung filling yarn.

HARDENER: A substance or mixture added to a plastic composition to promote or control the curing action by taking part in it. The term is also used to designate a substance added to control the degree of hardness of the cured film. See CATALYST.

HARDNESS: The resistance to surface indentation usually measured by the depth of penetration (or arbitrary units related to the depth of penetration) of a blunt point under a given load using a particular instrument according to a prescribed procedure. See BARCOL HARDNESS, MOHS HARDNESS, ROCKWELL HARDNESS, and SHORE HARDNESS.

HARMONICS [UT]: Those vibrations which are integral multiples of the fundamental frequency; used in resonance testing.

HARNESS SATIN: Weaving pattern producing a satin appearance. “Eight-harness” means the warp tow crosses over seven fill tows and under the eighth (repeatedly). Also produced as four harness and five harness.

HASH: Numerous, small indications appearing on the viewing screen of the ultrasonic instrument indicative of many small in homogeneities in the material or background noise; also known as grass.

HAT SECTION: A structural member with a cross-section in the shape of a hat.

HAZARDOUS MATERIAL: Material with the potential to become a hazardous waste. These are typically toxic or corrosive substances or mixtures of substances; irritants, strong sensitizers, flammables, or combustibles; or other substances with special characteristics that could harm personnel, structures, or the environment if used or stored improperly.

HEAT ACTIVATED ADHESIVE: A dry adhesive that is rendered tacky or fluid by application of heat, or heat and pressure, to the assembly.

HEAT AFFECTED AREA: (i) The area adjacent to the repair which may be affected by the heat of the heater blanket. (ii) May also be an area that has suffered from unwanted overheating (e.g., lightning strike, engine fire, etc.). Such areas require special inspection.

HEAT BLANKET: Rubber blanket, often silicone rubber for higher temperatures, containing electrical heating elements. Used with a “hot-bonder” control unit to heat up repair areas to cure film adhesives, prepreg, and resins.

HEAT BUILDUP: The rise in temperature in a part resulting from the dissipation of applied strain energy, as heat or from applied mold cure heat. Also caused by exotherm during resin cure. See HYSTERESIS.

HEAT CLEANED: A condition in which glass or other fibers are exposed to elevated temperatures to remove preliminary sizing's or binders not compatible with the resin system to be applied.

HEAT CONVERTIBLE RESIN: A thermosetting resin convertible by heat into an infusible and insoluble mass.

HEAT DAMAGE: Loss of strength and/or loss of material in an area of structure that is caused by exposure to very high temperature for a short period of time, or by a moderately high temperature for a long period of time.

HEAT DEFLECTION TEMPERATURE (HDT): The temperature at which a standard test bar deflects a specified amount under a stated load. Also known as Deflection Temperature Under Load (DTUL).

HEAT DISTORTION TEMPERATURE (HDT): The temperature at which a polymer or plastic sample deforms under a specified load. This property of a given plastic material is applied in many aspects of product design, engineering, and manufacture of products using thermoplastic components.

HEAT DISTORTION POINT: The temperature at which a standard test bar deflects a specified amount under a stated load. Now called deflection temperature.

HEAT FAIL TEMPERATURE: The temperature at which delamination occurs under static loading in shear.

HEAT GUN: A hand-held device for heating a local area e.g., during lay-up to increase tack. Must be limited to 150 °F (60 °C) to prevent over-heat.

HEAT LAMP: Heating element such as incandescent bulb, quartz bulb, quartz tube, and ceramic that is used to heat the repair area with thermal radiation. It is also known as a RADIANT HEATER.

HEAT MARK: Extremely shallow depression or groove in the surface of a plastic visible because of a sharply defined rim or a roughened surface. See SHRINK MARK.

HEAT RESISTANCE: The property or ability of plastics and elastomers to resist the deteriorating effects of elevated temperatures.

HEAT SEALER: Equipment used to seal the moisture proof bag containing the prepregs, foaming adhesive films and adhesive films. Also known as iron heat sealer.

HEAT SEALING: A method of joining plastic films by simultaneous application of heat and pressure to areas in contact.

HEAT SEALING ADHESIVE: A thermoplastic film adhesive that is melted between the adherend surfaces by heat application to one or both of the adjacent adherend surfaces.

HEAT SINK: A contrivance for the absorption or transfer of heat away from a critical element or part. Bulk graphite is often used as a heat sink. Also a metal part in a composite structure that will act as a heat sink.

HEAT TREATING: Term used to cover annealing, hardening, tempering, etc.

HELICAL WINDING: In filament-wound items, a winding in which a filament band advances along a helical path, not necessarily at a constant angle except in the case of a cylinder.

HERCULES BRAID: A braided fabric with an over three, under three weave pattern (3 x 3).

HERMETICALLY SEALED: Any type of sealing that makes a given object airtight (excludes the passage of air, oxygen, or other gases). The term originally applied to airtight glass containers, but as technology advanced it applied to a larger category of materials, including rubber and plastics.

HETERO POLYMERIZATION: A special case of additive copolymerization which involves the combination of two dissimilar unsaturated organic monomers.

HETEROGENEOUS: Descriptive term for a material consisting of dissimilar constituents separately identifiable. A medium consisting of regions of unlike properties separated by internal boundaries. Note that not all nonhomogeneous materials are necessarily heterogeneous.

HIGH-ENERGY WIDE AREA BLUNT IMPACT (HEWABI): Dynamic events that typically include an impact object or impacting vehicle whose geometrical and other characteristics spreads the resulting forces over a large area of a composite aircraft structure. The high energies involved in HEWABI events can cause damage within the composite structure, both at the impact location and in reacting structures that are some distance from the contact area. The damaged area may not have exterior indications of damage as seen with traditional metallic structures, which are more prone to visual plastic deformation (dents).

HEXA: Shortened form of hexamethylenetetramine, a source of reactive methylene for curing novo lacs.

HIGH-DENSITY POLYETHYLENE (HDPE): A thermoplastic polymer produced from the monomer ethylene. It is sometimes called “alkathene” or “polythene.”

HIGH ENERGY SURFACE: A high energy surface has a high value of surface free energy, usually measured in millijoules per square meter (mJ/m^2). Metals, metal oxides, and ceramics are classified as high energy surfaces and typically have surface energies greater than 500 mJ/m^2. To achieve a good adhesive bond to a surface it is essential that the surface energy of the surface should be higher, preferably considerably higher, than the surface tension of the adhesive to be used in order to achieve the good wetting of the surfaces that is necessary. Low energy surfaces have a surface energy below 100 mJ/m^2. High energy surfaces have a surface energy of several hundreds of mJ/m^2.

HIGH FREQUENCY BONDTESTER: Wet-coupled bond tester generally operating at frequencies above 100 kHz.

HIGH FREQUENCY HEATING: The heating of materials by dielectric loss in a high-frequency electrostatic field. The material is exposed between electrodes and is heated quickly and uniformly by absorption of energy from the electrical field.

HIGH-INTENSITY RADIATED FIELDS (HIRF): Electrical interference caused by proximity (too close or in contact with) to large intentional external transmitters.

HIGH MODULUS (HM): Carbon fibers with a high tensile modulus. Increased tensile modulus compared to INTERMEDIATE MODULUS carbon fibers. See INTERMEDIATE MODULUS and ULTRA-HIGH MODULUS.

HIGH PRESSURE LAMINATES: Laminates molded and cured at pressures not lower than 6.9 MPa (1.0 ksi), and more commonly in the range of 8.3 to 13.8 MPa (1.2 to 2.0 ksi).

HIGH PRESSURE LAMINATING: A term usually reserved for matched die molding, typically done under high pressures in a press. High pressure laminating is not so common as autoclave molding.

HIGH PRESSURE MOLDING: A molding process in which the pressure used is greater than 6.9 MPa (1.0 ksi).

HIGH PRESSURE SPOT: See RESIN STARVED AREA.

HIGH TEMPERATURE PRESSURE SENSITIVE TAPE: Tape used for a variety of applications in composite fabrication processes. It will stick to another material when it is applied under fingertip pressure and it is capable of withstanding the high temperatures encountered during an autoclave cure. The tape is removed after the cure cycle is complete and is not a part of the final composite assembly. Tape used for various composite fabrication purposes, such as securing thermocouple wires.

HIGH TENACITY (HT): Carbon fibers with high tensile strength. Standard fiber type. See SUPER TENACITY.

HOLD PRESSURE: In molding, the melt pressure during the hold time interval in injection molding.

HOLE: A puncture or cut-out that is fully surrounded by undamaged material.

HOLOGRAM: Three-dimensional photograph or image produced by interference between two sets of coherent light waves.

HOMOGENEOUS: A descriptive term for a material of uniform composition throughout. A medium that has no internal physical boundaries. A material whose properties are constant at every point, that is, constant with respect to spatial coordinates (but not necessarily with respect to directional coordinates).

HOMOPOLYMERIZED: A condition whereby a monomeric material is polymerized only with itself.

HONEYCOMB: Manufactured product of resin-impregnated sheet material (paper, glass fabric, and so on) or metal foil, formed into hexagonal-shaped cells. Other cell shapes are produced. Used as a core material in sandwich construction. It is also known as honeycomb core or core. See SANDWICH CONSTRUCTION.

HONEYCOMB SANDWICH ASSEMBLY: A structural composition consisting of relatively dense, high-strength facings (skin) bonded to a lightweight, cellular honeycomb core. See SANDWICH CONSTRUCTION.

HOOP STRESS: The circumferential stress in a material of cylindrical form subjected to internal or external pressure.

HORIZONTAL BLEED: See EDGE BLEED.

HOT AIR BLOWER: A piece of equipment used in conjunction with a hot bonder and tent or box used to contain the heated air and distribute the temperature evenly for curing, drying, heating, etc.

HOT BOND REPAIR: Bonded repairs which are cured at an elevated temperature, typically greater than 180 °F (82 °C) using a controlled cure cycle.

HOT BONDER: An instrument that provides electrical power to a heat source and may provide a vacuum source, has thermocouples and can control, monitor, and record the time/vacuum/temperature cycle required for repair process.

HOT DRAPE FORMING: The application of heat and vacuum or mechanical force to facilitate forming of prepreg materials.

HOT HEAD TAPE LAYER: A computer controlled automated tape placement process for thermoplastic prepreg utilizing a gantry mounted hot shoe to partially consolidate each consecutive ply in a programmed orientation and laminate size.

HOT ISOSTATIC PRESSING (HIP): A process for fabricating certain metal matrix composites. A preform is consolidated under fluid pressure (usually an inert gas) at high temperature and pressure in a pressure vessel. This method can also be used to consolidate ceramic materials which have no metal matrix.

HOT KNIFE: A tool that is used to seal the moisture proof bag containing the prepreg, foaming adhesive films and adhesive films.

HOT MELT ADHESIVE: An adhesive that is applied in a molten state and forms a bond after cooling to a solid state. A bonding agent that achieves a solid state and resultant strength by cooling, as contrasted with other adhesives, which achieve the solid state through evaporation of solvents or chemical cure. A thermoplastic resin that functions as an adhesive when melted between substrates and cooled.

HOT SETTING ADHESIVE: An adhesive that requires a temperature at or above 212 °F (100 °C) to set.

HOT WET PROPERTIES: The mechanical properties required of a composite or bonded metal assembly under prescribed conditions of temperature, time and relative humidity or water immersion. Testing is usually carried out at a specified temperature after exposure to the required environment for a specified period of time.

HOT WORKING: Any form of mechanical deformation processing carried out on a metal or alloy above its recrystallization temperature but below its melting point.

HUMIDITY: See RELATIVE HUMIDITY.

HYBRID: A composite laminate consisting of laminae of two or more composite material systems. A combination of two or more different fibers, such as carbon and glass or carbon and aramid, into a structure. Tapes, fabrics, and other forms may be combined; usually only the fibers differ. See INTERPLY HYBRID and INTRAPLY HYBRID.

HYBRID JOINT: Hybrid joint is a structure which utilizes both adhesive and fastener to transfer load between the elements.

HYDRAULIC PRESS: A press in which the molding force is created by the pressure exerted by a fluid.

HYDROBURST: Test in which a fluid is used to load a pressure vessel to failure.

HYDROCARBON PLASTICS: Plastics based on resins made by the polymerization of monomers composed of carbon and hydrogen only.

HYDROCLAVE: An autoclave that uses water as its pressurizing medium.

HYDROFLUORIC ACID: Is a colorless fuming liquid which can cause painful burns. Hydrofluoric acid (HF) is used in the production of aluminum and chlorofluorocarbons, and in the glass and aluminum etching.

HYDROGEN BONDING: Hydrogen bonding is a very important mechanism for intermolecular attraction and therefore adhesion. Hydrogen bonding is due to the strong interaction of hydrogen attached to one atom (such as oxygen, nitrogen, or carbon) by a polar covalent bond with an adjacent atom of high electronegativity (such as oxygen, nitrogen, or one of the halogens).

HYDROLYSIS: Chemical decomposition of a substance involving the addition of water. Reaction between ions of a salt and ions of water forming a solution which is either acidic or alkaline.

HYDROMECHANICAL PRESS: A press in which the molding forces are created partly by a mechanical system and partly by a hydraulic system.

HYDROPHILIC: Having an attraction for water. Capable of adsorbing or absorbing water. Easily wetted by water.

HYDROPHOBIC: Capable of repelling water. Poorly wetted by water. The opposite of hydrophilic.

HYDROPROOF: Test in which a fluid is used to carry out a proof loading requirement for a pressure vessel.

HYGROSCOPIC: Capable of attracting, absorbing, and retaining atmospheric moisture.

HYGROTHERMAL EFFECT: Change in properties due to moisture adsorption and temperature change.

HYSTERESIS: The energy absorbed in a complete cycle of loading and unloading. This energy is converted from mechanical to frictional energy (heat).

3.9 I

IGNITION LOSS: The difference in weight before and after burning. As with glass, the burning off of the binder or size.

IMMISCIBLE: With respect to two or more fluids, not mutually soluble; incapable of attaining homogeneity.

IMPACT DAMAGE: Damage from foreign object (other than ballistic).

IMPACT STRENGTH: The ability of a material to withstand shock loading. The work done in fracturing a test specimen in a specified manner under shock loading.

IMPACT TEST: Measure of the energy necessary to fracture a standard notched bar by an impulse load. See CHARPY IMPACT TEST, IZOD IMPACT TEST, and REVERSE IMPACT TEST.

IMPACT VALUE: The energy absorbed by a specimen of standard design when sheared by a single blow from a testing machine hammer. Expressed in joules per square meter (J/m^2) or foot-pound-force per square inch ($ft{\cdot}lbf/in^2$).

IMPREGNATE: In reinforced plastics, to saturate a fabric or fiber reinforcement with a resin.

IMPREGNATED FABRIC: A fabric impregnated with a synthetic resin. See PREPREG.

IMPREGNATOR: A mechanical device for wetting or impregnating fabrics with resin. Generally consists of a trough through which the fabric is drawn and a set of adjustable scraper bars to remove excess resin.

IN TRANSIT LIFE: The time period which extends from the date of shipment to the date of receipt and during which the material is shipped.

INCLUSION: (i) A physical and mechanical discontinuity occurring within a material or part, usually consisting of solid, encapsulated foreign material. Inclusions are often capable of transmitting some structural stresses and energy fields, but in a noticeably different degree from the parent material. Visible foreign material such as particles, chips, and films. See VOIDS. (ii) Foreign materials, such as particles, chips, films, backing paper, peel ply, etc., which are unintentionally incorporated in a composite part.

INCONEL: Nickel-chromium-molybdenum base alloy. Nickel, chromium, and molybdenum elements with trace amounts of several other elements. Has high strength and oxidation resistance at high temperatures. A trademark of Special Metals Corporation.

INDENTATION HARDNESS: Hardness evaluated from measurements of area or indentation depth caused by pressing a specified indentor into the surface of a material with a specified force.

INDICATION: In non-destructive inspection or testing, a response, or evidence of a response, that requires interpretation to determine its significance.

INDUCTION BONDING: A secondary bonding for thermoplastic composite parts in which a metallic susceptor is placed in the bond line and an induction coil is used to heat the joint above the melt temperature of the thermoplastic matrix.

INERT ATMOSPHERE: The use of a gas (usually nitrogen) that does not absorb or react with ultraviolet light in a curing chamber, in place of oxygen.

INERT FILLER: A material added to a plastic to alter the end-item properties through physical rather than chemical means.

INFRARED: Part of the electromagnetic spectrum between the visible light range and the radar range. Radiant heat is in this range, and infrared heaters are frequently used in the thermoforming and curing of plastics and composites. Infrared analysis is used for identification of polymer constituents.

INFRARED THERMOGRAPHY: See THERMOGRAPHY.

INHIBITOR: A substance that retards a chemical reaction. A material added to a resin to slow down curing. Also used in certain types of monomers and resins to prolong storage life. Synonym for RETARDER.

INHOMOGENEOUS: Consisting of more than one phase; e.g., discrete regions of different materials.

INITIAL MODULUS: The slope of the initial straight portion of a stress-strain or load-elongation curve. See YOUNG'S MODULUS.

INITIAL PULSE [UT]: Electrical pulse generated by the ultrasonic instrument; used to excite a search unit in order to produce ultrasonic energy.

INITIAL STRAIN: The strain produced in a specimen by given loading conditions before creep occurs.

INITIAL STRESS: The stress produced by force in a specimen before stress relaxation occurs.

INITIATOR: Sources of free radicals, often peroxides or azo compounds. They are used in free- radical polymerizations, for curing thermosetting resins, as cross-linking agents for elastomers and polyethylene, and for polymer modification.

INJECTION MOLDING: Method of forming a plastic to the desired shape by forcing the heat- softened plastic into a relatively cool cavity under pressure. The production of a composite component by the injection of resin or a fiber/resin mix into a closed mold.

INJECTION TIME: The time interval from the beginning of screw forward movement until switching over to hold pressure.

INNER MOLD LINE (IML): Inner surface of a cured part; refers to the inside surface of the fuselage skin.

INNER SKIN: That side of the part which is cured against the vacuum bag.

INORGANIC: Designating or pertaining to the chemistry of all elements and compounds not classified as organic. Matter other than animal or vegetable, such as earthy or mineral matter. Applies to the chemistry of all elements and compounds not classified as organic.

INORGANIC PIGMENTS: Natural or synthetic metallic oxides, sulfides, and other salts that impart heat and light stability, weathering resistance, color, and migration resistance to plastics.

INPLANE LOADS: Loads which are parallel to the facings.

INSERT: (i) An integral part of a plastic molding consisting of metal or other material that may be molded or pressed into position after the molding is completed. (ii) Apparatus placed into the sandwich for attaching items; synonymous with hard points. (iii) In the case of floor panels and others where high shear loads have to be carried through the panel to surrounding structure, special inserts are used to ensure that the required loads can be transmitted.

INSERT PIN: A pin which keeps an inserted part (insert) inside the mold by screwing or friction; it is removed when the object is being withdrawn from the mold.

INSTANTANEOUS STRESS: See INITIAL STRESS.

INSTRUMENTED NDI: An inspection that uses approved instrumentation to find internal defects or flaws in a material. See NON-DESTRUCTIVE INSPECTION (NDI).

INSULATION PLY: As an example, a ply of fiberglass to isolate graphite/epoxy laminate from an aluminum surface finish or conductive coating to prevent galvanic corrosion. See ISOLATION PLY and PLY (NON-STRUCTURAL).

INSULATION RESISTANCE: The electrical resistance between two conductors or systems of conductors separated only by insulating material. The ratio of the applied voltage to the total current between two electrodes in contact with a specified insulator. The electrical resistance of an insulating material to a direct voltage.

INSULATOR: A material of such low electrical conductivity that the flow of current through it can usually be neglected. Similarly, a material of low thermal conductivity, such as that used to insulate structural shells.

INTEGRAL COMPOSITE STRUCTURE: Composite structure in which several structural elements, which would conventionally be assembled together by bonding or mechanical fasteners after separate fabrication, are instead laid up and cured as a single, complex, continuous structure, for example, spars, ribs, and one stiffened cover of a wing box fabricated as a single integral part. The term is sometimes applied more loosely to any composite structure not assembled by mechanical fasteners. All or some parts of the assembly may be co-cured.

INTEGRAL SKIN FOAM: Urethane foam with a cellular core structure and a relatively nonporous skin.

INTEGRALLY HEATED: A term referring to tooling that is self-heating, through use of electrical heaters such as cal rods. Most hydroclave tooling is integrally heated. Some autoclave tooling is integrally heated to compensate for thick sections, to provide high heat-up rates, or to permit processing at a higher temperature than is otherwise possible with the autoclave.

