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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION

R 1927

REFRACTORY MATERIALS

CLASSIFICATION OF PREPARED UNSHAPED MATERIALS

(DENSE AND INSULATING)

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BRIEF HISTORY

The ISO Recommendation R 1927, *Refractory materials – Classification of prepared unshaped materials (Dense and insulating)*, was drawn up by Technical Committee ISO/TC 33, *Refractories*, the Secretariat of which is held by the British Standards Institution (BSI).

Work on this question led to the adoption of Draft ISO Recommendation No. 1927, which was circulated to all the ISO Member Bodies for enquiry in February 1970. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Australia	Hungary	Sweden
Austria	India	Thailand
Canada	Israel	Turkey
Chile	Italy	U.A.R.
Czechoslovakia	Korea, Rep. of	United Kingdom
Denmark	New Zealand	U.S.S.R.
France	Portugal	Yugoslavia
Germany	Romania	
Greece	South Africa, Rep. of	

No Member Body opposed the approval of the Draft.

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided to accept it as an ISO RECOMMENDATION.

REFRACTORY MATERIALS

CLASSIFICATION OF PREPARED UNSHAPED MATERIALS (DENSE AND INSULATING)

1. SCOPE

- 1.1 This ISO Recommendation gives the definition, classification and designation of prepared unshaped refractory materials.

It does not apply to materials that are of the nature of refractory materials but that have only been crushed or granulated.

- 1.2 The designation of prepared unshaped refractory materials is based on

- classification in terms of the nature of the constituents;
- terminology according to type of use and method of placing.

2. DEFINITIONS

- 2.1 *Refractory materials.* Materials and products other than metals and alloys (although not excluding materials containing a metallic constituent), the refractoriness of which is at least 1500 °C.

- 2.2 *Prepared unshaped refractory materials.* Mixtures (see Note below) containing one or more refractory constituents and a bond, prepared ready for use, either directly in the condition in which they are supplied or after the addition of a suitable liquid. The refractoriness of the refractory constituent (or constituents) of the mixture should be at least 1500 °C.

NOTE. — These mixtures may be either dense or insulating; the true porosity of insulating batches, determined on a test piece prepared under the conditions of industrial use and fired at the temperature of use, should be at least 45 %.

3. CLASSIFICATION

3.1 General principle

Prepared unshaped refractory materials are classified

- in terms of the chemical and mineralogical nature of the major constituent or constituents;
- in terms of the nature of the bond.

3.2 Nature of the major constituents

The subdivisions according to the chemical and mineralogical nature of the major refractory constituents of the mix (see Table 1) correspond to the principal divisions in the classification of dense shaped products (see ISO Recommendation R 1109, *Classification of dense refractory products*).

TABLE 1 — Classification according to the nature of the major constituents

Subdivisions	Limiting content of principal oxide
High alumina materials, Group 1	$56 \% \leq \text{Al}_2\text{O}_3$
High alumina materials, Group 2	$45 \% \leq \text{Al}_2\text{O}_3 < 56 \%$
Fireclay materials	$30 \% \leq \text{Al}_2\text{O}_3 < 45 \%$
Siliceous fireclay materials	$10 \% \leq \text{Al}_2\text{O}_3 < 30 \%; \text{SiO}_2 < 85 \%$
Siliceous materials	$85 \% \leq \text{SiO}_2 < 93 \%$
Silica materials	$93 \% \leq \text{SiO}_2$
Basic materials (magnesia, chrome, forsterite, dolomite, other alkaline earth oxides)	
Special materials (carbon, silicon carbide, zircon, etc.)	

Before any determination of the content of oxides (for example Al_2O_3 , SiO_2 , MgO) of the major constituents, these constituents should first be separated from the bond (for example by wet screening) and then calcined.

3.3 Nature of the bond

The subdivisions according to the nature of the bond (see Table 2) correspond to the different processes of hardening of prepared unshaped refractory materials.

TABLE 2 — Classification according to the nature of the bond

Subdivisions	Process of hardening
Ceramic bond	Hardening only during firing
Hydraulic bond	Setting and hydraulic hardening at room temperature
Chemical (mineral or organic-mineral) bond	Hardening by chemical reaction at room temperature or at some other temperature below that of a ceramic bond
Organic bond	Binding or hardening at room temperature

When several bonds are used conjointly, the material is classified in terms of the type of bond that plays the principal part during the placing of the material.

4. TERMINOLOGY (according to type of use and method of placing)

4.1 General

The types of use of prepared unshaped refractory materials make it possible to distinguish between :

- jointing materials;
- coatings;
- mixes for monolithic construction and for repairs.

4.2 Jointing materials

These materials are applied by trowel or similar instrument, or in some cases by dusting in the joints or by dipping the piece to be bonded.

The chemical and mineralogical nature of the major constituent or constituents should be compatible with that of the bricks with which these materials are used.

The following types are distinguished :

- (a) *Refractory mortars*. Mixtures of finely ground raw materials, delivered dry, containing a ceramic bond.
- (b) *Refractory cements*. Mixtures of finely ground raw materials, generally delivered dry, sometimes as a putty, containing a bond other than a ceramic bond (hydraulic, mineral, organic-mineral, organic).

4.3 Coatings

These materials are applied as a thin layer, manually (for example by brushing or trowelling) or by mechanical projection (particularly by spray gun).

The chemical and mineralogical nature of these materials is similar to that of refractory mortars and cements, but their grain size composition is suited to the method of application.

4.4 Mixes for monolithic construction and for repairs

These mixes have a grain size distribution suited to the production of shapes or of monolithic linings of a certain thickness.

The following types are distinguished :

- (a) *Ramming materials*. Granular materials that are non-coherent before use, delivered dry or ready for use; they may contain a chemical or an organic bond. They are placed, as delivered or after they have been moistened, by ramming or by compacting, sometimes by hand but more commonly by suitable mechanical devices.
- (b) *Mouldable materials*. Mixes that are plastic, delivered unformed ready for use; they may contain a chemical or an organic bond and are placed by hand or by machine ramming.
- (c) *Castables*. Mixes that are non-coherent before use, delivered dry, ready to be mixed with water. They contain a hydraulic or a chemical bond and are placed as a mix of variable consistency by casting, vibration, tamping or ramming.
- (d) *Gunning materials*. Mixes that are non-coherent before use, conveniently prepared ready, after moistening, for use by mechanical or manual projection. Depending on their other properties they can be assigned to one or other of the three preceding groups.

5. DESIGNATION

The complete designation of a prepared unshaped refractory material includes the following information :

- type of use;
- nature of the major refractory constituent;
- nature of the bond;
- condition in which it is delivered;
- method of placing.

Example : High-alumina mouldable refractory for repair work, with mineral bond, to be placed by ramming.

However, it is often possible, while taking account of the classification and terminology set out in this ISO Recommendation, to designate a prepared unshaped refractory material more succinctly, yet without ambiguity.

Example : “A fireclay repair material having a hydraulic bond, delivered dry, to be placed by casting” could be designated more simply by the terms “Castable fireclay refractory”.

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