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Classification of dense shaped refractory products —

Part 3: Basic products containing from 7 % to 50 % residual carbon

Classification des produits réfractaires façonnés denses —

Partie 3: Produits basiques contenant de 7 % à 50 % de carbone résiduel

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 10081-3 was prepared by Technical Committee ISO/TC 33, *Refractories*.

The various parts of this revised series of ISO 10081 will cancel and replace ISO 1109:1975. Part 1 is a partial revision of ISO 1109:1975, Part 2 cancels and replaces ISO 10081-1:1991, and Part 3 is new.

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 is under preparation and is intended to cover special products as given in Clause 2 of ISO 1109:1975.

Classification of dense shaped refractory products —

Part 3:
Basic products containing from 7 % to 50 % residual carbon

1 Scope

This part of ISO 10081 specifies the classification and designation of dense shaped basic refractory products containing 7 % or more but less than 50 % residual carbon after coking. It is applicable to products with or without antioxidant additives, with or without metal plates and reinforcement.

NOTE 1 ISO 10081-2 covers the classification of dense shaped basic products containing less than 7 % residual carbon.

NOTE 2 All bricks can be encased in metal plate and can be reinforced by means of an internal metal plate and/or mixed metal fibre.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 10058, *Magnesites and dolomites — Chemical analysis*

ISO 10060, *Dense, shaped refractory products — Test methods for products containing carbon*

ISO 12677, *Chemical analysis of refractory products by XRF — Fused cast bead method*

3 Classification

3.1 Basis of classification

Dense shaped basic products containing 7 % or more but less than 50 % residual carbon after coking shall be classified according to the following five criteria:

a) the type of product;

b) the group determined by its magnesia and carbon content as well as the presence of antioxidant additives;

c) the state of the raw materials;

d) the nature of the bond;

e) any post-treatment.

3.2 Type of product

The types of dense shaped refractory products of the basic series included in this classification are

a) magnesia carbon (MC),

b) magnesia lime carbon (MLC) (containing lime and/or synthetic MgO-CaO co-clinker),

c) magnesia doloma carbon (MDC) (containing sintered natural dolomite), and

d) doloma carbon (DC) (containing sintered natural co-clinker).

These product types shall be classified in accordance with Table 1, by their chemical analysis carried out on the calcined products in accordance with ISO 10058 and ISO 12677.

Residual carbon content shall be determined in accordance with ISO 10060.

3.3 Classification groups

The product types shall be classified into groups according to their magnesia and carbon contents and according to the presence or absence of antioxidant additives.

The product types without antioxidant additives shall be classified into groups according to Table 1. Two criteria shall be used for defining the group classification:

a) the magnesia content of the product type;

b) the residual carbon content after carbonization.

For magnesia lime carbon and lime carbon products, limits on lime content is imposed on the various groups.

The product types with antioxidant additives shall be classified according to the same criteria with the addition of a suffix A indicating the presence of antioxidant additives.

Table 1 — Classification of magnesia carbon, magnesia doloma carbon and doloma carbon products

Product type	Group	Contents % (mass fraction) (calcined sample)		Residual carbon content % (mass fraction)
		MgO	CaO	
Magnesia carbon	MC 98/7	MgO $\geqslant$ 98		7 $\leqslant$ C $<$ 10
	MC 98/10	MgO $\geqslant$ 98		10 $\leqslant$ C $<$ 15
	MC 98/15	MgO $\geqslant$ 98		15 $\leqslant$ C $<$ 20
	MC 98/20	MgO $\geqslant$ 98		20 $\leqslant$ C $<$ 25
	MC 98/25	MgO $\geqslant$ 98		25 $\leqslant$ C $<$ 30
	MC 98/30	MgO $\geqslant$ 98		30 $\leqslant$ C $<$ 50
Magnesia carbon	MC 95/7	95 $\leqslant$ MgO $<$ 98		7 $\leqslant$ C $<$ 10
	MC 95/10	95 $\leqslant$ MgO $<$ 98		10 $\leqslant$ C $<$ 15
	MC 95/15	95 $\leqslant$ MgO $<$ 98		15 $\leqslant$ C $<$ 20
	MC 95/20	95 $\leqslant$ MgO $<$ 98		20 $\leqslant$ C $<$ 25
	MC 95/25	95 $\leqslant$ MgO $<$ 98		25 $\leqslant$ C $<$ 30
	MC 95/30	95 $\leqslant$ MgO $<$ 98		30 $\leqslant$ C $<$ 50
Magnesia carbon	MC 90/7	90 $\leqslant$ MgO $<$ 95		7 $\leqslant$ C $<$ 10
	MC 90/10	90 $\leqslant$ MgO $<$ 95		10 $\leqslant$ C $<$ 15
	MC 90/15	90 $\leqslant$ MgO $<$ 95		15 $\leqslant$ C $<$ 20
	MC 90/20	90 $\leqslant$ MgO $<$ 95		20 $\leqslant$ C $<$ 25
	MC 90/25	90 $\leqslant$ MgO $<$ 95		25 $\leqslant$ C $<$ 30
	MC 90/30	90 $\leqslant$ MgO $<$ 95		30 $\leqslant$ C $<$ 50