INTERFACE: The boundary or surface between two different, physically distinguishable media. On fibers, the contact area between fibers and sizing or finish. In a laminate, the contact area between the reinforcement and the laminating resin.

INTERFERENCE FITS: A joint or mating of two parts in which the male part has an external dimension larger than the internal dimension of the mating female part. Distension of the female by the male creates a stress, which supplies the bonding force for the joint.

INTERLAMINAR: Descriptive term pertaining to an object (voids, etc.), event (fracture, etc.), or potential field (shear stress, etc.) referenced as existing or occurring between two or more adjacent laminae.

INTERLAMINAR SHEAR: Shearing force tending to produce a relative displacement between two laminae in a laminate along the plane of their interface.

INTERLAMINAR SHEAR STRENGTH (ILSS): The maximum shear stress between layers that a laminated material can resist.

INTERMEDIATE BEARING STRESS: The bearing stress at the point on the bearing load- deformation curve where the tangent is equal to the bearing stress divided by a designated percentage (usually 4%) of the original hole diameter.

INTERMEDIATE MODULUS (IM): Carbon fibers with an intermediate tensile modulus. See HIGH MODULUS and ULTRA-HIGH MODULUS.

INTERMEDIATE TEMPERATURE SETTING ADHESIVE: An adhesive that sets in the temperature range from 87 to 212 °F (30 to 100 °C).

INTERNAL ADHESIVE STRESS: Stress created within an adhesive layer by the movement of the adherend at differential rates or by the contraction or expansion of the adhesive layer.

INTERNATIONAL RUBBER HARDNESS DEGREE: A measure of hardness, the magnitude of which is derived from the depth of penetration of a specified indentor into a test piece under specified conditions.

INTERPHASE: The boundary region between a bulk resin or polymer and an adherend in which the polymer has a high degree of orientation to the adherend on a molecular basis. It plays a major role in the load transfer process between the bulk of the adhesive and the adherend or the fiber and the laminate matrix resin.

INTERPLY CRACKS: Through-cracking of individual layers within a composite lay-up perpendicular to the ply interfaces.

INTERPLY HYBRID: A composite in which adjacent laminae are composed of different materials.

INTERPRETATION: The determination of the cause of an indication or the evaluation of the significance of discontinuities from the standpoint of whether they are detrimental defects or superficial blemishes. See EVALUATION.

INTERWEAVE: Weave together, interlace.

INTERWOVEN WIRE FABRIC (IWWF): Small diameter metallic wires woven into a layer of fiber fabric added to the exposed surface of a composite laminate as part of the LIGHTNING STRIKE PROTECTION.

INTRALAMINAR: Descriptive term pertaining to an object (voids, etc.) event (fracture, etc.), or potential field (temperature gradient, etc.) existing entirely within a single lamina without reference to any adjacent laminae.

INTRAPLY HYBRID: A composite in which different materials are used within a specific layer or band.

INTRINSIC FLAW: Defect inherent in the composite material or resulting from the production process.

INTRINSIC VISCOSITY: A measure of the capability of a polymer in solution to enhance the viscosity of the solution. Intrinsic viscosity increases with increasing molecular weight.

INVAR: An alloy of iron and nickel with some carbon and chromium with a coefficient of thermal expansion similar to carbon fiber-reinforced plastic. Used to make tools to hold composite structure during a high-temperature cure. A trademark of Imphy Alloys.

INVENTORY LIFE: The time period which extends from the date of manufacture to the date shipment and during which the supplier stores the prepreg.

INFRARED (IR) CAMERA: A camera used to view or record thermal images during thermographic testing. See THERMOGRAPHY.

IRIDITE: A chemical conversion coating that is applied to an aluminum surface. This passivation process protects the metal from more oxidation. The natural aluminum oxide (Al_2O_3) on the surface is converted to a thicker oxide containing chromium (Cr_2O_3). A tradename of the MacDermid Corporation. See ALODINE and CHEMICAL CONVERSION COATING.

IRRADIATION: As applied to plastics, the bombardment with a variety of subatomic particles, usually alpha-, beta-, or gamma-rays. Used to initiate polymerization and copolymerization of plastics and in some cases to bring about changes in the physical properties of a plastic.

IRREVERSIBLE: Not capable of redissolving or remelting. Descriptive of chemical reactions which proceed in a single direction and are not capable of reversal (as applied to thermosetting resins).

ISOCYANATE PLASTICS: Plastics based on resins made by the condensation of organic isocyanates with other compounds. Generally reacted with polyols on a polyester or polyether backbone molecule, with reactants being joined through the formation of the urethane linkage. See POLYURETHANE and URETHANE PLASTICS.

ISOLATION PLY: As an example, a ply of fiberglass to isolate graphite/epoxy laminate from an aluminum part to prevent galvanic corrosion. See PLY and INSULATION PLY.

ISOPROPYL ALCOHOL (IPA): A wipe solvent used as a less hazardous replacement for methyethylketone, or acetone. It is rated as “flammable” with a flash point of 53 °F (11.7 °C) and is toxic by inhalation and ingestion.

ISOSTATIC PRESSING: Pressing powder under a gas or liquid so that pressure is transmitted equally in all directions, for example, in sintering.

ISOTACTIC POLYMER: A polymer which contains long blocks of identically oriented monomer units. Each unit has the same steric configuration as each successive unit in its own block.

ISOTROPIC: Having uniform properties in all directions. The measured properties of an isotropic material are independent of the axis of testing.

ISOTROPIC LAMINATE: A laminate in which the strength properties are the same in all directions. Difficult to achieve. See QUASI-ISOTROPIC.

ISOTROPIC PLY: A ply with similar properties in all directions; i.e., a sheet of metal or other material with similar properties in all directions.

IZOD IMPACT TEST: A test for shock loading in which a notched specimen bar is held at one end and broken by striking, and the energy absorbed is measured.

3.10 J

JACQUARD BRAID: A braided design made with the aid of a jacquard machine, which is a shedding mechanism by means of which a large number of ends may be controlled independently, and complicated patterns produced.

JOGGLE: The projecting or retreating surface of a formed part, or the section of a tool that forms a joggle. An offset formed in a part or tool to step over or jog over another part.

JOINT: A point at which parts of a structure are joined. See ADHESIVE JOINT, BONDED JOINT, BOLTED JOINT, BUTT JOINT, EDGE JOINT, LAP JOINT, OVERLAP JOINT, SPLICE, SPLICE BUTT, SPLICE OVERLAP, and SPLICE REPAIR.

3.11 K

KAPTON: A polyimide film. Low smoke and flame. Lightweight, resists hydraulic fluids. Heat resistant. Good low temperature performance. A trademark of DuPont.

KERF: The width of a cut made by a saw blade, torch, water jet, laser beam, etc.

KEVLAR: An aramid fiber. An organic polymer composed of aromatic polyamides having a para-type orientation (parallel chain extending bonds from each aromatic nucleus). Has good impact resistance, low density, high strength, and low radio frequency attenuation. Absorbs some moisture. A trademark of DuPont. See ARAMID.

K FACTOR: The coefficient of thermal conductivity. The amount of heat that passes through a unit cube of material in a given time when the difference in temperature of two opposite faces is 1 degree.

KINK: A yarn that has doubled back on itself to form a loop in the yarn.

KISSING BOND: Type of interfacial defect in which two surfaces within the structure are in intimate contact with poor bonding existing between the adhesive and the substrate. Such bond line has lower mechanical properties than designed and is difficult to be detected by standard NDT procedures. Also known as WEAK BOND.

KITTING: To pre-assemble pre-cut composite partial plies into a package or “kit” from which the lay-up technician can draw during part lay-up. Kits are used to avoid repeat thawing cycles of materials. Kits are also recommended for the shipment of small quantities of prepreg or adhesive films. Kitted prepreg or adhesive film shall not be folded. It can be laid flat or rolled for storage.

KNIT: Textile process that interlocks, in a specific pattern, loops of yarn by means of needles or wires.

KNITTED FABRICS: Fabrics produced by interloping chains of yarn.

KNITTING: A method of constructing fabric by interlocking series of loops of one or more yarns.

KNOOP HARDNESS: Hardness that is measured by calibrated machines that force a rhomb shape, pyramidal diamond inventor having specified edge angles under specified conditions into the surface of the test material; the long diagonal is measured after removal of the load. The microhardness Knoop tester uses a relatively small load to measure surface hardness.

KNUCKLE AREA: The area of transition between sections of different geometry in a filament-wound part; for example, where the skirt joins the cylinder of the pressure vessel. Also known as Y-joint.

KOREX: An aramid paper honeycomb material. A trademark of DuPont.

K SAMPLE DATA: A collection of data consisting of values observed when sampling from k-batches.

3.12 L

LACK OF FILL OUT: Characteristic of an area, occurring usually at the edge of a laminated plastic, where the reinforcement has not been wetted with resin.

LACQUER: Solution of natural or synthetic resins in readily evaporating solvents, used as a protective coating.

LAG TIME: The difference in time to arrive at the cure temperature between monitoring thermocouples at the repair bond line and the controlling thermocouples. The lag time is added to the cure phase dwell time to ensure the repair bond line achieves full cure.

LAGGING THERMOCOUPLE: The thermocouple that shows the slowest heating and cooling rates.

LAID IN YARNS: A system of longitudinal yarns in a tri-axial braid that are inserted between the bias yarns.

LAMB WAVE [UT]: A type of wave that propagates in thin plates; can be symmetric or asymmetric; also known as a plate wave; a type of guided wave; can only be generated at particular values of angle of incidence, frequency and plate thickness; can exist only when the plate is thicker than one wavelength; velocity of the wave is dependent on the product of plate thickness and frequency.

LAMINA: A single ply or layer in a laminate made up of a series of layers (organic composite).A flat or curved surface containing unidirectional fibers or woven fibers embedded in a matrix (metal matrix composite).

LAMINAE: Plural of lamina.

LAMINATE: (i) A product made by bonding together two or more layers (plies) of material. See BI-DIRECTIONAL LAMINATE, UNIDIRECTIONAL LAMINATE, QUASI-ISOTROPIC LAMINATE, and ISOTROPIC LAMINATE. (ii) To laminate is to unite laminae with a bonding material, usually with pressure and/or vacuum and heat (normally used with reference to flat sheets, but also rods and tubes).

LAMINATE COORDINATES: A reference coordinate system (used to describe the properties/directions of a laminate), generally in the directions of principal axes, when they exist.

LAMINATE ORIENTATION: The configuration of a cross-plied composite laminate with regard to the angles of cross-plying, the number of laminae at each angle, and the exact sequence of the lamina lay-up.

LAMINATE PLY: One fabric-resin or fiber-resin layer of a product that is bonded to adjacent layers in the curing process.

LAMINATED MOLDING: A molded plastic article produced by bonding together, under heat and pressure or/and vacuum in a mold, layers of resin-impregnated laminating reinforcement. Also known as LAMINATED PLASTICS.

LAMINATION: The process of preparing a laminate. Also, any layer in a laminate.

LAMINATION SEQUENCE: Composite lay-up usually begins with the ply nearest the tool surface. Each successive ply is then stacked or nested in sequence. Plies are laid up from the tool surface out.

LAP: In filament winding, the amount of overlay between successive windings, usually intended to minimize gapping. In bonding, the distance one adherend covers another adherend.

LAP JOINT: A joint made by placing one adherend partly over another and bonding the overlapped portions.

LAP SHEAR TEST: This test is carried out by a standard test according to ASTM D1002. Aluminum alloy adherend of a standard thickness are normally used but the test can be adapted for use with other materials including composites. In the standard test 1-inch wide (25.4 mm) sheets are overlapped by 0.5 inch (12.7 mm) and pulled at a specified crosshead speed.

LATENT CURING AGENT: A curing agent that produces long-term stability at room temperature but rapid cure at elevated temperatures.

LATTICE PATTERN: A pattern of filament winding with a fixed arrangement of open voids.

LAY: (i) In glass fiber, the spacing of the roving bands on the roving package expressed in the number of bands per inch. (ii) In filament winding, the orientation of the ribbon with some reference, usually the axis of rotation.

LAYERED LAMINATE: When two or more plies, both of the same or different materials, are bonded and stacked one on top of the other to act as a single structural layered element, then this structural element is called a layered laminate.

LAY UP: (i) The process of placing the reinforcing material in position in the mold. (ii) The resin-impregnated reinforcement. (iii) A description of the component materials, geometry, etc., of a laminate. (iv) A stack up of composite materials that forms either a cured or uncured part.

LAY UP AREA: See CONTROLLED CONTAMINATION AREA.

LAY UP CODE: A designation system for abbreviating the stacking sequence of laminae in a laminated composite material.

L DIRECTION: The ribbon direction, that is, the direction of the continuous sheets of honeycomb. See RIBBON DIRECTION and CORE RIBBON DIRECTION.

LEADING THERMOCOUPLE: The thermocouple that shows the highest/lowest heating and cooling rates.

LEVEL WINDING: See CIRCUMFERENTIAL WINDING.

LIFE ENHANCEMENT FACTOR: An additional load factor and/or test duration applied to structural repeated load tests, relative to the intended design load and life values, used to account for material variability. It is used to develop the required level of confidence in data. It is also known as LOAD ENHANCEMENT FACTOR or LIFE SCATTER FACTOR.

LIGHTNING STRIKE DAMAGE: Loss of strength and/or loss of material in an area of structure that was caused by a lightning strike between its attachment to and its exit from the structure. Damage can be seen as discoloration, pits, holes, and/or melted material.

LIGHTNING STRIKE PROTECTION: Various materials and measures to reduce the effects and consequences of lightning strikes and electromagnetic fields. Composite parts located in lightning-strike prone areas of an aircraft must have appropriate lightning strike protection, as their electrical conductivity is inferior compared to metallic structures. See MESH, EXPANDED FOIL, and ALUMINIZED GLASS.

LIMIT LOAD: Limit loads are the maximum loads anticipated on an aircraft during its service life. The aircraft structure shall be capable of supporting the limit loads without suffering any detrimental permanent deformation. For all loads up to the limit loads the deformation shall be such as not to interfere with the safe operation of the aircraft.

LINE TOOL: Ultrasound based tool for go/no go decision when suspicion of damage to monolithic composite structure.

LINE SIZING TOOL: Ultrasound based tool for quantifying damage on a monolithic composite structure.

LINE MAPPING TOOL: Triangulation based tool for locating damage relative to other structure.

LINEAR DENSITY FIBERS: Weight per unit length of a fiber. Basic unit is tex.

LINEAR EXPANSION: The increase of a given dimension, measured by the expansion or contraction of a specimen or component subject to a thermal gradient or changing temperature. See COEFFICIENT OF THERMAL EXPANSION.

LINEAR POLYMER: A polymer whose molecular chain is free of branches or side chains formed by polymerization.

LINER: In a filament-wound pressure vessel, the continuous, usually flexible coating on the inside surface of the vessel, used to protect the laminate from chemical attack or to prevent leakage under stress.

LIQUID COUPLANT: Liquid interface between a transducer and the substrate of a non-destructive test method.

LIQUID CRYSTAL FILM: A Mylar sheet impregnated with cholesteric liquid crystals used in thermographic inspection for ice or water in honeycomb parts. It is also known as LIQUID CRYSTAL SHEET.

LIQUID CRYSTAL POLYMER: A newer thermoplastic polymer that is melt process able and develops high orientation in molding, with resultant tensile strength and high-temperature capability that is notably improved. First commercial availability was as an aromatic polyester. With or without fiber reinforcement.

LIQUID METAL INFILTRATION: Process for immersion of fibers in a molten metal bath to achieve a metal matrix composite for example, graphite fibers in molten aluminum.

LIQUID RESIN: An organic, polymeric liquid that becomes a solid when converted to its final state for use.

LIQUID SHIM: Material used to position components in an assembly where dimensional alignment is critical. For example, epoxy adhesive is introduced into gaps after the assembly is placed in the desired configuration.

LIQUIDUS: The maximum temperature at which equilibrium exists between the molten glass and its primary crystalline phase.

LOAD: The force applied to the specimen at any given time.

LOAD DEFLECTION CURVE: A curve in which the increasing tension, compression, or flexural loads are plotted on the ordinate axis and the deflections caused by those loads are plotted on the abscissa axis.

LOCUS OF FAILURE: The surfaces involved in bond failure.

LOFTING: The drawing of lines from the basic geometry drawing for the aircraft (full scale) on metal to make a master layout for use by tooling departments. A loft will show sections through the aircraft giving profiles at particular points. It will show buttock lines, water lines and reference planes and provides the master profiles from which tools and parts are made.

LOGNORMAL DISTRIBUTION: A probability distribution for which the probability that an observation selected at random from this population falls between “a” and “b” ($0 < a < b < B$) is given by the area under the normal distribution between log a and log b. The common (base 10) or the natural (base e) logarithm may be used.

LONG-TERM EXPOSURE (LTE): Specified cumulative period of time, within which materials may be exposed to temperatures outside of the storage area temperature, including transportation of materials within a purchaser’s facility.

LONGITUDINAL: Along the length of a substrate or material.

LONGITUDINAL WAVE [UT]: Waves in which the particle motion or vibration is in the same direction as the propagation of the waves. See COMPRESSIONNAL WAVE.

LONGOS: Low angle helical or longitudinal windings.

LOOM STATE: Most reinforcement fibers as supplied by the manufacturer have a small amount of size on their surface, designed to reduce filament damage and facilitate handling during weaving. Fabrics woven from these fibers and supplied untreated are described as “loom state.”

LOOP TENACITY: The tenacity or strength value obtained by pulling two loops, as two links in a chain, against each other in order to demonstrate the susceptibility that a fibrous material has for cutting or crushing itself: loop strength.

LOOSE PICK: A filling yarn which is not flush with the surrounding fabric usually caused by insufficient tension. It is also known as loose filling yarn.

LOSS FACTOR: The product of the dissipation factor and the dielectric constant of a dielectric material.

LOSS MODULUS: A damping term describing the dissipation of energy into heat when a material is deformed. Basic unit is pound per square inch (psi).

LOSS OF BACK REFLECTION [UT]: Reduction in the amplitude of the reflection from the far surface of the article being inspected.

LOSS ON IGNITION: Weight loss, usually expressed as percent of total, after burning off an organic sizing from glass fibers, or an organic resin from a glass fiber laminate.

LOSS TANGENT: See ELECTRICAL DISSIPATION FACTOR.

LOT: See BATCH.

LOW TEMPERATURE DRYING: The drying of structures typically from a temperature of 176 °F (80 °C).

LOW TEMPERATURE REPAIR: See ROOM TEMPERATURE REPAIR.

LOW FREQUENCY BONDTESTER (LFBT): A dry-coupled bond tester generally operating at frequencies below 100 kHz. See MIA and EDDY-SONIC.

LOW PRESSURE LAMINATES: In general, laminates molded and cured in the range of pressures from 2760 kPa (400 psi) down to and including pressure obtained by the mere contact of the plies.

LOW PRESSURE MOLDING: The distribution of relatively uniform low pressure—0.2 ksi (1.4 MPa) or less—over a resin-bearing fibrous assembly of cellulose, glass, asbestos or other material, with or without application of heat from an external source to form a structure possessing definite physical properties.

LUBRICANT: A material added to most sizing's to improve the handling and processing properties of textile strands, especially during weaving.

3.13 M

M GLASS: A high beryllia (BeO_2) content glass designed especially for high modulus of elasticity.

MACERATE: To chop or shred fabric for use as a filler for a molding resin system. The molding compound obtained when so filled.

MACRO: In relation to composites, denotes the gross properties of a composite as a structural element but does not consider the individual properties or identity of the constituents.

MACROMECHANICS: The study of a composite material as a whole and does not differentiate between the constituents (fibers and resin system).

MACROSCOPY: Interpretation using only the naked eye, or magnification no greater than 10x.

MACROSTRAIN: The mean strain over any finite gage length of measurement that is large in comparison with interatomic distances.

MANDREL: The core tool around which resin-impregnated paper, fabric, or fiber is wound to form pipes, tubes, or structural shell shapes, usually by the filament winding process.

MANIPULATOR [UT]: A device used for orientation of the transducer assembly. As generally applied to immersion techniques, provides either angular or normal sound incidence on the surface of the part.

MARK OFF: (i) Visual evidence of interior details on the outer surface of a bonded assembly. (ii) Visual impression in a repair laminate caused by thermocouples or other items.

MARKING PEN: A colored pen approved in accordance with the documentation that can mark the surface of the prepreg backing foil, adhesive film or metal.

