
**Classification of dense shaped
refractory products —**

**Part 4:
Special products**

*Classification des produits réfractaires façonnés denses —
Partie 4: Produits spéciaux*



STANDARDSISO.COM : Click to view the full PDF of ISO 10081-4:2014



COPYRIGHT PROTECTED DOCUMENT

© ISO 2014

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

	Page
Foreword	iv
1 Scope	1
2 Principle	1
3 Classification	1
3.1 Type of product	1
3.2 Group	2
3.3 Nature of raw materials	8
3.4 State of raw materials	9
3.5 Nature of the bond	9
3.6 Post-treatment	9
4 Other refractory products	10
5 Designation of a special product	10
Bibliography	11

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information.

The committee responsible for this document is ISO/TC 33, *Refractories*.

This second edition cancels and replaces the first edition (ISO 10081-4:2007), of which it constitutes a minor revision. Changes have been made to [Tables 7](#) and [8](#) and the bibliography has been updated.

ISO 10081 consists of the following parts, under the general title *Classification of dense shaped refractory products*:

- *Part 1: Alumina-silica*
- *Part 2: Basic products containing less than 7 % residual carbon*
- *Part 3: Basic products containing from 7 % to 50 % residual carbon*
- *Part 4: Special products*

Classification of dense shaped refractory products —

Part 4: Special products

1 Scope

This part of ISO 10081 specifies the classification and designation of dense shaped refractory products of special composition including

- a) oxide products,
- b) oxide and non-oxide products,
- c) non-oxide silicon carbide or carbon-based products, and
- d) further special products which are only designated but not classified, for example, non-oxide products, such as boride, nitride or further combinations of the series listed above.

2 Principle

Dense shaped special products shall be classified according to the following six criteria:

- a) the type of product;
- b) the group determined by the content of its main chemical component(s);
- c) the principal raw material(s);
- d) the state of the raw materials;
- e) the nature of the bond;
- f) any post-treatment.

3 Classification

3.1 Type of product

The following types of dense shaped refractory special products shall be classified by chemical analysis as shown in [3.2](#).

- a) alumina-chromia (ACr);
- b) chromia (Cr);
- c) alumina-chromia-zirconia (ACrZ);
- d) alumina-chromia-zirconia-silica (ACrZS);
- e) zirconia-silica (ZS);
- f) alumina-zirconia-silica (AZS);
- g) alumina-carbon (AC);

- h) alumina-magnesia-carbon (AMC);
- i) alumina-fused silica-carbon (AFC);
- j) alumina-silicon carbide-carbon (ASC);
- k) zirconia-carbon (ZC);
- l) silicon carbide (SiC);
- m) carbon (C).

3.2 Group

The groups of dense shaped refractory special products in the above-mentioned series shall be determined by the content of their main chemical component(s) as shown in [Tables 1 to 12](#), and in accordance with the ranges given in the tables.

**Table 1 — Alumina-chromia refractory special products —
Classification by product type and group**

Designation	Group	Contents % (mass fraction)	
		Al ₂ O ₃	Cr ₂ O ₃
Alumina-Chromia	ACr90/5	90 ≤ Al ₂ O ₃ < 95	5 ≤ Cr ₂ O ₃ < 10
	ACr80/10	80 ≤ Al ₂ O ₃ < 90	10 ≤ Cr ₂ O ₃ < 20
	ACr70/20	70 ≤ Al ₂ O ₃ < 80	20 ≤ Cr ₂ O ₃ < 30
	ACr60/30	60 ≤ Al ₂ O ₃ < 70	30 ≤ Cr ₂ O ₃ < 40
	ACr50/40	50 ≤ Al ₂ O ₃ < 60	40 ≤ Cr ₂ O ₃ < 50
Chromia	Cr90		90 ≤ Cr ₂ O ₃
	Cr50		50 ≤ Cr ₂ O ₃ < 90

NOTE The analysis is carried out on calcined products using International Standards such as ISO 12677.