Table 1 — Classification of magnesia carbon, magnesia doloma carbon and doloma carbon products (*continued*)

Product type	Group	Contents % (mass fraction) (calcined sample)		Residual carbon content % (mass fraction)
		MgO	CaO	
Magnesia carbon	MC 85/7	85 ⩽ MgO < 90		7 ⩽ C < 10
	MC 85/10	85 ⩽ MgO < 90		10 ⩽ C < 15
	MC 85/15	85 ⩽ MgO < 90		15 ⩽ C < 20
	MC 85/20	85 ⩽ MgO < 90		20 ⩽ C < 25
	MC 85/25	85 ⩽ MgO < 90		25 ⩽ C < 30
	MC 85/30	85 ⩽ MgO < 90		30 ⩽ C < 50
Magnesia carbon	MC 80/7	80 ⩽ MgO < 85		7 ⩽ C < 10
	MC 80/10	80 ⩽ MgO < 85		10 ⩽ C < 15
	MC 80/15	80 ⩽ MgO < 85		15 ⩽ C < 20
	MC 80/20	80 ⩽ MgO < 85		20 ⩽ C < 25
	MC 80/25	80 ⩽ MgO < 85		25 ⩽ C < 30
	MC 80/30	80 ⩽ MgO < 85		30 ⩽ C < 50
Magnesia lime carbon	MLC 80/7	80 ⩽ MgO < 90	CaO ⩾ 10	7 ⩽ C < 10
	MLC 80/10	80 ⩽ MgO < 90	CaO ⩾ 10	10 ⩽ C < 15
	MLC 80/15	80 ⩽ MgO < 90	CaO ⩾ 10	15 ⩽ C < 20
	MLC 80/20	80 ⩽ MgO < 90	CaO ⩾ 10	20 ⩽ C < 25
	MLC 80/25	80 ⩽ MgO < 90	CaO ⩾ 10	25 ⩽ C < 30
	MLC 80/30	80 ⩽ MgO < 90	CaO ⩾ 10	30 ⩽ C < 50
Magnesia lime carbon	MLC 70/7	70 ⩽ MgO < 80	CaO ⩾ 20	7 ⩽ C < 10
	MLC 70/10	70 ⩽ MgO < 80	CaO ⩾ 20	10 ⩽ C < 15
	MLC 70/15	70 ⩽ MgO < 80	CaO ⩾ 20	15 ⩽ C < 20
	MLC 70/20	70 ⩽ MgO < 80	CaO ⩾ 20	20 ⩽ C < 25
	MLC 70/25	70 ⩽ MgO < 80	CaO ⩾ 20	25 ⩽ C < 30
	MLC 70/30	70 ⩽ MgO < 80	CaO ⩾ 20	30 ⩽ C < 50
Magnesia lime carbon	MLC 60/7	60 ⩽ MgO < 70	CaO ⩾ 30	7 ⩽ C < 10
	MLC 60/10	60 ⩽ MgO < 70	CaO ⩾ 30	10 ⩽ C < 15
	MLC 60/15	60 ⩽ MgO < 70	CaO ⩾ 30	15 ⩽ C < 20
	MLC 60/20	60 ⩽ MgO < 70	CaO ⩾ 30	20 ⩽ C < 25
	MLC 60/25	60 ⩽ MgO < 70	CaO ⩾ 30	25 ⩽ C < 30
	MLC 60/30	60 ⩽ MgO < 70	CaO ⩾ 30	30 ⩽ C < 50
Magnesia lime carbon	MLC 50/7	50 ⩽ MgO < 60	CaO ⩾ 40	7 ⩽ C < 10
	MLC 50/10	50 ⩽ MgO < 60	CaO ⩾ 40	10 ⩽ C < 15
	MLC 50/15	50 ⩽ MgO < 60	CaO ⩾ 40	15 ⩽ C < 20
	MLC 50/20	50 ⩽ MgO < 60	CaO ⩾ 40	20 ⩽ C < 25
	MLC 50/25	50 ⩽ MgO < 60	CaO ⩾ 40	25 ⩽ C < 30
	MLC 50/30	50 ⩽ MgO < 60	CaO ⩾ 40	30 ⩽ C < 50
Magnesia lime carbon	MLC 40/7	40 ⩽ MgO < 50	CaO ⩾ 50	7 ⩽ C < 10
	MLC 40/10	40 ⩽ MgO < 50	CaO ⩾ 50	10 ⩽ C < 15
	MLC 40/15	40 ⩽ MgO < 50	CaO ⩾ 50	15 ⩽ C < 20
	MLC 40/20	40 ⩽ MgO < 50	CaO ⩾ 50	20 ⩽ C < 25
	MLC 40/25	40 ⩽ MgO < 50	CaO ⩾ 50	25 ⩽ C < 30
	MLC 40/30	40 ⩽ MgO < 50	CaO ⩾ 50	30 ⩽ C < 50