MARKING PENCIL: A colored pencil approved in accordance with the documentation that can be used to mark the surface of the prepreg backing foil, adhesive film, or metal.

MASKING: (i) A tape or sheet material used to protect the masked area from chemical treatment, grit blasting or paint spray on a temporary basis. It is easily removable after the treatment has been completed. (ii) Masking tape used to protect acrylic and other plastic sheeting must use an adhesive which does not itself damage the plastic in either short or long-term storage. (iii) Some special masking tapes are supplied, which can be used to protect treated surfaces between treatment and adhesive bonding or painting. Such tapes must leave no residue that could reduce adhesion when they are removed.

MASS STRESS: Used with fibers. Force per unit mass per unit length; e.g., grams per denier. This measure is used in the same way as force per unit area.

MASTER: A pattern whose contours are the absolute and final contour definition of a part or assembly. Tooling masters are most generally made from tooling plaster but can also be made of composite material.

MASTER ROLL: The full width prepreg tape roll manufactured on the production prepreg line.

MASTER ROLL OF WOVEN FABRIC: Woven fabric material that is manufactured in one continuous operation from which several smaller rolls are taken.

MAT: A fibrous material for reinforced plastic consisting of randomly oriented chopped filaments, short fibers (with or without a carrier fabric), or swirled filaments loosely held together with a binder. Available in blankets of various widths, weights, and lengths. Also, a sheet formed by filament winding a single-hoop ply of fiber on a mandrel, cutting across its width and laying out a flat sheet.

MAT BINDER: A resin system applied to glass fiber and cured during the manufacture of mat, used to hold the fibers in place and maintain the shape of the mat.

MATCHED METAL MOLDING: A reinforced plastics manufacturing process in which matching male and female metal molds are used (similar to compression molding) to form the part, with time, pressure, and heat.

MATERIAL ACCEPTANCE: The testing of incoming material to ensure that it meets requirements.

MATERIAL ALLOWABLES: See DESIGN ALLOWABLES.

MATERIAL NOISE [UT]: Extraneous signals caused by the structure of the material being tested.

MATERIAL QUALIFICATION: The procedures used to accept a material by a company or organization for production use.

MATERIAL SYSTEM: A specific composite material made from specifically identified constituents in specific geometric proportions and arrangements and possessed of numerically defined properties.

MATERIAL SYSTEM CLASS: A group of material systems categorized by the same generic constituent materials, but without defining the constituents uniquely; e.g., the carbon/epoxy class.

MATERIAL VARIABILITY: Any source of variability due to variations in the spatial, consistency, mechanical or physical properties, chemical content, or processing aspects of a material.

MATRIX: The essentially homogeneous resin or polymer material in which the fiber system of a composite is imbedded. Both thermoplastic and thermoset resins may be used, as well as metals, ceramics, and glasses.

MATRIX CONTENT: The amount of matrix present in a composite expressed as either percent by weight or percent by volume. For polymer matrix composites, this is called the resin content. See RESIN CONTENT.

MATRIX DOMINATED PROPERTIES: Those mechanical properties that depend heavily on the strength and stiffness of the matrix, its compatibility or bond ability to the fibers, and its ability to support the fibers so that they can continue to carry load. Short beam shear and compression strength fall into this category. Matrix dominated properties are also very sensitive to laminate quality in terms of void content, resin and fiber distribution.

MATRIX IMPERFECTIONS: Imperfections can be in the form of micro-cracks, porosity, blisters, etc. These can occur in the resin matrix during the cure cycle on the resin matrix-fiber interface, or in the resin matrix parallel to the fibers.

MATTE FINISH: An abraded part where gloss is a minimum of 70% removed

MAXIMUM EXPOSURE UNITS: Maximum number of exposure units before a time and temperature sensitive material must be scrapped. See TATS and EXPOSURE UNITS.

MAXIMUM NUMBER OF REMOVALS: Maximum number of times a time and temperature sensitive material can be removed from its storage temperature before it must be scrapped. See TATS.

MEAN: See SAMPLE MEAN and POPULATION MEAN.

MECHANICAL ADHESION: Adhesion between surfaces in which the adhesive holds the parts together by interlocking action.

MECHANICAL IMPEDANCE BONDTESTER: Dry-coupled, single-tipped dual element transducer probe instrument which operates between 2.5 kHz and 10 kHz and measures the mechanical impedance of the part.

MECHANICAL LIFE: The total time that an adhesive can stay out of cold storage before the start of the cure.

MECHANICAL PRESSURE: A pressure applied by other than fluid means. Mechanical pressure may be applied by deadweight, press, jacks, clamps, etc.

MECHANICAL PROPERTIES: (i) The properties of a material, such as compressive and tensile strengths and modulus, that are associated with elastic and inelastic reaction when force is applied. (ii) The individual relationship between stress and strain.

MECHANICAL SANDING/STRIPPING: Removal of material or surface finish by hand sanding or by using power tools.

MECHANICALLY FOAMED PLASTIC: A cellular plastic in which the cells are formed by the physical incorporation of gases.

MEDIAN: See SAMPLE MEDIAN and POPULATION MEDIAN.

MELT: (i) A charge of molten metal. (ii) A charge of molten plastic. See LIQUID METAL INFILTRATION.

MELT TEMPERATURE: The temperature of the molten plastic.

MELTING RANGE: Thermoplastics whose makeup includes a distribution of molecular weights which will not have a well-defined melting point but have a melting point.

MER: The repeating structural unit of any polymer.

MESH: A layer of metallic mesh added to the exposed surface of a composite laminate as part of the LIGHTNING STRIKE PROTECTION.

MESOPHASE: An intermediate phase in the formation of carbon from a pitch precursor. This is a liquid crystal phase in the form of microspheres, which upon prolonged heating above 750 °F (400 °C) coalesce, solidify, and form regions of extended order. Heating to above 3630 °F (2000 °C) leads to the formation of graphite structure.

METAL MATRIX COMPOSITES (MMC): Composites made with reinforcing nonmetallic fibers embedded in metallic material matrices.

METAL-TO-METAL CONSTRUCTION: An assembly that contains no honeycomb core material.

METALBOND REPAIR: An overlay repair that requires bonding of a metal doubler or reinforcement onto a metal surface.

METALLIC FIBER: Manufactured fiber composed of metal, plastic-coated metal, metal-coated plastic, or a core completely covered by metal.

METHACRYLATOSILANE FINISH: A finish applied to glass fibers to give the highest performance of laminates using polyester resins.

METHYL ETHYL KETONE (MEK): Also known as 2-butanone. A wipe solvent used for cleaning composite surfaces prior to bonding. Also used for cleaning metal surfaces prior to other treatments.

METHYL ETHYL KETONE PEROXIDE (MEKP): A catalyst for polyester resins.

METHYL ISOBUTYL KETONE (MIBK): A less commonly used solvent similar to MEK but with a higher flash point 64 °F (18 °C) and a lower evaporation rate.

MICRO: In relation to composites, denotes the properties of the constituents, that is, matrix, reinforcement, and interface only, and their effects on the composite properties.

MICROBALLOONS: Small, hollow glass spheres used as fillers in epoxy and polyester compounds to reduce density, increase viscosity, and control bondline thickness. Can also be made from phenolic resins and ceramics. Also known as MICROSPHERES.

MICROCRACKING: Cracks formed in composites when thermal or mechanical stresses locally exceed the strength of the matrix. Since most microcracks do not penetrate the reinforcing fibers, microcracks in a cross-plied tape laminate or in a laminate made from cloth prepreg are usually limited to the thickness of a single ply.

MICROMECHANICS: A study whereby the constituent materials (fibers and matrix) are looked at separately and not as one entity.

MICRON: A unit of length replaced by the micrometer. 1 µm = 10^{-6} m = 10^{-3} mm = 0.00003937 inch = 39.4 µin.

MICROPROCESSOR: The basic element of a central processing unit developed on a single integrated circuit chip. A single integrated chip provides the basic core of a central processing unit, even though it may require additional components to operate as a central processing unit.

MICROSPHERES: See MICROBALLOONS.

MICROSTRAIN: (i) The strain over a gage length comparable to the material's interatomic distance. (ii) In design, the limit is often expressed as 5000 microstrain or some other figure. In this case, it means microinches per inch (µin/in). 1 µin = 1/1000000 inch.

MICROSTRUCTURE: A structure with heterogeneities that can be seen through a microscope.

MIL: Milliinch, used as "mil" is the American term for one thousandth (1/1000) of an inch. A common unit used in measuring the diameter of glass fiber strands, wire, etc. 1 mil = 0.001 inch = 25 µm.

MILLED FIBER: Continuous glass strands hammer milled into very short glass fibers. Useful as inexpensive filler or anti-crazing reinforcing fillers for adhesives.

MIRROR FINISH: A highly polished reflective surface.

MISCIBLE: That can be mixed with.

MISPICK: A fill yarn not properly interlaced causing a break in the weaving pattern.

MISSING PICK: A filling yarn missing from all or a portion of the width of the fabric.

MODE [UT]: The manner in which acoustic energy is propagated through a material as characterized by the particle motion of the wave.

MODE CONVERSION [UT]: Changing from one mode of vibration to another; caused by refraction at an interface.

MODIFIER: Any chemically inert ingredient added to an adhesive formulation that changes its properties. See FILLER, PLASTICIZER, and EXTENDER.

MODULATED DIFFERENTIAL SCANNING CALORIMETRY (MDSC): It is a high-performance version of DSC that improves the possibility for T_g detection because it can offer a fivefold increase in sensitivity over DSC and with no loss in signal resolution.

MODULUS: A measure of the ratio of the applied load (stress) to the resultant deformation of the material. The stiffness of a material. See MODULUS OF ELASTICITY.

MODULUS OF ELASTICITY: The ratio of the stress applied to the strain or deformation produced in a material that is elastically deformed. Also known as YOUNG'S MODULUS. See OFFSET MODULUS and SECANT MODULUS.

MODULUS OF RESILIENCE: The energy that can be absorbed per unit volume without creating a permanent distortion. Calculated by integrating the stress-strain curve from zero to the elastic limit and dividing by the original volume of the specimen.

MODULUS OF RIGIDITY: The ratio of stress to strain within the elastic region for shear or torsional stress. See SHEAR MODULUS or TORSIONAL MODULUS.

MOHS HARDNESS: A measure of the scratch resistance of a material. The higher the number, the greater the scratch resistance.

MOISTURE ABSORPTION: The pickup of water vapor from air by a material. It relates only to vapor withdrawn from the air by a material and must be distinguished from water absorption, which is the gain in weight due to the take-up of water by immersion.

MOISTURE CONTENT: The amount of moisture in a material determined under prescribed conditions and expressed as a percentage of the mass of the moist specimen; that is, the mass of the dry substance plus the moisture present.

MOISTURE EQUILIBRIUM: The condition reached by a sample when it no longer takes up moisture from, or gives up moisture to, the surrounding environment.

MOISTURE INGRESSION: The movement of moisture as water molecules (pure or contaminated) from the external environment into the composite component. Moisture ingression can occur through voids or porosity.

MOISTURE METER: An instrument that indicates moisture content in a material. Originally developed for paper and wood. Usually based on measurement of radio frequency signal loss attributed to the moisture content of the component or material. Such instruments are very useful on nonconducting fibers such as fiberglass and aramids but cannot be used on electrically conducting fibers such as carbon fiber.

MOISTURE MIGRATION: The movement of moisture as water molecules (pure or contaminated) within the composite component. Moisture migration can be via the matrix or fiber of the solid laminate or sandwich structure core materials.

MOISTURE PROOF BAG: An airtight bag made from polyethylene or equivalent clean plastic with a minimum thickness of 0.15 mm (0.006 inch) that is used to store prepreg, adhesive films, and foaming adhesive films.

MOISTURE VAPOR TRANSMISSION (MVT): A rate at which water vapor passes through a material at a specified temperature and relative humidity g mil/100 in^2 day (g mm/m^2 day).

MOLD (alt. MOULD): The cavity or matrix into or on which the plastic composition is placed and from which it takes form. To shape plastic parts of finished articles by heat and pressure. The assembly of all the parts that function collectively in the molding process.

MOLD OPEN TIME: The time interval from the instant mold begins to open until it is closed again.

MOLD RELEASE AGENT: A lubricant, liquid, or powder (often silicone oils and waxes), used to prevent sticking of molded articles in the cavity. See PARTING AGENT and RELEASE AGENT.

MOLD SEAM: Line on a molded or laminated piece, differing in color or appearance from the general surface, caused by the parting line of the mold.

MOLD SHRINKAGE: The immediate shrinkage that a molded part undergoes when it is removed from a mold and cooled to room temperature. The difference in dimensions, expressed in inches per inch, between a molding and the mold cavity in which it was molded (at normal-temperature measurement). The incremental difference between the dimensions of the molding and the mold from which it was made, expressed as a percentage of the mold dimensions.

MOLD SURFACE: The side of a laminate that faced the mold (tool) during cure in an autoclave or hydroclave.

MOLD TEMPERATURE: The mean temperature of the mold cavity surface measured after the system has obtained thermal equilibrium and immediately after opening the mold.

MOLDABLE PLASTIC SHIM: A two-part epoxy resin system used for shimming.

MOLDED EDGE: An edge that is not physically altered after molding for use in final form, and particularly one that does not have fiber ends along its length.

MOLDED NET: Description of a molded part that requires no additional processing to meet dimensional requirements.

MOLDING: The forming of a polymer or composite into a solid mass of prescribed shape and size by the application of pressure and heat for given times. Sometimes used to denote the finished part.

MOLDING CYCLE: (i) The period of time required for the complete sequence of operations on a molding press to produce one set of moldings. (ii) The operations necessary to produce a set of moldings without reference to the total time taken.

MOLDING POWDER OR COMPOUND: Plastic material in varying stages of pellets or granulation, and consisting of resin system, filler, pigments, reinforcements, plasticizers, and other ingredients, ready for use in the molding operation.

MOLDING PRESSURE: The pressure applied to the ram of an injection machine or compression or transfer press to force the softened plastic to fill the mold cavities completely.

MOLECULAR WEIGHT: The sum of the atomic weights of all the atoms in a molecule. A measure of the chain length for the molecules that make up the polymer.

MONEL: Nickel-copper base alloy. A metal that is hardened by cold-working (driving a rivet, for example) and has good strength and oxidation resistance at high temperatures. Also resistant to acids and alkaline. Nickel and copper elements with smaller amounts of several other elements. A trademark of Special Metals Corporation.

MONITORING THERMOCOUPLE: The thermocouple which the hot bond machine uses for monitoring the temperature of the heat blanket. Cure temperature is not controlled with this thermocouple.

MONOFILAMENT: A single fiber or filament of indefinite length, strong enough to function as a yarn in commercial textile operations.

MONOLAYER: The basic laminate unit from which cross-plied or other laminate types are constructed. Also, a “single” layer of atoms or molecules adsorbed on or applied to a surface.

MONOLITHIC: Originally derived from monolith, meaning a single block of stone. In composite terminology it means made from fiber and matrix only; i.e., solid composite. See SOLID LAMINATE.

MONOMER: A single molecule that can react with like or unlike molecules to form a polymer. The smallest repeating structure of a polymer (mer). For addition polymers, this represents the original un-polymerized compound.

MORPHOLOGY: The overall form of a polymer structure, that is, crystallinity, branching, molecular weight, etc.

MULTI CIRCUIT WINDING: In filament winding, a winding that requires more than one circuit before the band repeats by laying adjacent to the first band.

MULTI DIRECTIONAL: Having multiple ply orientations in a laminate.

MULTI FILAMENT YARN: A large number (500 to 2000) of fine, continuous filaments (often 5 to 100 individual filaments), usually with some twist in the yarn to facilitate handling.

MULTI-ORIENTED PLY LAMINATE (MOPL): A laminate made from multi oriented plies; i.e., plies with fibers in more than one direction.

MULTI SITE DAMAGE: Effect of damage adjacent to other damage.

MULTIPLE LAYER ADHESIVE: A film adhesive, usually supported, with a different adhesive composition on each side; designed to bond dissimilar materials such as the core-to-face bond of a sandwich composite. See DUPLEX FILM.

MYLAR: A (polyethylene terephthalate) thermoplastic polyester film. It is an excellent moisture and oxygen barrier. It is typically used as a release film in adhesive and composite bonding and as a template material. A tradename of DuPont.

3.14 N

NARROWBANDED [UT]: Having a relatively narrow bandwidth; opposite of broad-banded.

NEAR FIELD [UT]: The region of the ultrasonic beam adjacent to the search unit, having complex beam profiles. Also known as the “Fresnel zone.”

NEAR NET SHAPE: Part fabrication or repair resulting in final dimensions that require minimal machining, cutting, or other finishing operations.

NEAT RESIN: Resin to which nothing (additives, reinforcements, etc.) has been added.

NEAT RESIN PROPERTIES: Mechanical properties of the cured resin itself, without reinforcement. In this case, neat resin includes all additives in the formulation being tested.

NECKING: The localized reduction in cross section that may occur in a material under tensile stress.

NEEDLED MAT: A mat formed of strands cut to a short length, then felted together in a needle loom, with or without a carrier.

NEGATIVELY SKEWED: A distribution is said to be negatively skewed if the distribution is not symmetric and the longest tail is on the left.

NEPS: Little lumps of tangled fibers found in yarn or fabrics.

NESTED LAMINATE: In reinforced plastics, the placing of plies of fabric so that the yarns of one ply lie in the valleys between the yarns of the adjacent ply (nested cloth).

NESTING: Orienting small ply details that are to be cut from a roll of fabric in such a way that waste of composite fabric material is minimized. This place the ply details of common orientation very close together, and typically uses automated optimizing routines to accomplish this.

NET RESIN SYSTEM: A material system impregnated with approximately the percentage of resin content that is required in the cured composite part. Such material systems do not require resin to be bled out during the cure cycle, so savings are achieved in bagging material and labor costs compared to traditional bleed systems. Also known as a no-bleed system, or a zero bleed system

NET SHAPE: Part fabrication resulting in final dimensions that do not require machining or cutting.

NETTING ANALYSIS: The analysis of filament-wound structures that assumes the stresses induced in the structure are carried entirely by the filaments, and the strength of the resin is neglected, and that assumes also that the filaments possess no bending or shearing stiffness, and carry only the axial tensile loads.

NETWORK STRUCTURE: An atomic or molecular arrangement in which primary bonds form a three-dimensional network.

NIBS: Small thickened places in a yarn or fiber.

NICK: A local gouge with sharp edges. A series of nicks in a line pattern can be considered equal to a gouge.

NO GROWTH APPROACH: A method that requires demonstration that the structure, with defined flaws present, is able to withstand appropriate repeated loads without detrimental flaw growth for the life of the structure.

NODE: The connected portion of adjacent ribbons of honeycomb.

NODE BONDS: That area of the honeycomb core where the cell walls are adhesively bonded.

NOISE [UT, ET]: Any undesired signal that tends to interfere with normal reception or processing of the desired signal. Origin may be electrical or from small reflectors in a material.

NOL RING: A parallel filament- or tape-wound hoop test specimen developed by the Naval Ordnance Laboratory (now the National Surface Weapons Laboratory), for measuring various mechanical strength properties of the material, such as tension and compression, by testing the entire ring or segments of it. Also known as parallel fiber-reinforced ring.

NOMEX: Aramid fiber or paper. The paper form is used to make honeycomb. Low smoke and flame. A trademark of DuPont. See ARAMID.

NOMINAL SPECIMEN THICKNESS: The nominal ply thickness multiplied by the number of plies.

NOMINAL STRESS: The stress at a point calculated on the net cross section without taking into consideration the effect on stress of geometric discontinuities, such as holes, grooves, fillets, etc. The calculation is made by simple elastic theory.

NOMINAL VALUE: A value assigned for the purpose of a convenient designation. A nominal value exists in name only. It is often an average number with a tolerance so as to fit together with adjacent parts.

NON-CONTACT USE MATERIALS: The expendable materials that are not permitted to contact the prepreg, adhesive, wet layup, dry fibers, etc., materials during the layup and cure operations of the repair.

NON-CRIMP FABRIC: This type of fabric consists of plies of unidirectional material laid up at any required angles and held together by a bonding agent or cross stitching. It avoids the crimping involved with woven materials and results in higher laminate properties when impregnated with a suitable resin and fully cured.

NON-DESTRUCTIVE EVALUATION (NDE): See NON-DESTRUCTIVE TESTING (NDT). Historically used interchangeably with NDI and NDT.