**Table 2 — Alumina-chromia-zirconia refractory special products —
Classification by product type and group**

Designation	Group	Contents % (mass fraction)		
		Al ₂ O ₃	Cr ₂ O ₃	ZrO ₂
Alumina-Chromia-Zir- conia	ACrZ15/5	15 < Al ₂ O ₃ ≤ 70	5 ≤ Cr ₂ O ₃ < 25	25 ≤ ZrO ₂ < 50
	ACrZ5/25	5 < Al ₂ O ₃ ≤ 65	25 ≤ Cr ₂ O ₃ < 40	10 ≤ ZrO ₂ < 40
	ACrZ5/40	5 < Al ₂ O ₃ ≤ 55	40 ≤ Cr ₂ O ₃ < 80	5 ≤ ZrO ₂ < 30

NOTE 1

Al₂O₃ + Cr₂O₃ + ZrO₂ ≥ 85 % by mass,

5% by mass < Al₂O₃ ≤ 70 % by mass,

5% by mass ≤ Cr₂O₃ < 80 % by mass, and

5% by mass < ZrO₂ ≤ 50 % by mass.

NOTE 2 ZrO₂ content includes HfO₂.

NOTE 3 The analysis is carried out on calcined products using International Standards such as ISO 12677.

**Table 3 — Alumina-chromia-zirconia-silica refractory special products —
Classification by product type and group**

Designation	Group	Contents % (mass fraction)		
		Al ₂ O ₃	Cr ₂ O ₃	ZrO ₂ +SiO ₂
Alumina-Chromia-Zirconia-Silica	ACrZS20/10	20 < Al ₂ O ₃ ≤ 55	10 ≤ Cr ₂ O ₃ < 25	25 ≤ ZrO ₂ +SiO ₂ < 50
	ACrZS15/25	15 < Al ₂ O ₃ ≤ 60	25 ≤ Cr ₂ O ₃ < 40	10 ≤ ZrO ₂ +SiO ₂ < 50
	ACrZS5/40	5 < Al ₂ O ₃ ≤ 30	40 ≤ Cr ₂ O ₃ < 80	10 ≤ ZrO ₂ +SiO ₂ < 30
NOTE 1 ZrO ₂ content includes HfO ₂ .				
NOTE 2 The analysis is carried out on calcined products using International Standards such as ISO 12677.				

**Table 4 — Zirconia-silica refractory special products —
Classification by product type and group**

Designation	Group	Contents % (mass fraction)	
		ZrO ₂	SiO ₂
Zirconia	Z95	95 ≤ ZrO ₂	
	Z90	90 ≤ ZrO ₂ < 95	
	Z70	70 ≤ ZrO ₂ < 90	10 ≤ SiO ₂ < 30
Zirconia-Silica	ZS60	60 ≤ ZrO ₂ < 70	30 ≤ SiO ₂ < 40
	ZS50	50 ≤ ZrO ₂ < 60	40 ≤ SiO ₂ < 50
	ZS35	35 ≤ ZrO ₂ < 50	50 ≤ SiO ₂ < 65
NOTE 1 The analysis is carried out on calcined products using International Standards such as ISO 12677.			
NOTE 2 ZrO ₂ content includes HfO ₂ .			
NOTE 3 If necessary, the stabilizer should be specified in "Nature of raw materials" (see 3.3).			

**Table 5 — Alumina-zirconia-silica refractory special products —
Classification by product type and group**

Designation	Group	Contents % (mass fraction)		
		Al ₂ O ₃	ZrO ₂	SiO ₂
Alumina-Zirconia-Silica	AZS70/2	70 < Al ₂ O ₃ ≤ 95	2 ≤ ZrO ₂ < 15	SiO ₂ < 28
	AZS30/15	30 < Al ₂ O ₃ ≤ 50	15 ≤ ZrO ₂ < 30	SiO ₂ < 35
	AZS30/30	30 < Al ₂ O ₃ ≤ 55	30 ≤ ZrO ₂ < 40	SiO ₂ < 40
	AZS30/40	30 < Al ₂ O ₃ ≤ 55	40 ≤ ZrO ₂ < 50	SiO ₂ < 30
NOTE 1 The analysis is carried out on calcined products using International Standards such as ISO 12677.				
NOTE 2 For AZS products, a group is indexed according to the zirconia content (see Table 4).				
NOTE 3 ZrO ₂ content includes HfO ₂ .				