Table 1 — Classification of magnesia carbon, magnesia doloma carbon and doloma carbon products (*continued*)

Product type	Group	Contents % (mass fraction) (calcined sample)		Residual carbon content % (mass fraction)
		MgO	CaO	
Magnesia lime carbon	MLC 7	MgO $<$ 40	CaO $\geqslant$ 50	7 $\leqslant$ C $<$ 10
	MLC 10	MgO $<$ 40	CaO $\geqslant$ 50	10 $\leqslant$ C $<$ 15
	MLC 15	MgO $<$ 40	CaO $\geqslant$ 50	15 $\leqslant$ C $<$ 20
	MLC 20	MgO $<$ 40	CaO $\geqslant$ 50	20 $\leqslant$ C $<$ 25
	MLC 25	MgO $<$ 40	CaO $\geqslant$ 50	25 $\leqslant$ C $<$ 30
	MLC 30	MgO $<$ 40	CaO $\geqslant$ 50	30 $\leqslant$ C $<$ 50
Magnesia doloma carbon	MDC 80/7	80 $\leqslant$ MgO $<$ 90	CaO $\geqslant$ 10	7 $\leqslant$ C $<$ 10
	MDC 80/10	80 $\leqslant$ MgO $<$ 90	CaO $\geqslant$ 10	10 $\leqslant$ C $<$ 15
	MDC 80/15	80 $\leqslant$ MgO $<$ 90	CaO $\geqslant$ 10	15 $\leqslant$ C $<$ 20
	MDC 80/20	80 $\leqslant$ MgO $<$ 90	CaO $\geqslant$ 10	20 $\leqslant$ C $<$ 25
	MDC 80/25	80 $\leqslant$ MgO $<$ 90	CaO $\geqslant$ 10	25 $\leqslant$ C $<$ 30
Magnesia doloma carbon	MDC 70/7	70 $\leqslant$ MgO $<$ 80	CaO $\geqslant$ 20	7 $\leqslant$ C $<$ 10
	MDC 70/10	70 $\leqslant$ MgO $<$ 80	CaO $\geqslant$ 20	10 $\leqslant$ C $<$ 15
	MDC 70/15	70 $\leqslant$ MgO $<$ 80	CaO $\geqslant$ 20	15 $\leqslant$ C $<$ 20
	MDC 70/20	70 $\leqslant$ MgO $<$ 80	CaO $\geqslant$ 20	20 $\leqslant$ C $<$ 25
	MDC 70/25	70 $\leqslant$ MgO $<$ 80	CaO $\geqslant$ 20	25 $\leqslant$ C $<$ 30
Magnesia doloma carbon	MDC 60/7	60 $\leqslant$ MgO $<$ 70	CaO $\geqslant$ 30	7 $\leqslant$ C $<$ 10
	MDC 60/10	60 $\leqslant$ MgO $<$ 70	CaO $\geqslant$ 30	10 $\leqslant$ C $<$ 15
	MDC 60/15	60 $\leqslant$ MgO $<$ 70	CaO $\geqslant$ 30	15 $\leqslant$ C $<$ 20
	MDC 60/20	60 $\leqslant$ MgO $<$ 70	CaO $\geqslant$ 30	20 $\leqslant$ C $<$ 25
	MDC 60/25	60 $\leqslant$ MgO $<$ 70	CaO $\geqslant$ 30	25 $\leqslant$ C $<$ 30
Magnesia doloma carbon	MDC 50/7	50 $\leqslant$ MgO $<$ 60	CaO $\geqslant$ 40	7 $\leqslant$ C $<$ 10
	MDC 50/10	50 $\leqslant$ MgO $<$ 60	CaO $\geqslant$ 40	10 $\leqslant$ C $<$ 15
	MDC 50/15	50 $\leqslant$ MgO $<$ 60	CaO $\geqslant$ 40	15 $\leqslant$ C $<$ 20
	MDC 50/20	50 $\leqslant$ MgO $<$ 60	CaO $\geqslant$ 40	20 $\leqslant$ C $<$ 25
	MDC 50/25	50 $\leqslant$ MgO $<$ 60	CaO $\geqslant$ 40	25 $\leqslant$ C $<$ 30