NON-DESTRUCTIVE INSPECTION (NDI):

(i) An examination of a specific item, installation, or assembly, making use of specialized inspection techniques and/or equipment to detect damage, failure, or irregularity, and without impairing or destroying the serviceability of the inspected parts. Such techniques may include borescoping, TAP TEST, COIN TEST, or the use of direct readout instruments such as: scales, basic ULTRASONIC thickness gauges without oscilloscope display, or EDDY CURRENT coating thickness gauges.

(ii) Historically used interchangeably with NDE and NDT. However, evolving regulations and publications may differentiate and use NDI to describe tools and methods that require training but do not require special qualification to set up the instrument, and/or to adjust the signal display, and/or to interpret and evaluate the indication for acceptance or rejection, or tools that are defined as NDI equipment specified by the appropriate technical manual intended for use by non-NDT personnel (“Go-/No-Go” devices”, such as LINE SIZING TOOL, RAMP DAMAGE CHECKER, DOLPHICAM). Reference EASA AMC 145.A.30(f)(8) and IMRBPB IP 122.

NON-DESTRUCTIVE TESTING (NDT):

(i) An examination of a specific item, installation, or assembly, making use of specialized inspection techniques and/or equipment to detect damage, failure or irregularity, and without impairing or destroying the serviceability of the inspected parts. Such techniques may include ULTRASONIC TESTING, BONDTESTER, THERMOGRAPHY, SHEAROGRAPHY, EDDY CURRENT TESTING, X-RAY TESTING, or RADIOGRAPHY.

(ii) Historically used interchangeably with NDE and NDT. However, evolving regulations and publications may differentiate and use NDT to describe tools and methods that require personnel qualification and certification in accordance with applicable technical standards for non-destructive testing (NDT) personnel. Typical indicators for such techniques are: tools and methods that require special non-destructive method skills and qualification to set up the instrument, to adjust the signal display, and to interpret and evaluate the indication for acceptance or rejection, and that are not being considered as NON-DESTRUCTIVE INSPECTION (NDI). Reference EASA AMC 145.A.30(f)(8) and IMRBPB IP 122.

NON-HYGROSCOPIC: Lacking the property of absorbing and retaining an appreciable quantity of moisture (water vapor) from the air.

NON-PERFORATED RELEASE FILM: Non-perforated release film, also known as non-porous parting film or separator, is placed over the bleeder plies and is intended to stop resin flow from bleeder plies into breather cloth layers. It is to be spliced or otherwise overlapped wide enough to prevent bleed-through from the resin or adhesive onto the vacuum bag. Non-perforated release film is also used as a barrier to stop excess resin from bleeding onto heat blankets and caul plates when they are used.

NON-POROUS PARTING FILM: See NON-PERFORATED RELEASE FILM or SEPARATOR.

NON-RELEVANT INDICATIONS: Signals received during an inspection which are not caused by the flaw or other condition sought.

NON-STRUCTURAL PLY: A ply or layer in a composite structure that is not needed to transmit loads, but is used as follows: (i) As isolation from other materials. See ISOLATION PLY and INSULATION PLY. (ii) As a barrier from moisture and other contamination. See TEDLAR. (iii) As a filler to get a needed contour. See FILLER PLY. (iv) To get the needed smoothness so can be sanded to get the necessary result. See SANDING PLY.

NON-WOVEN FABRIC: A planar textile structure produced by loosely compressing together fibers, yarns, roving's, etc., with or without a scrim cloth carrier. Accomplished by mechanical, chemical, thermal, or solvent means and combinations thereof.

NOODLE: Composite materials that are formed to fill the void that occurs between two radii, typically at the upper and lower the center of laid-up I-stiffener halves or the lower center of blade stiffener halves. Noodles are formed as a separate detail. May be formed by pultrusion or by cutting the shape from a stack of plies. Also known as RADIUS FILLER.

NORMAL DISTRIBUTION: A two parameter (μ, σ) family of probability distributions for which the probability that an observation will fall between "a" and "b" is given by the area under the curve between "a" and "b" using Equation 1.

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left[-\frac{(x-\mu)^2}{2\sigma^2}\right] \quad \text{(Eq. 1)}$$

NORMAL STRESS: The stress component that is perpendicular to the plane on which the forces act.

NORMALIZATION: A mathematical procedure for adjusting raw test values for fiber-dominated properties to a single (specified) fiber volume content.

NORMALIZED STRESS: Stress calculated by multiplying the raw stress value by the ratio of measured fiber volume to the nominal fiber volume. This ratio is often approximated by the ratio of the measured specimen thickness to the nominal specimen thickness. Stresses for fiber-dominated failure modes are often normalized.

NOTCH FACTOR: Ratio of the resilience determined on a plain specimen to the resilience determined on a notched specimen.

NOTCH SENSITIVITY: The extent to which the sensitivity of a material to fracture is increased by the presence of a surface no homogeneity, such as a notch, a sudden change in cross section, a crack, or a scratch. Low notch sensitivity is usually associated with ductile materials, and high notch sensitivity is usually associated with brittle materials.

NOTCHED SPECIMEN: A test specimen that has been deliberately cut or notched, usually in aV-shape, to induce and locate point of failure.

NOVOLAC: A linear thermoplastic B-staged phenolic resin, which, in the presence of methylene or other cross-linking groups, reacts to form a thermoset phenolic.

NYLON: The generic name for all synthetic polyamides. A trademark of DuPont.

NYLON PLASTICS: Plastics based on a resin composed principally of a long-chain synthetic polymeric amide that has recurring amide groups as an integral part of the main polymer chain. Numerical designations (nylon 6, nylon 66, and so on) refer to the monomeric amides of which they are made. Characterized by great toughness and elasticity, low coefficient of friction and excellent electrical properties, chemical resistance and wear resistance. Resins are hygroscopic and dimensional stability is poorer than with most other engineering plastics.

3.15 O

OBSERVED SIGNIFICANCE LEVEL (OSL): The probability of observing a more extreme value of the test statistic when the null hypothesis is true.

OFF AXIS LAMINATE: A laminate whose principal axis is oriented at an angle other than 0 degrees or 90 degrees with respect to a reference direction, usually related to principal load or stress direction.

OFFSET MODULUS: The ratio of the offset yield stress to the extension at the offset point.

OFFSET MOLDING: A specialized adaptation of injection molding which permits use of incompletely cured thermosetting resins by heating only a small charge at one time, heating the charge just enough to make the resin plastic, using very high pressures for injection, utilizing the heat of compression and frictional heat developed during injection, and finally adding additional heat only as the resin passes through the injection nozzle.

OFFSET YIELD STRENGTH: The stress at which the strain exceeds by a specific amount (the offset) and extension of the initial approximately linear proportional portion of the stress-strain curve. It is expressed in force per unit area.

OFFSET YIELD STRESS: The stress at which the stress/strain curve departs from linearity by a specified percentage of strain (offset).

OLEFIN: A group of unsaturated hydrocarbons of the general formula C_nH_{2n} named after the corresponding paraffin's by the addition of "ene" or "ylene" to the root; for example, ethylene, propylene, and pentene.

OLIGOMER: A polymer consisting of only a few monomer units such as a dimer, trimer, etc., or their mixtures.

ON-THE-JOB TRAINING (OJT): Training, during work time, in learning equipment set-up, equipment operation, repair techniques, and repair evaluation, under the technical guidance of an experienced composite repair technician or other designated individual.

ONE COMPONENT ADHESIVE: An adhesive material incorporating a latent hardener or catalyst that is activated by heat.

ONE STAGE CURE: The honeycomb core and repair plies, patch, or doubler(s) are bonded together at the same time (one application of heat).

OPEN CELL FOAM: Foamed or cellular material with cells that are generally interconnected. Closed cell refers to cells that are not interconnected.

OPEN MOLD PROCESSES: A family of techniques for composites fabrication which makes use of single cavity molds and requires little or no external pressure.

OPEN TIME: See OUT TIME.

OPTIMUM FREQUENCY [ET, UT]: The frequency which provides the highest signal-to-noise ratio obtainable for the detection of an individual property such as conductivity, crack, or inclusion in the test specimen. Each type of defect in a given material may have its own optimum frequency.

ORANGE PEEL: An uneven surface somewhat resembling that of an orange peel; said of injection moldings that have unintentionally ragged surfaces. Description of the surface of an acrylic plastic after overheating during buffing or polishing. A similar appearance is sometimes found on painted surfaces.

ORGANIC: Matter originating in plant or animal life or composed of chemicals of hydrocarbon origin, either natural or synthetic.

ORIENTATION: (i) Direction of alignment of tape or warp direction of fabrics in a composite. (ii) The alignment of the crystalline structure in polymeric materials in order to produce a highly aligned structure. Orientation can be accomplished by cold drawing or stretching in fabrication. (iii) In ultrasonic inspection, the position of a discontinuity or part or surface in relation to the test surface of the article or ultrasonic beam.

ORIENTED MATERIALS: Materials, particularly amorphous polymers and composites, whose molecules and/or macro constituents are aligned in a specific way. Oriented materials are anisotropic. Orientation can generally be divided into two classes: uniaxial and biaxial.

ORIGINAL EQUIPMENT MANUFACTURER (OEM): The manufacturer of the airplane or component.

ORTHOTROPIC: Having three mutually perpendicular planes of elastic symmetry.

ORTHOTROPIC PLY: A ply is said to be orthotropic if there are usually two different material properties in two mutually perpendicular directions at a point, and the two mutually perpendicular directions also form the planes of material properties symmetry at the point; i.e., a ply of woven fabric.

OUT LIFE: The cumulative length of time a material may be out of freezer storage, prior to curing, and still maintain the required process ability characteristics and mechanical properties. Also known as a limit on the amount of accumulated out time before further action needs to be taken to ensure the raw material is still usable (also known as work life). See WORK LIFE and MECHANICAL LIFE.

OUT OF AUTOCLAVE PREPREG: Material used to fabricate composite parts without a pressurized autoclave vessel. See PREPREG.

OUT OF AUTOCLAVE (OOA) REPAIR: Any repair performed with method or equipment other than autoclave.

OUT TIME: The cumulative length of time a material spends out of freezer storage.

OUTER MOLD LINE (OML): Outer surface of a cured part; refers to the external surface of the fuselage.

OUTER SKIN: That side of the part which is cured against the mold.

OUTGASSING: Release of solvents and moisture from composite parts under vacuum. Also occurs during the normal curing process under vacuum and may continue once in service.

OUTSIDE AGENCY: The organization under contract for training services which may include an examination of personnel to the requirements of a specified standard. Consultants and self-employed individuals are included in this definition.

OVALOID: A surface of revolution symmetrical about the polar axis that forms the end closure for a filament-wound cylinder.

OVEN: A vessel at atmospheric pressure used to provide a controlled and uniform temperature. It must be ventilated.

OVEN DRY: The condition of a material that has been heated under prescribed conditions of temperature and humidity until there is no further significant change in its mass.

OVERAGED MATERIAL: Overaged material is a material that is out of the shelf life and out of the mechanical life. It is also known as overdue material.

OVERCURING: The beginning of thermal decomposition resulting from too high a temperature or too long a molding time.

OVEREXPANDED CORE: Honeycomb core whose hexagonal-shaped cells are over expanded into a rectangular shape perpendicular to the ribbon direction in order to enhance its flexibility in that direction.

OVERLAP JOINT: Joining two pieces of material by the means of overlapping one material end over the other end. In case of repairs, see OVERLAP SPLICE.

OVERLAP SPLICE: Repair solution using overlap joints. See OVERLAP JOINT and SPLICE.

OVERLAY PLY: Additional structural ply, occurred or bonded over a repaired area, added for strength.

OVERLAY REPAIR: A repair that requires installation of metal or composite repair materials onto a metal or composite surface without taper sanding or step sanding process.

OVERLAY SHEET: A nonwoven fibrous mat (of glass, synthetic fiber, etc.) used as the top layer in a cloth or mat lay-up, to provide a smoother finish, minimize the appearance of the fibrous pattern, or permit machining or grinding to a precise dimension. Also known as SURFACING MAT.

OXIDATION: In carbon/graphite fiber processing, the step of reacting the precursor polymer (rayon, PAN, or pitch) with oxygen, resulting in stabilization of the structure for the hot stretching operation. In general usage, oxidation refers to any chemical reaction in which electrons are transferred.

3.16 P

PACKAGE: Yarn, roving, etc., in the form of units capable of being unwound and suitable for handling, storing, shipping, and use.

PAD UP: Localized ply build-up confined to a relatively small area usually to support structural requirements (e.g., bearing strength).

PAN FIBERS: Reinforcement fiber derived from the controlled pyrolysis of poly acrylo nitrile fiber.
See CARBON FIBER and PYROLYSIS.

PARALLEL LAMINATE: A laminate of woven fabric in which the plies are aligned in the same position as originally aligned in the fabric roll. A series of flat or curved cloth-resin layers stacked uniformly on top of each other.

PARALLEL WOUND: Yarn or other material wound into a flanged spool.

PARAMETER: An arbitrary constant, as distinguished from a fixed or absolute constant. Any desired numerical value may be given as a parameter.

PARENT ROLL: A prepreg tape or fabric roll produced from slitting a master roll into smaller width rolls. A prepreg tape roll utilized in the production of slit tape tow.

PARISON: The shaped plastic mass, generally in the form of a tube, used in blow molding.

PART: A manufactured article which is being inspected.

PART FAMILY: Any number of parts or assemblies that share similar design features and manufacture processes and can be grouped together, generically, in a way that similar concerns can be shared conservatively. Function on aircraft is not a consideration for the definition of this term.

PART TEMPERATURE: The actual temperature of the repair part, measured by a pyrometer (thermocouples or other probes) during the cure cycle.

PART THERMOCOUPLE: A thermocouple which is located in an actual or simulated part.

PARTICULATE COMPOSITE: Material consisting of one or more constituents suspended in a matrix of another material. These particles are either metallic or nonmetallic.

PARTING AGENT: A material, liquid, or solid film used on the tool surface to ease removal of the assembly. See MOLD RELEASE AGENT and RELEASE AGENT.

PARTING FILM: See RELEASE FILM.

PARTING LINE: A mark on a molded piece where the sections of a mold have met in closing.

PASCAL-SECOND: The measure of the specific viscosity of a fluid. The older unit is the poise. To convert poise to pascal-seconds (Pa·s), divide by 10.

PASTE ADHESIVE: (i) An adhesive composition having a characteristic plastic-type consistency, that is a high order of yield value, such as that prepared by heating a mixture of starch and water and subsequently cooling the hydrolyzed product. (ii) An adhesive that flows very little without being forcibly spread. Having a similar consistency to toothpaste as it leaves the tube.

PEEL PLY: A layer of open-weave material, usually polyester, fiberglass, or heat-set nylon, applied directly to the surface of an uncured prepreg or wet lay-up. It protects the surface to be bonded from contamination during manufacturing or repair operations. The peel ply is removed from the cured laminate immediately before bonding operations. There are two types of peel ply: silicone and non-silicone. Warning: not to be confused with RELEASE FILM.

PEEL STRENGTH: The adhesive bond strength, as in pounds of inch of width, obtained by a stress applied in the peeling mode.

PEEL STRESS: Out-of-plane stress that tries to separate the bonded joint in the peeling mode.

PEGGING: The joining of two pieces of core by crush splicing them together with a third piece of core.

PENETRAMETER [RT]: A tool used as a means of measuring the sensitivity of radiographic inspections.

PENETRATION: (i) A surface discontinuity which penetrates one skin and core or both skins and core, and whose width is the same order of magnitude as its length; i.e., hole, ballistic damage. (ii) The entering of an adhesive into an adherend. This property of a system is measured by the depth of penetration of the adhesive into the adherend.

PENETRATION [RT]: (i) A qualitative term used to describe the degree to which radiation is capable of penetrating a given object. Penetration is usually a function of the applied tube voltage in X-rays or equivalent voltage in isotope radiography. (ii) In wet lay-up of composite fabrics, the term may be used to describe how easily the resin penetrates the fabric being impregnated.

PERFORATED CORE: See SLOTTED CORE.

PERFORATED RELEASE FILM: Also known as parting film, or separator, is placed between the outer repair ply or peel ply, if it is used, and bleeder cloth and allows for gas flow and resin bleed out through the film and facilitates bleeder system removal from the laminate after cure. It is important to note that the kind of film selected (hole size and type of perforations, as well as perforation spacing) in combination with the choice of bleeder cloth can have a direct effect on the resin content of the cured component. It prevents bleeder material from bonding to the component during the cure cycle.

PERFORATED SKIN: An outer skin of an acoustical panel that has a pattern of small holes punched or drilled to allow air passage in and out of the panel for noise abatement.

PERMANENCE: The property of a plastic that describes its resistance to appreciable changes in characteristics with time and environment.

PERMANENT PATTERN: A secondary pattern or master having all of the necessary coordination data and reference points on its surface from which a tool can be directly made with repeated accuracy.

PERMANENT SET: The deformation remaining after a specimen has been stressed a prescribed amount in tension, compression, or shear for a specified time period and released for a specified time period. For creep tests, the residual unrecoverable deformation after the load causing the creep has been removed for a substantial and specified period. Also, the increase in length, expressed as a percentage of the original length, by which an elastic material fails to return to original length after being stressed for a standard period.

PERMEABILITY: The product of the solubility coefficient and the diffusion coefficient. It is directly measured as the rate of transfer of liquid, vapor or gas through unit thickness, usually of a polymer in film form, per unit area and pressure difference across the film.

PERSONAL PROTECTIVE EQUIPMENT (PPE): A level of protection that places a barrier between a person and chemical. Use personal protective equipment (PPE) where engineering controls such as ventilation or administrative controls cannot adequately control the hazardous exposure. Common PPE includes goggles, safety glasses, face shields, respiratory equipment and protective clothing such as gloves, hard hats and footwear, hearing protection, aprons, and fall protection.

pH: The measure of the acidity or alkalinity of a substance, neutrality being at pH 7. Acid solutions are less than 7, alkaline solutions are more than 7.

PHASE: In periodic changes of any magnitude varying according to a simple harmonic law (as ultrasonic vibrations, alternating electric currents, etc.), the point or stage in the period to which the variation has advanced, considered in relation to its standard position. Can be expressed in degrees. See PHASE ANGLE.

PHASE ANALYSIS: An instrumentation technique which discriminates between variables in the test part by the different phase angle changes which these conditions produce in the test signal.

PHASE ANGLE: The angular equivalent of the time displacement between corresponding points on two sine waves of the same frequency.

PHASE SHIFT: A change in the phase relationship between two alternating quantities of the same frequency.

PHENOLIC RESIN: A thermosetting resin produced by the condensation of an aromatic alcohol with an aldehyde, particularly of phenol with formaldehyde. Used in high-temperature applications with various fillers and reinforcements. Used for aircraft interior components because in fire it gives off less smoke and toxic fumes than epoxy or polyester resins.

PHENYLSILANE RESINS: Thermosetting copolymers of silicone and phenolic resins. Furnished in solution form.

PHOSPHORIC ACID ANODIZING (PAA): Developed to improve bond reliability for metal-bond structure parts. The process was established as a reliable production process. Furthermore, the hydration resistant oxides of PAA result in environmentally durable bonded part components.

PHYSICAL CATALYST: Radiant energy capable of promoting or modifying a chemical reaction.

PICK: (i) An individual filling yarn, running the width of a woven fabric at right angles to the warp. Also known as FILL, WOOF, or WEFT. (ii) To experience tack. (iii) To transfer unevenly from an adhesive applicator mechanism due to high surface tack.

PICK COUNT: The number of filling yarns per inch of woven fabric.

PICK UP ROLL: A spreading device where the roll for picking up the adhesive runs in a reservoir of adhesive.

PIGMENT: A finely divided coloring agent.

PIMPLE: Small raised area not separated from the release paper or film.

PIN HOLES: Small cavities that penetrate the surface of a cured part.

PIT: (i) For composite materials, a small, regular, or irregular crater in the surface of a plastic material, usually of a width approximately the same order of magnitude as its depth. (ii) For metals, a form of corrosion that occurs under particular conditions which result in small pits rather than general surface corrosion.

PITCH: A high molecular weight material left as a residue from the destructive distillation of coal and petroleum products. Pitches are used as base materials for the manufacture of certain high-modulus carbon fibers and as matrix precursors for carbon-carbon composites.

PITCH CATCH [UT]: Used to describe an inspection method in which the ultrasonic energy is emitted by one transducer element and received by another on the same or adjacent surface.

PITCH FIBERS: Reinforcement fiber derived from petroleum or coal tar pitch. See CARBON FIBER.