**Table 6 — Alumina-carbon refractory special products —
Classification by product type and group**

Designation	Group	Contents	
		% (mass fraction)	
		Al ₂ O ₃	C
Alumina-Carbon	AC90/N*	90 ≤ Al ₂ O ₃	N
	AC80/N*	80 ≤ Al ₂ O ₃ < 90	N
	AC70/N*	70 ≤ Al ₂ O ₃ < 80	N
	AC60/N*	60 ≤ Al ₂ O ₃ < 70	N
	AC50/N*	50 ≤ Al ₂ O ₃ < 60	N
	AC40/N*	40 ≤ Al ₂ O ₃ < 50	N
	AC30/N*	30 ≤ Al ₂ O ₃ < 40	N
N*		Carbon contents	
		% (mass fraction)	
1		1 ≤ C < 5	
5		5 ≤ C < 10	
10		10 ≤ C < 15	
15		15 ≤ C < 20	
20		20 ≤ C < 25	
25		25 ≤ C < 30	
30		30 ≤ C	
NOTE 1	The asterisk indicates the antioxidant additive which is denoted by adding A to the group classification.		
NOTE 2	The analysis is carried out on calcined products using International Standards such as ISO 12677.		
NOTE 3	Residual carbon content after coking.		
NOTE 4	N is equal to the lowest limit of the residual carbon content range.		

**Table 7 — Alumina-magnesia-carbon refractory special products —
Classification by product type and group**

Designation	Group	Contents		
		% (mass fraction)		
		Al ₂ O ₃	MgO	C
Alumina-magnesia-carbon	AMC90/N*	90 ≤ Al ₂ O ₃	5 ≤ MgO < 10	N
	AMC80/N*	80 ≤ Al ₂ O ₃ < 90	10 ≤ MgO < 20	N
	AMC70/N*	70 ≤ Al ₂ O ₃ < 80	20 ≤ MgO < 30	N
	AMC60/N*	60 ≤ Al ₂ O ₃ < 70	30 ≤ MgO < 40	N
	AMC50/N*	50 ≤ Al ₂ O ₃ < 60	40 ≤ MgO < 50	N
N*		Carbon contents		
		% (mass fraction)		
1		1 ≤ C < 5		
5		5 ≤ C < 10		
10		10 ≤ C < 15		
15		15 ≤ C < 20		
20		20 ≤ C < 25		
25		25 ≤ C < 30		
NOTE 1	The asterisk indicates the antioxidant additive which is denoted by adding A to the group classification.			
NOTE 2	The analysis is carried out on calcined products using International Standards such as ISO 12677.			
NOTE 3	Residual carbon content after coking.			
NOTE 4	N is equal to the lowest limit of residual carbon content range.			

**Table 8 — Alumina-fused silica-carbon refractory special products —
Classification by product type and group**

Designation	Group	Contents		
		% (mass fraction)		
		Al ₂ O ₃	Fused Silica (FS)	C
Alumina-fused silica-carbon	AFC80/N*	80 ≤ Al ₂ O ₃	5 ≤ SiO ₂ < 20	N
	AFC70/N*	70 ≤ Al ₂ O ₃ < 80	15 ≤ SiO ₂ < 30	N
	AFC60/N*	60 ≤ Al ₂ O ₃ < 70	25 ≤ SiO ₂	N
N*		Carbon contents		
		% (mass fraction)		
1		1 ≤ C < 5		
5		5 ≤ C < 10		
10		10 ≤ C < 15		
15		15 ≤ C < 20		
20		20 ≤ C < 25		
25		25 ≤ C < 30		
30		30 ≤ C < 35		
NOTE 1	The asterisk indicates the antioxidant additive which is denoted by adding A to the group classification.			
NOTE 2	The analysis is carried out on calcined products using International Standards such as ISO 12677.			
NOTE 3	Fused silica content determined in delivered state.			
NOTE 4	Residual carbon content after coking.			
NOTE 5	N is equal to the lowest limit of residual carbon content range.			