Magnesia doloma carbon	MDC 40/7	40 $\leqslant$ MgO $<$ 50	CaO $\geqslant$ 50	7 $\leqslant$ C $<$ 10
	MDC 40/10	40 $\leqslant$ MgO $<$ 50	CaO $\geqslant$ 50	10 $\leqslant$ C $<$ 15
	MDC 40/15	40 $\leqslant$ MgO $<$ 50	CaO $\geqslant$ 50	15 $\leqslant$ C $<$ 20
	MDC 40/20	40 $\leqslant$ MgO $<$ 50	CaO $\geqslant$ 50	20 $\leqslant$ C $<$ 25
	MDC 40/25	40 $\leqslant$ MgO $<$ 50	CaO $\geqslant$ 50	25 $\leqslant$ C $<$ 30
Doloma carbon	DC 40/7	MgO $<$ 40	CaO $\geqslant$ 50	7 $\leqslant$ C $<$ 10
	DC 40/10	MgO $<$ 40	CaO $\geqslant$ 50	10 $\leqslant$ C $<$ 15
	DC 40/15	MgO $<$ 40	CaO $\geqslant$ 50	15 $\leqslant$ C $<$ 20
	DC 40/20	MgO $<$ 40	CaO $\geqslant$ 50	20 $\leqslant$ C $<$ 25
	DC 40/25	MgO $<$ 40	CaO $\geqslant$ 50	25 $\leqslant$ C $<$ 30

3.4 State of raw materials

The raw materials shall be classified by using one of the four designations, as follows:

a) naturally occurring sintered;

b) synthetic sintered;

c) co-clinker (magnesia lime);

d) fused.

3.5 Nature of the bond

The bonding system shall be classified by using one of the three designations, as follows:

a) organic chemical bond: formed at ambient temperature or higher temperatures (up to 800 °C);

b) carbon bond, formed by firing (temperatures greater than 800 °C);

c) inorganic chemical bond: formed by chemical reaction.

3.6 Post-treatment

Where post-treatment has occurred, it shall be classified by using one, or all, of the three designations, as follows:

a) tempering (at a temperature up to 800 °C);

b) firing (at a temperature greater than 800 °C);

c) impregnation.

4 Designation

The designation of dense shaped refractories of the basic series with 7 % or more residual carbon but less than 50 % (mass fraction) after coking shall comprise the listing of the five criteria of classification given in Clause 3: product type, group, state of raw materials, nature of the bond, post-treatment.

EXAMPLES Some examples of designations are as follows:

— magnesia carbon product of the group MC 95/10, based on naturally occurring sintered magnesia and fused magnesia, with organic chemical bond with tempering;

— magnesia carbon product with antioxidant additives, of the group MC 85/10A, based on synthetic sintered magnesia, with organic chemical bond with tempering and impregnation.