PLAIN WEAVE: A weaving pattern in which the warp and fill fibers alternate; that is, the repeat pattern is warp/fill/warp/fill, etc. Both faces of a plain weave are identical. Properties are significantly reduced relative to a weaving pattern with fewer crossovers.

PLANAR: Lying essentially in a single plane.

PLANAR HELIX WINDING: A winding in which the filament path on each dome lies on a plane that intersects the dome, while a helical path over the cylindrical section is connected to the dome paths.

PLANAR WINDING: A winding in which the filament path lies on a plane that intersects the winding surface. See POLAR WINDING.

PLASTIC: A material that contains as an essential ingredient, an organic polymer of large molecular weight, hardeners, fillers, reinforcements, etc.; is solid in its finished state; and at some stage in its manufacture or it's processing into finished articles, can be shaped by flow. Made of plastic. A plastic may be either thermoplastic or thermoset.

PLASTIC DEFORMATION: Change in dimensions of an object under load that is not recovered when the load is removed, as opposed to elastic deformation.

PLASTIC FLOW: (i) Deformation under the action of a sustained force. More likely to occur at high temperatures or long times. (ii) Flow of semi-solids in the molding of plastics.

PLASTIC MEMORY: Plastic memory is the ability of some plastics to return to their original form when hot.

PLASTIC TOOLING: Tools constructed of plastics, generally laminates or casting materials. A term employed for structures composed of plastics, usually reinforced thermosets, which are used as tools in the fabrication of metals or other materials including plastics.

PLASTICITY: That property of materials by virtue of which they tend to retain the size and shape resulting from deformation. The opposite of elasticity.

PLASTICIZE: To make a material moldable by softening it with heat or a plasticizer.

PLASTICIZER: A material incorporated in a plastic to increase its workability and flexibility or distensibility. Normally used in thermoplastics. A lower molecular weight material added to an epoxy to reduce stiffness and brittleness, thereby resulting in a lower glass transition temperature for the polymer.

PLATE MARK: Any imperfection in appressed plastic sheet resulting from the surface of the pressing plate.

PLATE SHEAR STRESS: A type of honeycomb shear strength test in which the honeycomb is bonded between two thick steel plates which are displaced relative to each other to place the specimen in shear. Displacement is accomplished by loading either in tension or compression. The plate shear represents the best currently known method for obtaining true shear data on honeycomb material.

PLATENS: The mounting plates of a press, to which the entire mold assembly is bolted.

PLEAT: See TUCK.

PLIED YARN: A yarn formed by twisting together two or more single yarns in one operation.

PLY: (i) In general, fabrics or felts consisting of one or more layers. See NON-STRUCTURAL PLY and STRUCTURAL PLY. (ii) The layers that make up a stack. (iii) Yarn resulting from twisting operations (three-ply yarn, etc.). (iv) A single layer of prepreg. (v) A single pass in filament winding (two plies forming one layer). (vi) A sheet or layer that is one discrete piece of manufactured material such as fabric, tape or adhesive film etc. A discrete piece may consist of just one piece or of adjoining pieces of the same material.

PLY COMPACTION: See COMPACTION.

PLY COUNT: In laminated composite structures, the number of plies or laminae used to construct the composite.

PLY DISTORTION: In plane fiber, waviness not accompanied by bag side or tool side wrinkles and/or core movement.

PLY DROP-OFF: Edge termination of plies within a part (not at edge of part).

PLY GROUPING: Uncured or unconsolidated plies that are only part of a cured part and are grouped together for drawing. Clarity or for manufacturing engineering purposes.

PLY MATERIAL COORDINATE AXES: The coordinate axes defined per the tow filament orientation of each uni- or bi-axial material.

PLY ORIENTATION: (i) The tow filament orientation of uni- or bi-axial material with respect to the tool or part reference axis. Usually expressed as 0 degrees, +45 degrees, 90 degrees, -45 degrees, or a similar variation. (ii) The angle between the principal material direction of a ply (0 degree - direction) and a chosen coordinate system usually the reference coordinate system.

PLY WRINKLE: An out-of-plane distortion of fibers in a cured composite part.

POLYMERIZATION OF MONOMER REACTANTS (PMR) POLYIMIDES: Polymerization of monomer reactants. A novel class of high-temperature-resistant polymers. Also represents polymerization of monomer reactants.

POISE: The measure of the specific viscosity of a fluid. The CGS unit of viscosity. 1 poise = 100 centipoise. The term “poise” is derived from the name of the man who discovered the laws of flow, Poiseuille. A more common term is now the pascal-second (Pa·s). 1 Pa·s = 10 poise.

POISSON’S RATIO: The ratio of the change in lateral width per unit width to change in axial length per unit length caused by the axial stretching or stressing of a material. The ratio of transverse strain to the corresponding axial strain below the proportional limit.

POLAR: In an unsymmetrical molecule such as water or sulphur dioxide, the mean center of all the electronic charges does not coincide with the mean electrical center of the nuclei. Such a molecule is termed polar; it may be regarded as an electric doublet or dipole, analogous to a tiny magnet. Polar molecules have an electric moment which is equal to the distance between the two electrical centers multiplied by the total electric charge of either sign in the molecule. Liquid polar molecules in an electric field tend to orient themselves so that their potential energy is reduced to a minimum. When the electrical centers of a molecule coincide, the molecule has no electric moment and is said to be nonpolar.

POLAR SOLVENTS: Such solvents as alcohols and ketones that contain hydroxyl or carbonyl groups, have high di-electric constants, and show strong polarity.

POLAR WINDING: A winding in which the filament path passes tangent to the polar opening at one end of the chamber and tangent to the opposite side of the polar opening at the other end. A one- circuit pattern is inherent in the system.

POLARITY: The relative surface charge of a material resulting from the molecular structure of the adherend surface.

POLEPIECE: In reinforced plastics, the supporting part of the mandrel used in filament winding, usually on one of the axes of rotation.

POLY ACRYLO NITRILE (PAN): Also known as PAN, it is used as a base material or precursor in the manufacture of certain carbon fibers. See CARBON FIBER.

POLYAMIDE: A thermoplastic polymer in which the structural units are linked by amide or thio-amide groupings (repeated nitrogen and hydrogen groupings). Many polyamides are fiber forming.

POLYAMIDE IMIDE: A polymer containing both amide (nylon) and imide (as in polyamide) groups; properties combine the benefits and disadvantages of both.

POLYAMIDE PLASTIC: See NYLON PLASTICS.

POLYARYLSULFONE (PAS): A range of high-temperature-resistant thermoplastics with T_g values ranging from 374 to 500 °F (190 to 260 °C). The term is also occasionally used to describe the family of resins which includes polysulfone and polyether sulfone.

POLYBENZIM IDAZOLE (PBI): A condensation polymer of diphenyl isophthalate and 3,3’-di-aminobenzidine. Extremely high temperature resistance. Available as adhesive and fiber.

POLYCARBONATE RESIN: A thermoplastic polymer derived from the direct reaction between aromatic and aliphatic dihydroxy compounds with phosgene or by the ester exchange reaction with appropriate phosgene-derived precursors. Highest impact resistance of any transparent plastic. Impact resistance rapidly lost when in contact with certain solvents.

POLYCONDENSATION: See CONDENSATION POLYMERIZATION.

POLYESTER RESINS: Family of resins produced by the reaction of dibasic acids with dihydric alcohols. Polyethylene terephthalate is a thermoplastic which may be extruded, injection molded, or blow molded. Unsaturated polyesters are thermosets and are used in the reinforced plastics industry for applications such as boats, auto parts, etc. Modifications with multifunctional acids and bases and some unsaturated reactants permit crosslinking to thermosetting resins. Polyesters modified with fatty acids are called alkyds. Orthophthalic polyester resin is the standard economic resin. Isophthalic polyester resin is now becoming the preferred material in industries such as marine where its superior water resistance is desirable.

POLYARYL ETHER KETONE (PAEK): A semi-crystalline thermoplastic with high-temperature stability and high mechanical strength whose molecular backbone contains alternately ketone and ether groups.

POLYETHER ETHER KETONE (PEEK): A linear aromatic crystalline thermoplastic. A composite with a PEEK matrix may have a continuous-use temperature as high as 480 °F (250 °C).

POLYETHER KETONE KETONE (PEKK): A semi-crystalline thermoplastic in the polyaryletherketone (PAEK) family of polymers. It possesses high heat, chemical, and mechanical load resistance.

POLYETHERIMIDE: An amorphous polymer with good thermal properties for a thermoplastic. Reported glass transition temperature (T_g) of 419 °F (215 °C) and continuous use temperature of about 338 °F (170 °C).

POLYETHERSULFONE (PES): A thermoplastic material with a glass transition temperature (T_g) of 446 °F (230 °C). Victrex PES is a tradename of Victrex.

POLYETHYLENE TEREPHTHALATE (PET): A type of polyester. Also known as “Mylar,” a tradename of DuPont.

POLYIMIDE (PI): A polymer produced by reacting an aromatic dianhydride with an aromatic diamine. It is a highly heat-resistant resin (600 °F / 315 °C). Similar to a polyamide, differing only in the number of hydrogen molecules contained in the groupings. Suitable for use as a binder or an adhesive. May be either thermoplastic or thermoset.

POLYMETHYL METHACRYLATE: A thermoplastic polymer synthesized from methyl methacrylate.It is a transparent solid with exceptional optical properties available in the form of sheets, granules, solutions, and emulsions. Certain versions are commonly used for aircraft passenger and cockpit windows.

POLYMETHYL METHACRYLIMIDE: A thermoplastic polymer formed from a reaction of poly (methylmethlacrylate) and monomethyl amine.

POLYPHENYLENE (PPH): A polymer with a backbone consisting of repeating units containing six carbon atoms arranged in aromatic rings joined directly through carbon-carbon bonds between carbon atoms in the aromatic rings.

POLYPHENYLENE SULPHIDE (PPS): A high-temperature thermoplastic useful primarily as a molding compound. Optimum properties depend on slightly cross-linking the resin. Known for chemical resistance.

POLYPROPYLENE: A tough, lightweight thermoplastic made by the polymerization of high-purity propylene gas in the presence of an organometallic catalyst at relatively low pressures and temperatures.

POLYSULFIDE: A synthetic polymer containing sulfur and carbon linkages, produced from organic dihalides and sodium polysulfide. Material is elastomeric in nature, resistant to light, oil, and solvents, and impermeable to gases.

POLYSULFONE: A high-temperature-resistant thermoplastic polymer with the sulfone linkage, with a T_g of 375 °F (190 °C).

POLYURETHANE: A thermosetting resin prepared by the reaction of diisocyanates with polyols, polyamides, alkyd polymers, and polyether polymers. See ISOCYANATE PLASTICS and URETHANE PLASTICS.

POLYMER: A high molecular weight organic compound, natural or synthetic, whose structure can be represented by a repeated small unit, the mer, for example, polyethylene, rubber, and cellulose. Synthetic polymers are formed by addition or condensation polymerization of monomers. Some polymers are elastomers, some are plastics, and some are fibers. When two or more dissimilar monomers are involved, the product is called a copolymer. The chain lengths of commercial thermoplastics vary from near a thousand to over one hundred thousand repeating units. Thermosetting polymers approach infinity after curing, but their resin precursors, often called prepolymers, may be relatively short—6 to 100 repeating units—before curing. The lengths of polymer chains, usually measured by molecular weight, have very significant effects on the performance properties of plastics and profound effects on processability.

POLYMER MATRIX: The resin portion of a reinforced or filled plastic.

POLYMERIZATION: A chemical reaction in which the molecules of a monomer are linked together to form large molecules whose molecular weight is a multiple of that of the original substance. When two or more monomers are involved, the process is called “copolymerization.”

POLYMORPHISM: A composition with more than one crystal structure. For example, graphite and diamond are two polymorphs of carbon.

POLYTETRA FLUORO ETHYLENE: Porous or non-porous coated fiberglass used as a vacuum bag aid to prevent resin adherence. See ARMALON.

POPULATION: The set of measurements about which inferences are to be made or the totality of possible measurements which might be obtained in a given testing situation. For example, “all possible ultimate tensile strength measurements for a carbon/epoxy system A, conditioned at 95% relative humidity and room temperature.” In order to make inferences about a population, it is often necessary to make assumptions about its distributional form. The assumed distributional form may also be referred to as the population.

POPULATION MEAN: The average of all potential measurements in a given population weighed by their relative frequencies in the population.

POPULATION MEDIAN: That value in the population such that the probability of exceeding it is 0.5 and the probability of being less than it is 0.5.

POPULATION VARIANCE: A measure of dispersion in a population.

POROSITY: (i) A condition of trapped pockets of air, gas, or vacuum, within a solid material. Usually expressed as a percentage of the total nonsolid volume to the total volume (solid plus nonsolid) of a unit quantity of material. See VOID CONTENT. (ii) Small voids in a laminated part or an adhesive bond line caused by trapped air, water vapor, or volatiles coming out of solution at low cure pressures.

POROUS PARTING FILM: See PERFORATED RELEASE FILM.

POSITIVE PRESSURE: (i) Pressure that is above normal atmospheric pressure as differentiated from vacuum pressure, which is below normal atmospheric pressure. (ii) A term also applied to air pressure in a clean room where layup takes place prior to bonding. In this case the pressure in the room is slightly higher than outside to cause an outward flow of air to prevent dust and other contaminants entering the clean area.

POSITIVELY SKEWED: A distribution is said to be positively skewed if the distribution is not symmetric and the longest tail is on the right.

POST-FAB: Fabrication process where close-outs and inserts are attached or put into the panel after the facings are bonded to the core.

POSTCURE: Additional elevated temperature cure, usually without pressure to improve final properties and/or complete the cure or decrease the percentage of volatiles in the compound. In certain resins, complete cure and ultimate mechanical properties are attained only by exposure of the cured resin to higher temperatures than those of curing.

POSTFORMING: The forming, bending, or shaping of fully cured, C-staged thermoset laminates that have been heated to make them flexible. On cooling, the formed laminate retains the contours and shape of the mold over which it has been formed.

POT: To embed a component or assembly in liquid resin, using a shell, can, or case that remains an integral part of the product after the resin is cured.

POT LIFE: The length of time at some specified temperature that a catalyzed thermosetting resin system retains a viscosity low enough to be used in processing. Also known as WORK LIFE.

POTTING: Like encapsulating except that steps are taken to ensure complete penetration of all the voids in the object before the resin polymerizes.

POTTING COMPOUND: A resin that has been thickened by use of filler (e.g., milled fibers or fine metal shavings). Also, a resin reduced in density by the addition of hollow glass or phenolic microspheres. Used for jointing honeycomb and edge filling of sandwich panels.

POURCOAT: A liquid honeycomb sealant material of high solids content that is used to stabilize honeycomb core after crushing or as a seal against moisture entry by coating the cell walls. This pour coat is applied by pouring it through the honeycomb cells.

POWDERED ALUMINUM: Fine particle aluminum usually in the form of a 45 to 90 µm powder of mostly spherical particles. Similar material is sold as a plasma spray powder. Many of the popular paste adhesives contain aluminum filler and are used for a wide variety of bonding applications, especially where their gap filling capabilities are required. They may also be used for core splicing in wet lay-up repair applications. See FILLER.

POWER FACTOR: The cosine of the angle between voltage applied and the current resulting. Measurements are usually made at million-cycle frequencies.

PREBOND TREATMENT: Synonym for surface preparation. See SURFACE TREATMENT.

PRECURE: (i) The full or partial setting of a synthetic resin or adhesive in a joint before the clamping operation is complete or before pressure is applied. (ii) To cure a part prior to joining it with other parts to form a bonded part.

PREFIT: A process for checking the fit of mating detail parts in an assembly prior to adhesive bonding, to ensure proper bond lines. Mechanically fastened structures are sometimes pre-fitted to establish shimming requirements.

PREFORM: A pre-shaped fibrous reinforcement formed by distribution of chopped fibers or cloth by air, water flotation, or vacuum over the surface of a perforated screen to the approximate contour and thickness desired in the finished part. Also, a preshaped fibrous reinforcement of mat or cloth formed to the desired shape on a mandrel or mock-up before being placed in a mold press.

PREFORM BINDER: A resin applied to the chopped strands of a preform, usually during its formation, and cured so that the preform will retain its shape and can be handled.

PREFORM MOLDING: Matched-die techniques in which the reinforcements is placed by hand over a heated male mold, resin is added as a viscous liquid or granules, and the mold is closed for curing.

PREGEL: An unintentional, extra layer of cured resin on part of the surface of a reinforced plastic. Not related to gel coat.

PREHEATING: The heating of a compound before molding or casting, to facilitate the operation or reduce the molding cycle.

PREIMPREGNATION: The practice of mixing resin and reinforcement and effecting partial cure before use or shipment to the user. See PREPREG.

PREMIX: A molding compound prepared prior to and apart from the molding operations and containing all components required for molding resin, reinforcement, fillers, catalysts, release agents, and other ingredients.

PREMIX MOLDING: A variation of matched-die molding in which the ingredients, usually chopped roving, resin, pigment, filler, and catalyst, are premixed as a gunk which can be placed in the mold as accurately weighed charges.

PREMOLDING: The lay-up and partial cure at an intermediate cure temperature of a laminated or chopped-fiber detail part to stabilize its configuration for handling an assembly with other parts for final cure.

PREPLIED PLIES: Multiple plies of pre-impregnated material that have been stacked up and compacted together to form a layup and packaged or stored prior to being cured individually or in combination with other parts.

PREPLIED TAPE: Tape received from the manufacturer with two or more plies laid into specific orientation.

PRE-PLY: A composite material lamina in the raw-material stage, ready to be fabricated into a finished laminate. The lamina is usually combined with other raw laminae before fabrication. A pre-ply includes a fiber system that is placed in position relative to all or part of the required matrix material to constitute the finished lamina. An organic matrix pre-ply is called a prepreg. Metal matrix pre-plies include green tape, flame-sprayed tape, and consolidated monolayers.

PREPOLYMER: A chemical intermediate whose molecular weight is between that of the monomer or monomers and the final polymer or resin.

PRECIPITATION STATIC: Interference to systems caused by charging due to airflow over external airplane surfaces. Also known as P-STATIC.

PRECISION: The degree of agreement within a set of observations or test results obtained. Precision involves repeatability and reproducibility.

PRECURSOR: For carbon or graphite fiber, the rayon, poly acryl nitrile, or pitch fibers from which carbon and graphite fibers are derived.

PREFERRED ORIENTATION: The preferential alignment of either crystals or molecular chains, producing a similar orientation in every part of the solid.

PREPREG: Prepreg stands for pre-impregnated. It can be a cloth, mat, unidirectional fiber, or paper impregnated with resin system that is in B-stage and stored in a freezer.

PREPREG BATCH: Prepreg containing reinforcement material from one batch, impregnated with one batch of resin in one continuous operation.

PREPREG LOT: Prepreg from one batch submitted for acceptance at one time.

PREPREG ROLL: Prepreg material including suitable protection foil(s) according to the process control document contained on one support tube.

PREPREG SYSTEM: Prepreg material produced under a specific trade name by a prepreg manufacturer. In most cases, a film adhesive is required for use with the prepreg for co-cure joint and sandwich bonding. The prepreg material and associated co-curing film adhesive are defined as the prepreg system. It shall be responsibility of the prepreg manufacturer to select the appropriate film adhesive for the system.

PRESS CLAVE: A simulated autoclave made by using the platens of a press to seal the ends of an open chamber, providing both the force required to prevent loss of the pressurizing medium and the heat required to cure the laminate inside.

PRESSURE: Force or load measured per unit area. Absolute pressure is measured with respect to zero. Gage pressure (or relative pressure) is measured with respect to atmospheric pressure.

PRESSURE BAG MOLDING: A process for molding reinforced plastics in which a tailored, flexible bag is placed over the contact lay-up on the mold, sealed, and clamped in place. Fluid pressure, usually provided by compressed air or water, is placed against the bag, and the part is cured.

PRESSURE BREAK: As applied to a defect in a laminated plastic a break apparent in one or more outer sheets of the paper, fabric, or other base visible through the surface layer of resin which covers it.

PRESSURE IMPREGNATION CARBONIZATION (PIC): A densification process for carbon-carbon composites involving pitch impregnation and carbonization under high temperature and isostatic pressure conditions. This process is carried out in hot isostatic press (HIP) equipment.

PRESSURE INTENSIFIER: A layer of flexible material (usually a high-temperature rubber) used to ensure the application of sufficient pressure to a location, such as a radius, in a lay-up being cured.