**Table 9 — Alumina-silicon carbide-carbon refractory special products —
Classification by product type and group**

Designation	Group	Contents		
		% (mass fraction)		
		Al ₂ O ₃	SiC	C
Alumina-SiC-carbon	ASC80/N*	80 ≤ Al ₂ O ₃	1 ≤ SiC < 5	N
	ASC70/N*	70 ≤ Al ₂ O ₃ < 80	5 ≤ SiC < 15	N
	ASC60/N*	60 ≤ Al ₂ O ₃ < 70	10 ≤ SiC	N
	ASC50/N*	50 ≤ Al ₂ O ₃ < 60	10 ≤ SiC	N
N*		Carbon contents		
		% (mass fraction)		
1		1 ≤ C < 5		
5		5 ≤ C < 10		
10		10 ≤ C < 15		
15		15 ≤ C < 20		
20		20 ≤ C < 25		
NOTE 1	The asterisk indicates the antioxidant additive which is denoted by adding A to the group classification.			
NOTE 2	The analysis is carried out on calcined products using International Standards such as ISO 12677.			
NOTE 3	SiC content determined on product as received.			
NOTE 4	Residual carbon content after coking.			
NOTE 5	N is equal to the lowest limit of residual carbon content range.			

**Table 10 — Zirconia-carbon refractory special products —
Classification by product type and group**

Designation	Group	Contents	
		% (mass fraction)	
		ZrO ₂	C
Zirconia-Carbon	ZC90/N*	90 ≤ ZrO ₂	N
	ZC80/N*	80 ≤ ZrO ₂ < 90	N
	ZC70/N*	70 ≤ ZrO ₂ < 80	N
	ZC50/N*	50 ≤ ZrO ₂ < 70	N
N*		Carbon contents	
		% (mass fraction)	
1		1 ≤ C < 5	
5		5 ≤ C < 10	
10		10 ≤ C < 20	
20		20 ≤ C < 30	
30		30 ≤ C < 50	
NOTE 1	The asterisk indicates the antioxidant additive which is denoted by adding A to the group classification.		
NOTE 2	The analysis is carried out on calcined products using International Standards such as ISO 12677.		
NOTE 3	Residual carbon content after coking.		
NOTE 4	N is equal to the lowest limit of residual carbon content range.		

**Table 11 — Silicon carbide refractory special products —
Classification by product type and group**

Designation	Group	Contents
		% (mass fraction)
		SiC
Silicon carbide	SiC99	$99 \leq \text{SiC}$
	SiC90	$90 \leq \text{SiC} < 99$
	SiC80	$80 \leq \text{SiC} < 90$
	SiC70	$70 \leq \text{SiC} < 80$
	SiC50	$50 \leq \text{SiC} < 70$
	SiC30	$30 \leq \text{SiC} < 50$

NOTE The analysis is carried out on the product as received, using the analytical methods in International Standards such as ISO 12677.

Table 12 — Carbon refractory special products — Classification by product type and group

Designation	Group	Contents	
		% (mass fraction)	
		C	Ash
Carbon	C99,9	$99,8 \leq \text{C}$	Ash < 0,2
	C99	$99 \leq \text{C}$	Ash < 1
	C95	$95 \leq \text{C} < 99$	$1 \leq \text{Ash} < 5$
	C90	$90 \leq \text{C} < 95$	$5 \leq \text{Ash} < 10$
	C80/M	$80 \leq \text{C} < 90$	$10 \leq \text{Ash} < 20$
	C60/M	$60 \leq \text{C} < 80$	$10 \leq \text{Ash} < 40$

NOTE 1 M indicates that the higher ash content is caused by non-carbon components (e.g. alumina, silicon carbide, metals, etc.). This leads to micro-pores in the structure.

NOTE 2 The analysis is carried out on products carbonized in accordance with ISO 10060 using the analytical methods in International Standards, and analytical results are expressed as a dry-basis percentage composition.

3.3 Nature of raw materials

Dense shaped refractory special products shall be classified in accordance with 3.1 by the chemical component contents which have been calculated from the chemical composition of their principal raw materials.