PRESSURE SENSITIVE ADHESIVE: A viscoelastic material that, in solvent-free form, remains permanently tacky. Such material will adhere instantaneously to most solid surfaces with the application of very light pressure.

PRIMARY STRUCTURE: The structure which carries flight, ground, or pressurization loads, and whose failure would reduce the structural integrity of the airplane.

PRIMER: A coating applied to a surface, before the application of an adhesive, lacquer, enamel, etc., to improve the adhesion performance or load-carrying ability of the bond. Some primers contain a corrosion inhibitor.

PRINCIPAL STRUCTURAL ELEMENT (PSE): An element that contributes significantly to the carrying of flight, ground, or pressurization loads, and whose integrity is essential in maintaining the overall integrity of the airplane. Defined by the design approval holder.

PRINTED WIRING BOARD: A completely processed conductor pattern, usually formed on a stiff, flat base (laminated plastic). It serves as a means of electrical interconnection and physical attachment for printed circuits. Also known as printed circuit board.

PROBE [UT]: A generic term for the sensing unit of a bond tester or ultrasonic instrument.

PROCESS CONTROL DOCUMENT (PCD): Document defining the material and its manufacturing process. The PCD shall include description of raw materials, equipment, procedures, and manufacturing standards.

PROCESSING WINDOW: The range of processing conditions, such as stock (melt) temperature, pressure, shear rate, etc., within which a particular grade of plastic can be fabricated with optimum or acceptable properties by a particular fabrication process, such as extrusion, injection molding, sheet molding, etc. The processing window for a particular plastic can vary significantly with design of the part and the mold, with the fabricating machinery used, and with the severity of the end-use stresses.

3.17 Q

QUADRAX BIAXIAL TAPE: Unidirectional thermoplastic prepreg tape ribbons interlaced in fabric weaves that have the benefits of fabric formability and the strength of unidirectional tapes in both longitudinal and transverse directions. A tradename of Quadrax Advanced Materials.

QUALIFICATION: Demonstrated skill, training, knowledge, and experience required for personnel to properly perform the duties of a specific job.

QUALIFICATION TEST: A series of tests conducted by the procuring activity, or an agent thereof, to determine conformance of material, or materials system, to the requirements of a specification which normally results in a qualified products list under the specification. Generally, qualification under a specification requires a conformance to all tests in the specification, or it may be limited to conformance to a specific type or class, or both, under the specification.

QUALIFIED BONDING PROCESS: The characterization and control of specific parameters used when surface preparation is required to at least one of the structural interfaces prior to bonding. A qualified bonding process is documented after demonstrating repeatable and reliable processing steps. A qualified bonding process entails understanding the sensitivity of structural performance based upon expected variation permitted per the process. Qualified bonding process entails both development and documentation of the process, and demonstration that the process can be executed by the user. Refer to AC 20-107B/AMC 20-29, para.6c.

QUALIFIED BONDING SYSTEM: The specific combination of substrate, adhesive, type of surface preparation, and cure parameters controlled and validated under a QUALIFIED BONDING PROCESS.

QUALIFIED MATERIAL: A raw material that has been found to meet the requirements of a particular material specification. In general, each specification has an associated qualified products list that identifies the raw materials that have been qualified to that specification. Qualification of a material to a particular specification does not mean it is approved for use, unless that specification is called out on a drawing or other document.

QUALIFIED PRODUCTS LIST (QPL): Usually a companion document or appendix to a material specification. A list of commercial products that have been pretested and found to meet the requirements of a specification. See QUALIFIED MATERIAL.

QUARANTINED: To be located in a separate place awaiting some further action; i.e., requalification test, inspection, repair information, spare parts, or disposal.

QUARTZ: Fused silica fiber yarns. A fiber similar in appearance to fiberglass but stronger and has better transmissivity properties. Often used in radomes.

QUASI-ISOTROPIC LAMINATE: A laminate laid up symmetrically with an equal number of plies at each 0 degree, 45 degree, and 90 degree angle. The properties in the plane of such a laminate will be nearly the same in all directions. The term may also be applied to laminates laid up with 0 degree and ±60 degree plies.

3.18 R

RACE TRACKING: Flow of resin from injection port to vacuum port along the path of least resistance in such a way that the fabric preform is not completely infused with resin. See RESIN TRANSFER MOLDING.

RADIANT HEATER: See HEAT LAMP.

RADIATION [RT]: The propagation of energy through matter or space in the form of waves. In atomic physics the term has been extended to include fast-moving particles (alpha and beta rays, free neutrons, etc.). Gamma rays and X-rays, of particular interest in atomic physics, are electromagnetic radiation in which energy is propagated in packets called photons.

RADICAL: A very reactive chemical intermediate.

RADIO FREQUENCY (RF) DISPLAY [UT]: A CRT signal display which is not rectified. Displayed signals are both above and below the sweep or baseline.

RADIOGRAPH [RT]: A permanent image on a recording medium (usually film) produced by penetrating radiation passing through the material being tested.

RADIOGRAPHIC INSPECTION [RT]: The use of X-rays or nuclear radiation or both to detect discontinuities in material and to present their images on a recording medium.

RADIOGRAPHIC INTERPRETATION [RT]: The identification of discontinuities (normally subsurface) indicated on the radiograph. The evaluation as to the acceptability or reject ability of the material is based upon the judicious application of the radiographic specifications and standards governing the material.

RADIOGRAPHIC TECHNIQUE [RT]: The selection of those radiographic factors such as voltage, current, type of film and screen, distance and exposure time as to render the best possible radiographic sensitivity.

RADIOGRAPHY [RT]: A non-destructive test method wherein a source of X-rays or gamma rays is utilized to indicate the condition of materials. A permanent record of the soundness characteristics is generally made on a specially prepared film called the radiograph.

RADIUS FILLER: See NOODLE.

RAMP DAMAGE CHECKER (RDC): Ultrasound based tool for go/no go decision if there is any possible hidden damage beyond the visible damage to monolithic structure.

RAMP RATE: Changing control process parameter(s) with time; e.g., temperature and/or pressure.

RAMPING: A gradual programmed increase/decrease in temperature or pressure to control cure or cooling of composite parts.

RANDOM EFFECT: A common shift in a group of measurements due to a random level change of a usually uncontrollable factor.

RANDOM ERROR: That part of data variation due to level changes in uncontrolled factors which affect each observation separately and independently.

RANDOM PATTERN: A winding with no fixed pattern. If a large number of circuits is required for the pattern to repeat, a random pattern is approached. A winding in which the filaments do not lie in an even pattern.

RANGE: The difference between the extreme high and low test values obtained from specimens cut from one test assembly.

RANGE [UT]: The maximum ultrasonic path length that can be displayed. See SWEEP.

RAYLEIGH WAVE [UT]: See SURFACE WAVE.

RAYON: Artificial textile material composed of regenerated and purified cellulose derived from plant sources, also known as viscose.

REVALIDATION: See RETEST.

REACTION INJECTION MOLDING (RIM): A process for molding polyurethane, epoxy, and other liquid chemical systems. Mixing of two to four components in the proper chemical ratio is accomplished by a high-pressure impingement-type mixing head, from which the mixed material is delivered into the mold at low pressure, where it reacts (cures).

REACTIVE DILUENT: As used in epoxy formulations, a compound containing one or more epoxy groups that functions mainly to reduce the viscosity of the mixture.

REAL TIME: Any measurement or inspection in real time is one that can be interpreted as it is happening; i.e., a radiographic inspection performed in real time is one where no film processing is required, the image is displayed and read whilst the radioactive source is being used. Film radiography is not a real time inspection. Fluoroscopy is a real time inspection format.

REBUILD: The process of rebuilding a part or significant portion of a part; i.e., one skin on a panel, when the damage is so severe that a smaller repair is not feasible or economical. Typically requires the use of a layup tool of the same contour as the molds used in original manufacture. Also known as REMANUFACTURE.

RECEIVER [UT]: Search unit or transducer element used to receive ultrasonic energy from a test part.

REDUCTION OF AREA: The difference between the original cross-sectional area of a tension test specimen and the area of its smallest cross section, usually expressed as a percentage of the original area.

REFERENCE COORDINATE SYSTEM: A coordinate system in which the structure is described with respect to loads and ply orientation. Usually an orthogonal coordinate system is chosen. For plates usually two axes are in the midplane of the plate and the third in the thickness direction perpendicular to it.

REFERENCE STANDARD: A piece of material, part, or piece from a part, containing an artificial discontinuity of known size; provides a means of producing a reflection of known characteristics; used to establish a measurement scale and set instrument parameters.

REFLECTION [UT]: An indication which has arisen as a result of an incident sound beam being reflected at the boundary of two materials of dissimilar acoustic impedance.

REFLECTOR [UT]: An interface at which an ultrasonic beam reflects.

REFRACTION [UT]: Change in direction of an ultrasonic beam as it passes obliquely through the interface between two materials with different acoustic velocity. Mode conversion may also occur at the interface.

REFRACTIVE INDEX: The ratio of the velocity of light (of specified wavelength) in air to its velocity in the substance under examination. Also defined as the sine of the angle of incidence divided by the sine of the angle of refraction as light passes from air into the substance.

REFRACTORY: Refractories are special materials of construction capable of withstanding high temperatures in various industrial processes and operations. The main bulk of commercial refractories are complex solid bodies consisting of high melting oxides or a combination of oxides of elements such as silicon, aluminum, magnesium, calcium, and zirconium, with small amounts of other elements present as impurities. Refractoriness is the ability of a material to withstand the action of heat without appreciable deformation or softening under particular service conditions. These materials are used for furnace linings, crucibles for melting metals, rocket nozzles, etc.

REGULAR BRAID: A braided fabric with an over two, under two weave patterns (2 x 2).

REINFORCED MOLDING COMPOUND: Compound supplied by raw material producer in the form of ready-to-use materials, as distinguished from premix.

REINFORCED PLASTICS: Molded, formed, filament-wound, tape-wrapped, or shaped plastic parts consisting of resins to which reinforcing fibers, mats, fabrics, etc., have been added before the forming operation to provide some strength properties greatly superior to those of the base resin.

REINFORCED REACTION INJECTION MOLDING (RRIM): A reaction injection molding with a reinforcement added. See REACTION INJECTION MOLDING.

REINFORCEMENT: A strong material bonded into a matrix to improve its mechanical properties. Reinforcements are usually long fibers, chopped fibers, whiskers, particulates, etc. The term should not be used synonymously with filler. A material used to reinforce, strengthen or give dimensional stability to a part.

REJECT [UT]: A control used for minimizing or eliminating low amplitude signals (electrical or material “noise”) so that larger signals are emphasized. Use of this control can reduce the vertical linearity of the amplifier. Also known as SUPPRESSION.

REJECTION LEVEL [UT]: The setting of the signal level above or below which all parts are rejectable; as in an automatic system, the level at which objectionable parts will actuate the reject mechanism of the system.

RELATIVE HUMIDITY (RH): The ratio of the actual pressure of existing water vapor to the maximum possible (saturation) pressure of water vapor in the atmosphere at the same temperature, expressed as a percentage.

RELAXATION: The gradual “decay” of stress in a specimen which is held stretched.

RELAXATION TIME: The time required for a stress under a sustained constant strain to diminish by a stated fraction of its initial value.

RELAXED STRESS: The initial stress minus the remaining stress at a given time during a stress-relaxation test.

RELEASE AGENT: A material that is applied in a thin film to the surface of a mold to keep the resin from bonding to the mold. Also known as a parting agent. See PARTING AGENT and MOLD RELEASE AGENT.

RELEASE FILM: Release film is a permeable or impermeable layer of film that does not bond to the resin being cured. The most common films available are modified halohydrocarbons, polyvinyl fluoride (PVF), coated fiberglass cloth (porous and non-porous), polyester, and fluorinated ethylene propylene (FEP). FEP films are used as release films for all types of epoxy resin and are light weight and easily conformable. Release films are interleaved between any adhesive film, resin, potting compound, or sealant and a surface not intended to be bonded. See SEPARATOR. Warning: not to be confused with PEEL PLY.

RELEASE PAPER: A sheet, serving as a protectant or carrier, or both, for an adhesive film or mass, which is easily removed from the film or mass prior to use. See BACKING MATERIAL.

RELIABILITY: The probability that an assembly or part will function properly in the operating environment for the expected service life.

REMANUFACTURE: See REBUILD.

REPAIR: The rebuilding of a rejected assembly to restore its intended form, fit, and function.

REPAIR KIT: Material cut from material master roll/prepreg roll and packaged as precut sheets or small roll to be distributed to repair depot

REPAIR PART: Discrete parts that are incorporated into a part or assembly that have a unique part number and engineering definition. For example, doublers, triplers, fillers, tapered shims, replacement skin, and/or replacement honeycomb core are repair parts. Primers, adhesives, and positioning fabric are not repair parts.

REPAIR PLY TEMPLATE: Typically a thin film of transparent plastic or a polyester used as a pattern to mark and cut repair plies.

REPAIR SYSTEM: The combination of matrix material and fiber reinforcement or other filler materials used to perform a repair of a damaged structure.

REPAIR TOOLING: Tooling that may be required for performing a repair to support the component and/or restore the geometric contour in the repair area or manufacturing any pre-cured repair parts. Refer to AIR5431 for additional information.

REPAIRABLE DAMAGE LIMITS (RDL): The maximum dimension of removed material that is permitted prior to initiating the repair procedure. Refer to the specific component repair section in the OEM manuals, service bulletin, or other approved engineering data for the repairable damage limits.

REPETITION RATE [UT]: The rate at which individual pulses, or groups of pulses, are generated. See PULSE REPETITION RATE.

REPLICA: Production of a defined material of an original source on another production line and/or different site using the same raw materials and processes as the original source.

REPROCESSED PLASTICS: A thermoplastic prepared from usually melt processed scrap or reject parts by a plastic processor, or from non-standard or non-uniform virgin material.

RESIDUAL GAS ANALYSIS (RGA): The study of residual gases in vacuum systems using mass spectrometry.

RESIDUAL STRAIN: The strain associated with residual stress.

RESIDUAL STRESS: The stress existing in a body at rest, in equilibrium, at uniform temperature, and not subjected to external forces. Often caused by the forming and curing process.

RESILIENCE: The ratio of energy returned, on recovery from deformation to the work input required to produce the deformation (usually expressed as a percentage). The ability to regain an original shape quickly after being strained or distorted.

RESIN: A solid or pseudo-solid organic material. In reinforced plastics, it is the material used to bind together the reinforcement material, also know as matrix. It is part of a resin system also known as base. See POLYMER.

RESIN APPLICATOR: In filament winding the device which deposits the liquid resin onto the reinforcement band.

RESIN BATCH: A quantity of homogeneous resin prepared in one operation with traceability to individual component batches as defined in the Process Control Document of the resin system manufacturer.

RESIN CONTENT: The amount of resin in a laminate expressed as either a percentage of total weight or total volume. See MATRIX CONTENT.

RESIN EXTENDER: Materials such as calcium carbonate and talc are added to resins to provide a thicker laminate at a lower cost. Although there is increased flexural stiffness, imparted by the increased thickness, tensile and impact properties are reduced. Resin extenders should not be used for any aerospace structural applications.

RESIN FILM INFUSION (RFI): A process where a stack-up of dry or tackifier non-impregnated composite fabric is placed on top of a tile of solid resin. As temperature rises, the resin changes to a liquid, infiltrates the fabric, and eventually solidifies, creating a composite laminate.

RESIN FLASH: Cured resin which protrudes outward from the part surface (as a thin ridge, for example). Resin flash usually occurs at the intersection where multiple tools are mechanically fastened together.

RESIN POCKET: An apparent accumulation of excess resin in a small, localized section visible on cut edges of molded surfaces, or internal to the structure and nonvisible. See RESIN-RICH AREA.

RESIN PULLOUT: See FIBER PULLOUT.

RESIN RICH AREA: Localized area filled with resin and lacking reinforcing material. See RESIN POCKET.

RESIN RIDGE: A sharp buildup on the surface of a part consisting of only resin.

RESIN STARVED AREA: Localized area of insufficient resin, usually identified by low gloss, dry spots, or fiber showing on the surface.

RESIN STREAK: A streak of excess resin on the surface of a laminated plastic.

RESIN SYSTEM: A mixture of resin and hardener with ingredients such as catalyst, initiator, diluents, etc., required for the intended processing and final product.

RESIN TRANSFER MOLDING (RTM): A process whereby catalyzed thermosetting resin is transferred or injected into an enclosed mold in which the fiber reinforcement has been placed. Cure is normally accomplished without external heat. RTM combines relatively low tooling and equipment costs with the ability to mold large structural parts. In general, thermoplastics are too viscous to be used in RTM even if heat is applied.

RESINOGRAPHY: The science of the morphology, structure, and related descriptive characteristics as correlated with the composition or conditions and with the properties or behavior of resins, polymers, plastics, and their products.

RESINOID: Any of the class of thermosetting synthetic resins, either in their initial temporarily fusible state or in their final infusible state. See NOVOLAK and THERMOSETTING.

RESISTIVITY: The ability of a material to resist passage of electrical current either through its bulk or on a surface.

RESOLUTION DEFECT: A property of a test system that enables the separation of indications due to defects in a test specimen that are in close proximity to each other. In ultrasonic testing, near surface resolution refers to the depth below the surface at which defects start to become detectable. Also, the limiting smallness of defect size that can be found.

RESONANCE [UT]: The condition in which the frequency of the forced vibration (ultrasonic wave) is the same as the natural frequency of the body (test piece) which results in abnormally large amplitudes of vibration.

RESONANCE/IMPEDANCE BONDTESTER: See WET COUPLED BONDTESTER.

RETARDER: See INHIBITOR.

RETEST: Tests performed to verify that material has not deteriorated beyond acceptable limits after the storage period or retest periods. Also known as re-validation.

RETEST PERIOD: Length of time between retesting of material (re-validation period).

RETICULATION: Reticulation is a process to create a perforated adhesive film or non-continuous adhesive film by shrinking the non-supported adhesive to either the honeycomb cell or perforated skin. This process allows air to flow from the outside to the inside of a structure maintaining the intended acoustic properties. This process requires film adhesive without any carrier fabric (unsupported) so that under careful application of hot air the adhesive can shrink back onto the cell ends. The heat must be sufficient to cause shrink back but not so much as to cause cure.

REVERSE HELICAL WINDING: In filament winding, as the fiber delivery arm traverses one circuit, a continuous helix is laid down, reversing direction at the polar ends. In contrast to biaxial, compact, or sequential winding. The fibers cross each other at definite equators, the number depending on the helix. The minimum region of crossover is three.

REVERSE IMPACT TEST: A test in which one side of a sheet of a material is struck by a pendulum or falling object and the reverse side is inspected for damage.

REWORK: A procedure that does not restore the strength but can return the structure to a serviceable condition. Blend-outs, stop-drilling, and hole-filling are examples.

R-GLASS: American and European version of S-GLASS.

RHEOLOGY: The study of the flow of materials, particularly plastic flow of solids and the flow of non-Newtonian liquids. The science treating the deformation and flow of matter.

RIB: A reinforcing member designed into a plastic part to provide lateral, horizontal, hoop, or other structural support.

RIBBON: A fiber having essentially a rectangular cross-section, where the width-to-thickness ratio is at least four.

RIBBON DIRECTION: In honeycomb, the direction of the node bonds. See CORE RIBBON DIRECTION and L-DIRECTION.

RIGID PLASTICS: For purposes of general classification, a plastic that has a modulus of elasticity either in flexure or in tension greater than 690 MPa (100 ksi) at 70 °F (23 °C) and 50% relative humidity.

RIGID RESIN: A resin having a modulus high enough to be of practical importance, for example, 690 MPa (100 ksi) or greater.

RIGIDITY: The property of bodies by which they can resist an instantaneous change of shape. The reciprocal of elasticity.

RINGING METHOD [UT]: A bonded structure inspection method in which unbonds are indicated by increased amplitude ringing signals.

RINGING SIGNALS [UT]: Closely spaced multiple signals can be caused by multiple reflections in a thin material or continued vibration of a transducer element.

RINGING TIME [UT]: The time that the mechanical vibrations of a transducer element continue after the electrical pulse has fallen below a pre-determined level.

RISE TIME: In urethane foam molding, the time between the pouring of the urethane mix and the completion of foaming.

ROCKWELL HARDNESS: A value derived from the increase in depth of an impression as the load on an indenter is increased from a fixed minimum value to a higher value and then returned to the minimum value. Indenters for the Rockwell test include steel balls of several specific diameters and a diamond cone penetrator having an included angle of 120 degrees with a spherical tip having a radius of 0.2 mm (0.0070 inch). Rockwell hardness numbers are always quoted with a prefix representing the Rockwell scale corresponding to a given combination of load and indenter; for example, HRC 30.

ROLLER: A tool with hard roller (e.g., nylon, metal) that can be used to ensure contact between each ply, and to remove wrinkles and entrapped air out of the lay-up, the same purpose as a squeegee. See SQUEEGEE.

ROOM TEMPERATURE (RT): A temperature in the range of 68 to 86 °F (20 to 30 °C). The term room temperature is usually applied to an atmosphere of unspecified relative humidity.

ROOM TEMPERATURE CURING ADHESIVE: A resin system used to perform a ROOM TEMPERATURE REPAIR.

ROOM TEMPERATURE REPAIR: A repair that sets at temperatures from 68 to 86 °F (20 to 30 °C) and later reaches full strength either with post-cure heating or without heating. Also known as LOW TEMPERATURE REPAIR.

ROOM TEMPERATURE SETTING ADHESIVE: An adhesive that sets in the temperature range from 68 to 86 °F (20 to 30 °C). Compare to COLD-SETTING ADHESIVE, HOT-SETTING ADHESIVE, INTERMEDIATE TEMPERATURE SETTING.

ROOM TEMPERATURE VULCANIZING (RTV): Vulcanization or curing at room temperature by chemical reaction; usually applies to silicones and other rubbers.

ROSETTE: A reference symbol used to align ply direction. See WARP CLOCK.

ROUGHNESS: Relatively finely spaced surface irregularities, the height, width, and direction of which establish the predominant surface pattern. See BAGSIDE SURFACE.

ROVING: A number of fiber yarns, strands, tows, or ends collected into a parallel bundle with little or no twist.

ROVING BALL: The supply package offered to the winder, consisting of a number of ends or strands wound to a given outside diameter onto a length of cardboard tube. Usually designated by either fiber weight or length in yards.

ROVING CLOTH: A textile fabric, course in nature, woven from rovings.

ROW NUCLEATION: The mechanism by which stress-induced crystallization is initiated, usually during fiber spinning or hot drawing.

RUBBER: Cross-linked polymers with glass transition temperature below room temperature, which exhibit highly elastic deformation and have high elongation.

RUBBER PLUNGER MOLDING: A matched-die technique used to achieve high fiber loadings by employing a heated metal female mold and a deformable, rubber plunger male mold.

RULE OF MIXTURES: When two materials are mixed it is normally the case that the properties of the mixture are an average of the properties of the constituents according to the proportion of each in the mixture. This applies, for example, to particulate reinforced composites and fillers in resins.

RUNNER: (i) The secondary feed channel in an injection or transfer mold that runs from the inner end of the sprue to the cavity gate. (ii) The molding material in this secondary feed channel.

RUPTURE: A sudden cleavage or break resulting from physical stress. Work of rupture. The integral of the stress-strain curve between the origin and the point of rupture.

RUPTURE STRENGTH: The true value of rupture strength is the stress in a material at failure based on the ruptured cross-sectional area itself.

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SACRIFICIAL PLY: A nonstructural ply or plies added to the outer surface of a repair for the purpose of being sanded or otherwise partially removed to aid in achieving a desirable surface texture, thickness, or contour. See SANDING PLY, PLY (NONSTRUCTURAL).

SAFETY HARDENER: A curing agent which causes only a minimum toxic effect on the human body, either on contact with the skin or as concentrated vapor in the air.

SAGGING: Run-off or flow-off of adhesive from an adherend surface due to application of excess or low viscosity material.

SAMPLE: (i) A small portion of a material or product intended to be representative of the whole. (ii) Statistically, a sample is the collection of measurements taken from a specified population.

SAMPLE MEAN: The arithmetic average of the measurements in a sample. The sample mean is an estimator of the population mean.

SAMPLE MEDIAN: The value of the middle observation, when the observations are ordered from smallest to largest, if the sample size is odd; the average of the two central observations if “n” is even. If the population is symmetric about its mean, the sample median is also an estimator of the population mean.

SAMPLE STANDARD DEVIATION: The square root of the sample variance.

SAMPLE VARIANCE: The sum of the squared deviations from the sample mean, divided by n-1.

SANDING: The use of abrasive paper or medium to either prepare a surface by light abrasion using a fine grit abrasive; or remove material and/or shape a part with a coarse grit abrasive.

SANDING DISC: Abrasive paper or medium cut into a circular shape and mounted to a pad. Available in multiple diameters and grits.

SANDING DUST: Dust composed of a mixture of resin and fiber formed from solid material by sanding, crushing, grinding, drilling, etc., of nonmetallic composites.

SANDING PLY: A nonstructural ply or plies added to the outer surface of a repair for the purpose of being sanded or otherwise partially removed to aid in achieving a desirable surface texture, thickness, or contour. See PLY (NON-STRUCTURAL) and SACRIFICIAL PLY.

SANDWICH CONSTRUCTION: See SANDWICH PANEL.

SANDWICH PANEL: A panel consisting of two thin face sheets bonded to a thick, lightweight honeycomb or foam core.

SATIN FINISH: A type of finish having a satin or velvety appearance, specified for plastics or composites.

SATIN WEAVE: See HARNESS SATIN.

SATURATION: (i) The maximum amount of moisture that can be absorbed by a laminate at a specified temperature and humidity. Under test conditions a laminate may take many weeks to reach saturation as measured by a zero-weight gain over time. In the case of thick laminates, this can take many months or even years. (ii) In NDT [UT, ET], the condition where the signal from a sensor exceeds the maximum input range of the instrumentation.

S-BASIS: The S-basis property allowable is the minimum value specified by the appropriate federal, military, SAE, ASTM, or other recognized and approved specifications for the material. See A-BASIS, B-BASIS, and TYPICAL BASIS.

SCALE: Equipment used to weigh components. The scale may be electronic, triple beam, or equal arm with a single beam. The accuracy must be better than 1% of the smallest amount being weighed; e.g., if the smallest amount of hardener to be weighed is 10 g, then the accuracy of the scale shall be 0.1 g. Typically used to weigh dry reinforcement, resin, and hardener used in wet layup repairs.

SCARF: A taper sanded area. See TAPER SAND.

SCARF ANGLE: The angle of taper of a scarf joint; i.e., the taper ratio of length to thickness.

SCARF JOINT: A bonded splice repair including taper sanding. See TAPER SAND.

SCORING: A type of wear in which the working face acquires grooves, axial or circumferential, according to whether the motion is reciprocating or rotary. Also applied to a similar effect on the rigid, nonmoving member. A groove which is smooth and has significant width compared to depth. A blunt scratch.

SCOTCH BRITE: A non-woven, abrasive fabric or pad. Usually, made of aluminum oxide or silicon carbide. A trademark of 3M Corporation. See ABRASIVE.

SCOURING: Cleaning process to remove size (steam, acid wash) followed by drying under controlled conditions.

SCRATCH: An elongated surface discontinuity which is infinitely small in width compared to length. Shallow mark, groove, furrow, or channel normally caused by improper handling or storage.

SCRIM: A low-cost reinforcing fabric made from continuous filament yarn in an open-mesh construction. Used in the processing of tape or other B-stage material to facilitate handling. Also used as a carrier of adhesive, to be used in secondary bonding. Also known as GLASS CLOTH or CARRIER.

SEALANT: A material applied to a joint in paste or liquid form that hardens or cures in place, forming a seal against gas or liquid entry.

SEARCH UNIT [UT]: A device for generating and/or receiving ultrasonic energy; may contain one or more transducer elements or, in the case of the Harmonic Bond tester, a microphone and coil.

SECANT MODULUS: Idealized Young's modulus derived from a secant drawn between the origin and any point on a nonlinear stress-strain curve. On materials whose modulus changes with stress, the secant modulus is the average of the zero applied stress point and the maximum stress point being considered. See TANGENT MODULUS.

SECONDARY BONDING: The joining together, by the process of adhesive bonding, of two or more already cured composite parts, during which the only chemical or thermal reaction occurring is the curing of the adhesive itself.

SECONDARY STRUCTURE: In aircraft and aerospace applications, a structure that is not critical to flight safety, but failure could cause significant problems.

SELECTIVE REINFORCEMENT: The addition of advanced composite materials to selected areas for local augmentation of strength or stiffness.

SELF EXTINGUISHING RESIN: A resin formulation that will burn in the presence of a flame but will extinguish itself within a specified time after the flame is removed.

SELF IGNITION TEMPERATURE: The temperature of a material at which spontaneous combustion takes place when the temperature rises slowly.

SELF SKINNING FOAM: A urethane foam that produces a tough outer surface over a foam core upon curing.

SELF VULCANIZING: Pertaining to an adhesive that undergoes vulcanization without the application of heat. See VULCANIZATION.

SELVAGE: The woven-edge portion of a fabric parallel to the warp, finished off so as to prevent the yarns from unravelling. Modern “jet” looms (since 1980s) leave cut ends in the weft, but locking threads are provided to stop edge unravelling. Selvage is always cut off. It is never incorporated into the work. Also known as selvedge.

SEMICRYSTALLINE: In plastics, materials that exhibit localized crystallinity. See CRYSTALLINE PLASTIC.

SEPARATOR: A permeable layer that also acts as a release film. Porous Teflon-coated fiberglass is an example. Often placed between lay-up and bleeder to facilitate bleeder system removal from laminate after cure. Also known as separator cloth.

SEPTUM: A continuous layer of film adhesive and/or prepreg cured or bonded between two pieces of core, to enhance shear and torsional stiffness. May be added as part of a repair if replacing partial thickness of core.

SERVICE CONDITIONS: The heat, cold, loading, flexing, shock, impact, vibration, moisture, etc., that a part will be subjected to in service.

SET: (i) The irrecoverable or permanent deformation or creep after complete release of the force producing the deformation. (ii) To convert an adhesive into a fixed or hardened state by chemical or physical action, such as condensation, polymerization, oxidation, vulcanization, gelation, hydration, or evaporation of volatile constituents. See CURE and DRY.

SET UP: To harden, as in curing of a polymer resin.

SETTING TEMPERATURE: The temperature to which an adhesive or resin is subjected in order to fully cross-link the polymer. See CURE TEMPERATURE.

SETTING TIME: The period during which a part or assembly is subjected to heat, pressure, or both to set the adhesive or resin.

S-GLASS: Structural Glass, used as fiber reinforcement, designed to give high tensile strength.

SHEAR: (i) An action or stress resulting from applied forces that causes or tends to cause two contiguous parts of a body to slide relative to each other in a direction parallel to their plane of contact. (ii) In interlaminar shear, the plane of contact is composed primarily of resin. See SHEAR STRENGTH and SHEAR STRESS.

SHEAR CRIMPING: Buckling of the compressive facing due to low core shear modulus. Usually causes the core to fail in shear at the crimp.

SHEAR EDGE: The cutoff edge of the mold.

SHEAR FRACTURE: For crystalline type materials, a mode of fracture resulting from translation along slip planes, which are preferentially oriented in the direction of the shearing stress.

SHEAR MODULUS: The ratio of shearing stress to shearing strain within the proportional limit of the material. See MODULUS OF RIGIDITY.

SHEAR RIGIDITY: The sandwich property which resists shear distortions; synonymous with shear stiffness.

SHEAR STRAIN: The tangent of the angular change caused by a force between two lines originally perpendicular to each other through a point in a body. Also known as angular strain.

SHEAR STRENGTH: The maximum shear stress that a material is capable of sustaining. Shear strength is calculated from the maximum load during a shear or torsion test and is based on the original cross-sectional area of the specimen.

SHEAR STRESS: The component of stress tangent to the plane on which the forces act.

SHEAR WAVE [UT]: A type of wave in which the particle motion is perpendicular to the direction of propagation.

SHEAROGRAPHY: An enhanced form of holography where the part is subjected to stress and a laser is used to illuminate the part. The output takes the form of an image processed video display. The process provides a full-field video strain gage, in real time, over large areas.

SHEET: A thin, generally plane product in which the thickness is small in proportion to length and width.

SHEET MOLDING COMPOUND (SMC): A composition of fibers with resin system, fillers and other additives that have been compounded and processed into sheet form to facilitate handling in the molding operation.

SHEETING: (i) Sheet made in continuous lengths and generally supplied in roll form. (ii) A synonym for sheet.

SHELF LIFE: The length of time a raw material, substance, product, or reagent may be in storage under specific conditions and still meet the requirements of the applicable material specification. See STORAGE LIFE.

SHELL TOOLING: A mold or bonding fixture consisting of a contoured surface shell supported by a substructure to provide dimensional stability.

SHIPMENT: An order of raw material received by purchaser. A shipment of prepreg may include rolls of raw material from more than one batch or more than one lot. A shipment of resins or adhesives may include resins or adhesives from one or more batches or more than one lot.

SHOE: A device for gathering filaments into a strand, in glass fiber forming.

SHOE [UT]: Device used to adapt a straight beam search unit for use in a specific type of inspection such as inspection of a curved surface, angle beam, or surface wave inspection; inspection around a fastener hole, radius, etc.

SHORE HARDNESS: A measure of the resistance of material to indentation by a spring-loaded indenter. The higher the number, the greater the resistance. Normally used for rubber materials. The Shore A scale is typically used for softer materials while the Shore D scale is typically used for harder materials.

SHORT: An imperfection in a molded plastic part due to an incompletely filled out condition.

SHORT BEAM SHEAR (SBS): A flexural test of a specimen having a low test span-to-thickness ratio (for example, 4:1), such that failure is primarily in shear.

SHORT BEAM SHEAR STRENGTH: The interlaminar shear strength of a parallel-fiber-reinforced plastic material as determined by three-point flexural loading of a short segment cut from a ring specimen. Four-point loading may also be used.

SHORT SHOT: Injection of insufficient material to fill the mold.

SHORT-TERM EXPOSURE (STE): A specified short period of time within which materials may be exposed to temperatures exceeding the storage area temperature. See SHORT TIME EXPOSURE.

SHORT TIME EXPOSURE: A term, found in most military specifications for adhesives, used normally to designate an exposure period of 10 min duration to any desired medium or condition.

SHOT CAPACITY: The maximum weight of material an injection machine can provide from one forward motion of the ram, screw, or plunger.

SHOT VOLUME: The total hollow space of a mold including cavity or cavities, runners, and sprue.

SHRINK MARK: An imperfection, a depression in the surface of a molded material where it has retracted from the mold.

SHRINKAGE: The relative change in dimension from the length measured on the mold when it is cold to the length of the molded object 24 hours after it has been taken out of the mold.

SIGNAL [UT, EC, ET]: (i) A graphical representation received from a sensing device. (ii) Vertical deflection from the baseline on an A-scan.

SIGNAL TO NOISE RATIO [UT, EC, ET]: Comparison of the level of a desired signal to the level of background noise.

SIGNIFICANT DIGIT: Any digit that is necessary to define a value or quantity to the required level of accuracy.

SILICA GEL: A form of colloidal silica which has the appearance of coarse sand and has many fine pores. It is extremely absorbent and is used as a catalytic material.

SILICON CARBIDE: Reinforcement, in whisker, particulate, and fine or large fiber, that has application as metal matrix reinforcement because of its high strength and modulus, density equal to that of aluminum, and comparatively low cost. As a whisker or particulate, it gives the composite isotropic properties and is easily machined.

SILICONE BAG: A permanent vacuum bag used in curing of composite lay-ups. It is made of silicone rubber sheet and has an inner-locking seal or rope-type seal.

SILICONE PLASTICS: Plastics based on resins in which the main polymer chain consists of alternating silicon and oxygen atoms, with carbon-containing side groups. Derived from silica (sand) and methyl chlorides and furnished in different molecular weights, including liquids, solid resins, and elastomers.

SILICONE RUBBER: A rubber prepared by the action of moisture on dichloro-dimethyl silicone. These rubbers withstand temperatures from -76 to 482 °F (-60 to 250 °C) and are vulcanized with benzoyl peroxide.

SILICONES: Resinous materials derived from organ siloxane polymers, furnished in different molecular weights including liquids, solid resins, and elastomers. Silicones exhibit outstanding heat resistance (from -100 to 500 °F or -73 to 260 °C), electrical properties and compatibility with body tissues. They cure by a variety of mechanisms, are relatively expensive, and are available in many forms including laminating resins, molding resins, coatings, casting or potting resins, and sealants.

SINGLE CIRCUIT WINDING: A winding in which the filament path makes a complete traverse of the chamber after which the following traverse lies immediately adjacent to the previous one.

SINGLE LAP SPECIMEN: A specimen used for adhesive testing made by bonding the overlapped edges of two sheets or strips of material, or by grooving a laminated assembly, as shown in ASTM D2339 and ASTM D3165. In testing, a single lap specimen is usually loaded in tension at the ends. Refer to ASTM D4896. For metal bonds, the most common method is ASTM D1002.

SINGLE SCARFING: Scarfing done to one side of a part, also known as SINGLE TAPER SCARF, SINGLE TAPER SANDING. See SCARF.

SINGLE SEARCH UNIT [UT]: A transducer or transducers contained within one element.

SINGLE SPREAD: Application of adhesive to only one adherend of a joint.

SINGLES YARN: One or more strands with applied twist.

SINGLY ORIENTED PLY LAMINATE (SOPL): A laminate made from singly oriented plies; i.e., plies with fibers in only one direction.

SINK MARK: A shallow depression or dimple on the surface of an injection-molded part due to collapsing of the surface following local internal shrinkage after the gate seals. An incipient short shot.

SINTERING: (i) The bonding of powders by solid-state diffusion, resulting in the absence of a separate bonding phase. The process is generally accompanied by an increase in strength, ductility, and density. (ii) A process by which fine particles, in direct contact with each other, form a solid body when heated to a suitable temperature.

SINTERING TEMPERATURE: The temperature at which a given powdered compact will densify to a certain desired density, say 90% of the theoretical density during a certain heating period.

SIZING: A chemical coating applied to filaments to protect the fiber from breaking during handling and processing, promote fiber wetting and processing, and provides improved bonding. The formulation is dependent on the fiber and matrix material.

SIZING CONTENT: The percent of the total strand weight made up by the sizing; usually determined by burning off or dissolving the organic sizing; known as loss on ignition.

SKEIN: A continuous filament, strand, yarn, or roving wound up to some measurable length and usually used to measure various physical properties.

SKEWING: A condition where the warp and fill yarns are not at right angles to each other.

SKEWNESS: See POSITIVELY SKEWED and NEGATIVELY SKEWED.

SKIN: The relatively dense material that may form the surface of a cellular plastic or of a sandwich.

SKIN PLY: A ply that covers a core bay or encompasses the entire area of a bond assembly. A ply that covers a core bay but does not extend down the core ramp is also considered to be a skin ply.

SKIRT: The extension of a motor case from the tangency plane, used for interstage connections, usually wound or laid up as an integral part of the case.

SLASHING: Cutting into or slicing of core.

SLEEVING: A common name for tubular braided fabric.

SLENDERNESS RATIO: The unsupported effective length of a uniform column divided by the least radius of gyration of the cross-sectional area.

SLIP: The relative collinear displacement of the adherend on either side of the adhesive layer in the direction of the applied load.

SLIP ANGLE: The angle at which a tensioned fiber will slide off a filament-wound dome. If the difference between the wind angles is less than the slip angle, fiber will not slide off the dome. Slip angles for different fiber-resin systems vary and must be determined experimentally.

SLIPPAGE: Undesired movement of the adherend with respect to one another during the bonding process. Slipping of the surfaces of parts to be bonded during the bonding process.

SLIT TAPE TOW: Unidirectional prepreg tape that has been slit into a width compatible with a fiber placement machine head.

SLIVER: A number of staple or continuous-filament fibers aligned in a continuous strand without twist. Pronounced “slyver.” See STRAND.

SLOTTED CORE: Honeycomb core with perforations (slots) in the cell wall. Allows the honeycomb cells to vent.

SLOW GROWTH APPROACH: A method that requires demonstration that the structure, with defined flaws present, is able to withstand appropriate repeated loads with slow, stable, and predictable flaw growth for the life of the structure, or beyond appropriate inspection intervals associated with appropriate damage detectability.

SLUB: An abruptly thickened place in a yarn.

SLURRY PREFORMING: Method of preparing reinforced plastic preforms by wet processing techniques similar to those used in the pulp molding industry. For example, glass fibers suspended in water are passed through a screen that passes the water but retains the fibers in the form of a mat.

SMASH: A place in the fabric where a number of warp or filling yarns have been broken.

S-N DIAGRAM: A plot of stress (S) against the number of cycles to failure (N) in fatigue testing. A log scale is normally used for N. For S, a linear scale is often used, but sometimes a log scale is used here, too. Also a representation of the number of alternating stress cycles a material can sustain without failure at various maximum stresses.

SOFTENING RANGE: The range of temperatures in which a plastic changes from a rigid to a soft state. Actual values will depend on the test method. Sometimes erroneously referred to as softening point.

SOL GEL: A chemical family of inorganic polymers used as a metal adhesion promoter.

SOLID LAMINATE: A structurally reinforced resin impregnated composite cured to a solid state containing no sandwich layers of honeycomb, plastic foam, or other material. See MONOLITHIC.

SOLID PARTING FILM: See NON-PERFORATED RELEASE FILM.

SOLIDS CONTENT: The percentage by weight of nonvolatile matter in an adhesive.

SOLUBILITY: The degree to which a substance will dissolve in a particular solvent, usually expressed as grams dissolved in 100 grams of solvent.

SOLUBILITY COEFFICIENT: The percentage of water or other fluid absorbed by a material at saturation at a given temperature.

SOLUBILITY PARAMETER: The solubility parameter, delta, is a measure of the energy required to separate the molecules of a liquid. Values for polymers can be obtained by measuring the swelling of a polymer in a range of solvents and taking the position that the greatest swelling occurs in the solvent most similar to the polymer in the value of its solubility parameter. Improvements in prediction can be obtained if comparisons of hydrogen bonding and dipole moment are also made.

SOLUTE: The dissolved material.

SOLVATION: The process of swelling, gelling, or dissolving a resin by a solvent or plasticizer.

SOLVENT: A substance (usually a liquid) used for dissolving and/or cleaning materials during reinforced plastics operations. Often flammable or toxic. Should be handled in accordance with safety instructions.

SOLVENT ACTIVATED ADHESIVE: A dry-film adhesive that is rendered tacky by the application of a solvent just prior to use.

SOLVENT ADHESIVE: An adhesive having a volatile organic liquid as a vehicle. This term excludes water-based adhesives.

SOLVENT WELDING: Also known as solvent cementing, is used for the mass production of strong and reliable joints for thermoplastic materials. After cleaning with a solvent that has no effect on the polymer to be joined, a suitable solvent is selected and applied only to the mating faces, masking being used to protect other areas.

SOURCE [RT]: The origin of radiation; an X-ray source or radioisotope.

SOURCE-FILM DISTANCE (SFD) [RT]: The distance between the focal spot of an X-ray tube or radiation source and the film. Generally expressed in inches.

SPATULA: A tool needed to transfer the resin and hardener to the mixing container and to mix the resin in the container. Typically, a metal spatula or a wooden tongue depressor is used.

SPECIALLY ORTHOTROPIC PLY: An orthotropic ply where the loads are in the direction of the principal plane of elastic symmetry.

SPECIFIC ADHESION: Adhesion between surfaces that are held together by valence forces of the same type as those that give rise to cohesion.

SPECIFIC GRAVITY: The density (mass per unit volume) of any material divided by that of water at a standard temperature. Solids and liquids are usually compared with water at 39 °F (4 °C).

SPECIFIC HEAT: The quantity of heat required to raise the temperature of a unit mass of a substance by 1 °C under specified conditions.

SPECIFIC PROPERTIES: Material properties divided by the material density.

SPECIFIC STRENGTH: The specific stress at the point of failure.

SPECIFIC SURFACE: (i) Surface area per unit volume. (ii) Surface area per unit weight.

SPECIFICATION: A detailed description of the characteristics of a product and of the criteria which must be used to determine whether the product is in conformity with the description.

SPECIMEN: (i) A piece or portion of a sample or other material taken to be tested. Specimens normally are prepared to conform to the applicable test method. (ii) In the case of adhesives, a specimen (or test piece) is made up to an ASTM or other standard using metal or composite adherend bonded together in order to test the adhesive and not the adherend. Some tests such as compression tests on short bars machined from cast adhesive samples, may be carried out using a sample of adhesive alone.

SPECTRA: Polyethylene fibers. A tradename of Allied Fibers and Plastics.

SPINNERET: A metal disc, containing numerous minute holes, used in the manufacture of fibers. The spinning solution or melted polymer is forced through the holes to form the fiber filaments.

SPLASH: An intermediate tool typically made using a fiber-reinforced plastic material. The airframe component, or an undamaged area on another component is covered locally with a release agent or film. Tooling materials (tooling prepreg, wet layup, gelcoat, plaster, etc.) are applied to the area and cured. The required repair patch can then be made using this tool.

SPLAY: A fanlike surface defect near the gate on a part.

SPLICE: Connection of two pieces of material.

SPLICE REPAIR: A repair method that restores the required design strength of the original structure by joining the ends or edges of two structural elements with an overlap along the damage cut by bonding and/or installing fasteners.

SPLICING: Connecting of two pieces of material.

SPLINTERING: A combination of cracking and delamination of the outer skin, fiber breakout from drilling operations, or broken or loose outer ply with fiber ends exposed.

SPLIT CORE: Core cell walls ruptured or split.

SPOOL: Slit tape tow interleaved with poly and wound onto a cone; a subunit of a set.

SPRAYED METAL MOLDS: Molds made by spraying molten metal onto a master until a shell of predetermined thickness is achieved. The shell is then removed and backed up with plaster, cement, casting resin, or other suitable material. Used primarily as a mold in the sheet forming process.

SPRAY-UP: Technique in which a spray gun is used as an application tool. In reinforced plastics, for example, fibrous glass and resin can be simultaneously deposited in a mold. In essence, roving is fed through a chopper and ejected into a resin stream that is directed at the mold by either of two spray systems. In foamed plastics, fast-reacting urethane foams or epoxy foams are fed in liquid streams to the gun and sprayed on the surface. On contact, the liquid starts to foam.

SPREAD: The quantity of adhesive per unit joint area applied to an adherend, usually expressed in pounds of adhesive per thousand square feet of joint area. See SINGLE SPREAD and DOUBLE SPREAD.

SPREADER: A broad flexible spatula used to spread the mixed resin over a large area, for example to spread resin over fabric. Sometimes called a “squeegee.” See SQUEEGEE.

SPRING BACK: Part distortion that is usually characterized by as-built angles or radii that are less than nominal tool geometry. Usually accounted for with correction factors in the tool geometry.

SPRING CONSTANT: The number of pounds required to compress a spring or specimen 25 mm in a prescribed test procedure.

SPRUE: A single hole through which molding compounds are injected directly into the mold cavity.

SPUN ROVING: A heavy, low-cost glass or aramid fiber strand consisting of filaments that are continuous but doubled back on themselves.

SQUARE BRAID: A braided pattern in which the yarns are formed into a square pattern.

SQUEEGEE: A tool that is used to ensure contact between each ply, and to remove wrinkles and entrapped air out of the lay-up. Typically, a nylon, polyethylene or polyurethane squeegee with rounded ends is used. A wiping action can also be used with the prepreg separator plastic film. See ROLLER.

SQUEEZE OUT: See EDGE BLEED.

SQUIRTER SYSTEM: An ultrasonic scanning system, usually through transmission, where sound is coupled to the part through water jets.

S-SCAN [UT]: S-scan (sectorial electronic scanniang), electronic scanning used to control an ultrasonic beam by electronically changing the beam angles within a defined sector.

STABILITY: A property which allows a compound to be stored under specific conditions without loss of its original properties.

STABILIZATION: In carbon fiber forming, the process used to render the carbon fiber precursor infusible prior to carbonization.

STABILIZED CORE: Honeycomb cores in which the cells have been filled with a specified reinforcing material for the purpose of supporting the cell walls during machining. Honeycomb core in which the cell walls have been reinforced with a specified reinforcing material.

STABILIZED HONEYCOMB COMPRESSIVE STRENGTHS: The compressive strength of honeycomb materials for which the plane surface of the test specimen has been stabilized with either a plastic resin or by the attachment of facings. The scatter of the test results is reduced, and the compressive strength of the honeycomb tested in the stabilized condition is generally higher than the same honeycomb tested in the bare condition. The stabilized test more closely approximates the honeycomb compressive strength expected in a sandwich application.

STABILIZER: A substance used in the formulation of some plastics to assist in maintaining the properties of the material at or near their initial values during processing and service life.

STACKING: The lamination sequence of a part.

STACKING SEQUENCE: A description of a laminate that details the ply orientations and their sequence in the laminate with respect to some reference axis.

STAGING: Heating a premixed resin system, such as in a prepreg, until the chemical reaction (curing) starts, but stopping the reaction before the gel point is reached. Staging is often used to reduce resin flow in subsequent press molding operations.

STANDARD: A reference used as A-basis for comparison or calibration. See REFERENCE STANDARD.

STANDARD DEVIATION: A measure of dispersion of data from the average.The root mean square of the individual deviation from the average.

STANDARDIZATION: The adjustment of instrument parameters to a reference standard before a test.

STAPLE FIBERS: Fibers of spinnable length manufactured directly or by cutting continuous filaments to short lengths (usually 12.7 to 50 mm or 0.5 to 2 inches long; 1 to 5 denier).

STARVED AREA: An area in a plastic part that has an insufficient amount of resin to wet out the reinforcement completely. This condition may be due to improper wetting, impregnation, or resin flow; excessive molding pressure; or improper bleeder cloth thickness.

STARVED JOINT: An adhesive joint that has been deprived of the proper film thickness of adhesive due to insufficient adhesive spreading or to the application of excessive pressure during the lamination process. A joint which has an insufficient amount of adhesive to produce a satisfactory bond.

STATIC CHARGE: The electric charge produced by the relative motion of a non-conducting material over a non-conducting plastic material. Charge separation is due to mechanical motion.

STATIC FATIGUE: Failure of a part under continued static load. Analogous to creep rupture failure in metals testing, but often the result of aging accelerated by stress.

STATIC MODULUS: The ratio of stress to strain under static conditions. It is calculated from static stress-strain tests, in shear, compression, or tension. Expressed in force per unit area.

STATIC STRESS: A stress in which the force is constant or slowly increasing with time; for example, test of failure without shock.

STATION LINE: Reference lines on loft and print used for locating and dimensioning purposes. They are in planes perpendicular to the horizontal centerline in the fuselage. They are in planes perpendicular to the wing reference plane in the wing. Stations are called out by number. This number is in inches (or millimeters) from Station 0. Fuselage Station 0 is located at a point well ahead of the nose of the airplane.

STATISTICALLY SIGNIFICANT: The value of a test statistic is significant if the probability of a value at least as extreme is less than or equal to a predetermined number called the significance level of the test.

STEP GROWTH POLYMERIZATION: A chemical reaction in which polymers are formed by the stepwise intermolecular addition of molecules through reactive groups. Any two molecular species present can react. Monomers disappear early in the reaction and polymer molecular weight rises steadily throughout the reaction.

STEP CUT: A cutting process that removes laminate material ply-by-ply for the creation of a STEP JOINT. The stepping must be accurate and uniform and must produce the specified overlap for each repair ply.

STEP JOINT: A bonded splice repair including step sanding. See STEP SAND and STEP CUT.

STEP SAND: A sanding process that removes laminate material ply-by-ply for the creation of a STEP JOINT. The stepping must be accurate and uniform and must produce the specified overlap for each repair ply.

STEP WEDGE: A reference standard used to calibrate an ultrasonic instrument to accurately display the depth of a flaw or surface. The step wedge must be made of material acoustically similar to that being inspected.

STEPPED WEDGE [RT]: A device which is used, with appropriate penetrameters on each step, for the inspection of parts having great variations in thickness or a complex geometry.

STEREOREGULAR POLYMER: A polymer whose chain configuration consists of small regularly oriented units. Isotactic and syndiotactic polymers fall within this class.

STIFFNESS: A measure of modulus. The relationship of load and deformation. The ratio between the applied stress and resulting strain. A term often used when the relationship of stress to strain does not conform to the definition of Young's modulus. See STRESS STRAIN.

STITCHING: A method of three-dimensional (translaminar) reinforcement in which a needle is used to insert a reinforcing thread through a two-dimensional laminate. Both dry preforms and prepreg laminates may be stitched.

STOPS: Metal pieces inserted between die halves. Used to control the thickness of a press-molded part. Not a recommended practice because the resin will receive less pressure, which can result in voids.

STORAGE LIFE: The period of time during which a liquid resin, packaged adhesive, or prepreg can be stored under specified temperature conditions and remain suitable for use. See SHELF LIFE.

STORAGE MODULUS: A quantitative measure of elastic properties in polymers, defined as the ratio of the stress, in phase with the strain, to the magnitude of strain. The storage modulus may be measured in tension, flexure, compression, or shear.

STRAIGHT BEAM [UT]: A vibrating pulse wave train traveling normal to the test surface.

STRAIN: Deformation due to stress. Measured as the change in length per unit of length in a given direction, and expressed in percentage, millimeter per millimeter (mm/mm), or inch per inch (in/in).

STRAIN GAGE: Device to measure strain in a stressed material based on the change in electrical resistance.

STRAIN RELAXATION: Reduction in internal strain over time. Similar molecular processes occur as in creep, except that the body is constrained.

STRAND: Normally an untwisted bundle or assembly of continuous filaments used as a unit, including slivers, tows, ends, yarn, etc. Sometimes a single fiber or filament is called a strand.

STRAND COUNT: The number of strands in a plied yarn. The number of strands in a roving.

STRAND INTEGRITY: The degree to which the individual filaments making up the strand or end are held together by the applied sizing.

STRAND TENSILE TEST: A tensile test of a single resin-impregnated strand of any fiber.

STRENGTH: The maximum stress which a material is capable of sustaining.

STRENGTH WET: The strength of an adhesive joint or composite determined immediately after removal from a liquid in which it has been immersed under specified conditions of time, temperature, and pressure. Note that the term is commonly used alone to designate strength after immersion in water.

STRESS: The internal force per unit area that resists a change in size or shape of a body. Expressed in force per unit area (pounds-force per square inch, pascal, etc.).

STRESS CONCENTRATION: On a macro mechanical level, the magnification of the level of an applied stress in the region of a notch, void, hole, or inclusion.

STRESS CONCENTRATION FACTOR: The ratio of the maximum stress in the region of a stress concentrator, such as a hole, to the stress in a similar strained area without a stress concentrator.

STRESS CRACK: External or internal cracks in a plastic caused by tensile stresses less than that of its short-time mechanical strength, frequently accelerated by the environment to which the plastic is exposed. The stresses that cause cracking may be present internally or externally or may be combinations of these stresses. See CRAZING.

STRESS CRACKING: The failure of a material by cracking or crazing sometime after it has been placed under load. Time-to-failure may range from minutes to years. Causes include molded-in stresses, post-fabrication shrinkage or warpage, and hostile environment.

STRESS RELAXATION: The decrease in stress under sustained, constant strain. Also known as stress decay.

STRESS STRAIN: Stiffness at a given strain.

STRESS STRAIN CURVE: Simultaneous readings of load and deformation, converted to stress and strain, plotted as ordinates and abscissae, respectively, to obtain a stress-strain diagram.

STRINGER: (i) A structural reinforcing element that typically runs longitudinally in fuselage structures and spanwise in wing and empennage structures. (ii) A clump of frayed carbon fiber filaments along the edge of the slit tape tow. Also known as FUZZBALL.

STRUCTURAL ADHESIVE: Adhesive used for transferring required loads between adherend exposed to service environments typical for the structure involved.

STRUCTURAL BOND: A bond that joins basic load-bearing parts of an assembly. The load may be either static or dynamic.

STRUCTURAL DAMAGE: Damage that may affect the structural integrity. In which case, a more detailed inspection is necessary to determine the extent of the damage and to assess acceptance or repair actions.

STRUCTURAL GLASS: A magnesia/alumina/silicate glass reinforcement providing high strength. Also known as S-GLASS.

STRUCTURAL HEALTH MONITORING (SHM): Aims to give, at every moment during the life of a structure, a diagnosis of the “state” of the different parts, and of the full assembly of these parts constituting the structure as a whole.

STRUCTURAL PLY: A ply or layer in a composite structure that is used to transmit loads.

STRUCTURAL REACTION INJECTION MOLDING (SRIM). A low pressure, low temperature liquid injected molding method, where structural elements are added to the mold prior to injection. It creates strong, lightweight, durable, large or highly detailed parts.

STRUCTURAL SANDWICH CONSTRUCTION: A laminar construction comprising a combination of alternating dissimilar simple or composite materials assembled and intimately fixed in relation to each other so as to use the properties of each to attain specific structural advantages for the whole assembly.

STRUCTURAL SIGNIFICANT ITEM (SSI): Any detail, element or assembly, which contributes significantly to carrying flight, ground, pressure or control loads, and whose failure could affect the structural integrity necessary for the safety of the aircraft. Determined by the design approval holder.

STYRENE MONOMER: An unsaturated hydrocarbon used in plastics. In polyester, it is a co-reactant diluent.

SUBSTITUTION: Finding an approved alternative material or fastener to replace the material or fastener that was initially installed in the airplane structure or called out in a repair.

SUBSTRATE: A material upon the surface of which an adhesive or resin is spread for any purpose such as bonding or coating. A broader term than adherend.

SUPERFORM: A patented double metallic diaphragm process utilizing the unique superplastic deformation properties of the aluminum calls to form and consolidate thermoplastic composite parts.

SUPERPLASTIC FORMING (SPF): A strain rate sensitive metal forming process that uses characteristics of materials exhibiting high elongation-to-failure.

SUPER TENACITY (ST): Carbon fibers with increased tensile strength compared to high tenacity carbon fibers. See HIGH TENACITY.

SUPPORTED ADHESIVE FILM: An adhesive supplied in a sheet or in a film form with an incorporated carrier that remains in the bond when the adhesive is supplied and used. Both mat and woven fabrics are used for this purpose.

SUPPRESSION [UT]: See REJECT.

SURFACE ACTIVATION: The (usually) chemical process of making a surface more receptive to bonding to a coating or an encapsulating material.

SURFACE DEPRESSION: A localized indentation or low spot in a surface.

SURFACE ENERGY: The measure or quantification of the available molecular bonds at the surface of a solid. Solid materials have a surface energy similar to surface tension which depends on the activity of the surface. Contamination or oxidation can reduce it considerably. The purpose of surface treatment of metals and other solids before bonding is to raise this surface energy to as high a figure as possible so that the adhesive will wet and bond well to the surface.

SURFACE PREPARATION: Physical and/or chemical preparation of an adherend to make it suitable for adhesive bonding. Synonym for pre-bond treatment.

SURFACE RESIN STARVATION: Incomplete resin coverage of fibers. See STARVED AREA.

SURFACE TENSION: The contractive force in the surface film of a liquid which tends to make the liquid occupy the least possible volume. It is due to the tendency of the body of liquid to attract the unbalanced surface molecules towards the interior. It is expressed in dynes per centimeter and varies for different liquids, being very high for mercury and very low for ether. It decreases with increasing temperature. Lyophilic colloids in sol form, such as soap and gelatin solutions, lower the surface tension of the medium appreciably, while lyophobic colloids have practically no effect.

SURFACE TREATMENT: (i) A material (size or finish) applied to fibrous material during the forming operation or in a subsequent process. For carbon-fiber surface treatment, the process used to enhance the bonding capability of fiber to resin. (ii) The term is also used for the preparation of surfaces to be bonded together.

SURFACE WAVE [UT]: A type of wave in which the molecules vibrate in an elliptical motion to a depth of one wavelength in the carrier material.

SURFACER: Material applied on the tool side surface of a part to fill in resin starvation, porosity, or roughness to maintain contour or aerodynamic smoothness.

SURFACING MAT: A thin mat of fine fibers used primarily to produce a smooth surface on an organic matrix composite.

SURFACTANT: A compound that affects interfacial tensions between two liquids. It usually reduces surface tension.

SURROGATE REPAIR PATCH: A temporary repair patch to fill the removed material area without using an adhesive when performing a thermal survey. See THERMAL SURVEY.

SUSPENSION: A dispersion of a solid in a liquid.

SWEEP [UT]: The uniform and repeated movement of an electron beam across the CRT. See RANGE.

SWEEP DELAY [UT]: See DELAYED SWEEP.

SWELLING: The change in dimensions, transversely and axial, of a fiber due to absorption of water. Can be expressed in terms of increase in diameter, area, length, or volume.

SYMMETRICAL LAMINATE: A composite laminate in which the stacking sequence of plies, ply properties and ply angles below the laminate mid-plane is a mirror image of the stacking sequence above the mid-plane.

SYNDIOTACTIC POLYMER: A polymer whose monomer units are oriented alternately dextro and levo.