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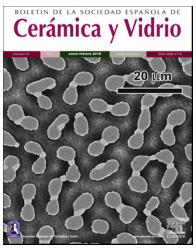
Cerámica y Vidrio



Raw material for the ceramic industry in Norte de Santander. III. Assessment of the technological properties when the residue test of deep abrasion is added

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ARTICLE INFO

Article history:
Received 26 January 2015
Accepted 7 March 2015

Keywords:
Milling
Pressing
Porosity
Wear
Mechanical properties

ABSTRACT

A study about the behaviour of a clay from the Guayabo formation in the Metropolitan Area of San José de Cúcuta when mixed with corundum was conducted; this work is a continuation of others previously performed. In this raw material the dominant minerals are kaolinite and mica; it has quartz, carbonates and free iron oxides, as well as excellent plasticity and a good particle size distribution. Three mixtures with percentages of 5% (M5), 10% (M10) and 20% (M20) of corundum were made using the press technique to form and record control in the drying process. It was sintered in a muffle furnace at 1200 °C and 1250 °C and tests were performed to determine their technological behaviour, as contractions, bulk density, water absorption, open porosity, mechanical resistance to bending and to deep abrasion. The research results showed that when corundum was added to the clay material, it improves its technological properties, allowing this residue to be used in industrial processes and minimizing the pollution generated by this.

Materia prima para la industria cerámica de Norte de Santander. III Evaluación de las propiedades tecnológicas al adicionarle el residuo del ensayo de abrasión profunda

Palabras clave:
Molienda
Prensado

RESUMEN

Se ha realizado el estudio del comportamiento de una arcilla de la formación Guayabo del Área Metropolitana de San José de Cúcuta al ser mezclada con corindón; este trabajo es la continuación de otros realizados con anterioridad. En esta materia prima los minerales

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Sample	Retained on sieve	Industrial waste	Humidity in pressing	Post-press expansion
	(%)	(%)	(%)	(%)
STANDARD	4,87	3,95	5,61	0,492
M5	10,80	4,30	5,66	0,486
M10	15,40	6,10	5,71	0,463
M20	25,90	9,00	5,74	0,460

Sample	Drying shrinkage	Weight loss	Dry bulk density	Mechanical resistance
	%	%	G/cm³	N/mm²
STANDARD	0,208	5,180	1,857	1,544
M5	0,263	4,890	1,946	1,561
M10	0,323	3,177	1,965	1,984
M20	0,278	10,499	2,038	1,769

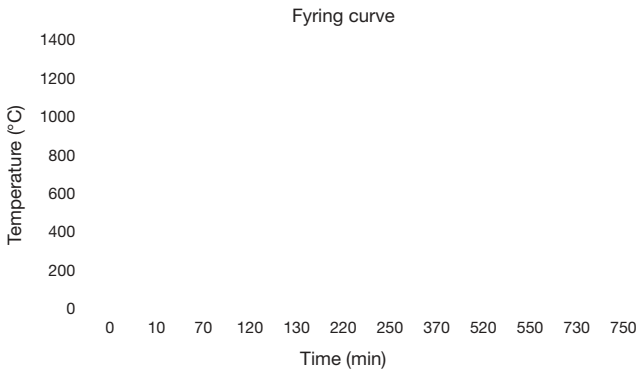

Fig. 3 – Fyring curve.

Composition		
Formula	Name	Mass %
SiO_2	Silicon oxide	64,87
Al_2O_3	Aluminum oxide	20,56
Fe_2O_3	Iron oxide	4,75
Na_2O	Sodium oxide	0,15
K_2O	Potassium oxide	1,63
CaO	Calcium oxide	0,22
MgO	Magnesium oxide	0,75
SO_3	Trioxide sulphur	0,04
Loss of ignition		0,99
Unrated		6,04
Total		100,00
Molar ratio (SiO_2/Al_2O_3)		5,40

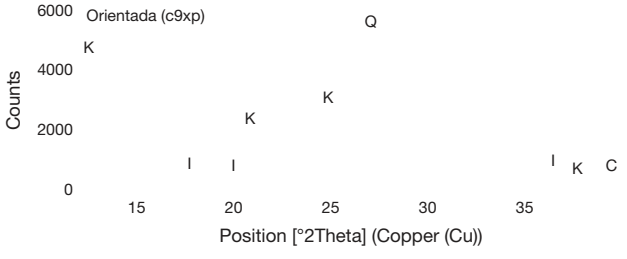

Fig. 4 – X-ray diffractograms of the clay (DRX).

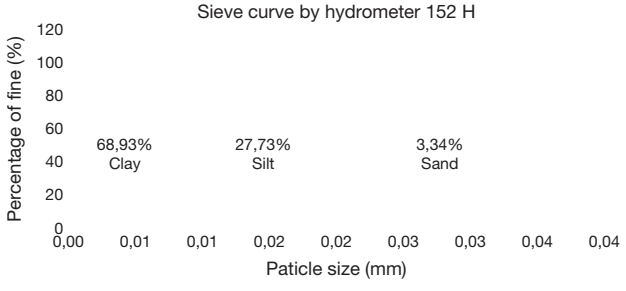

Fig. 5 – Grain size distribution of the clay.

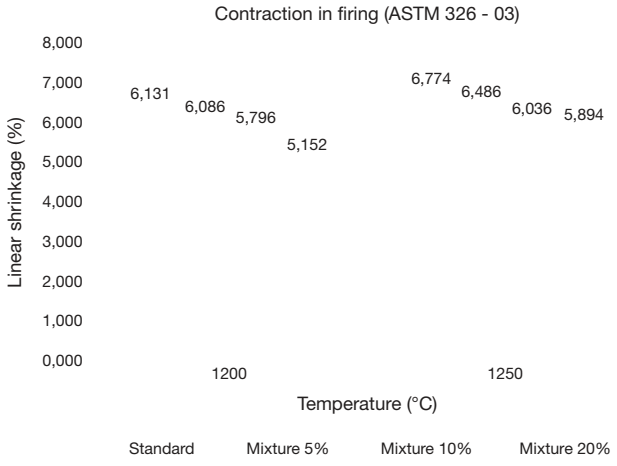

Fig. 6 – Contraction in firing.

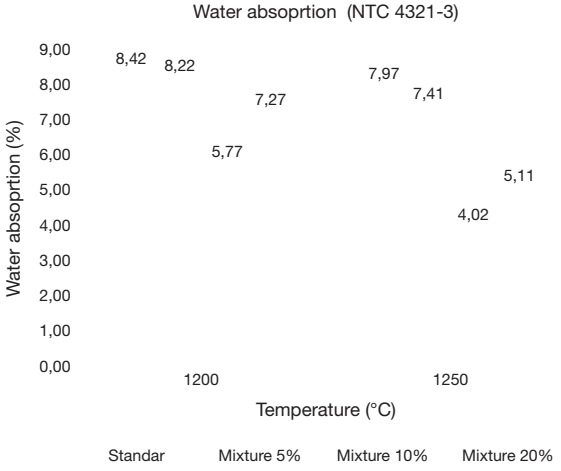

Fig. 7 – Water absortion determination using the boiling method (NTC 4321-3).

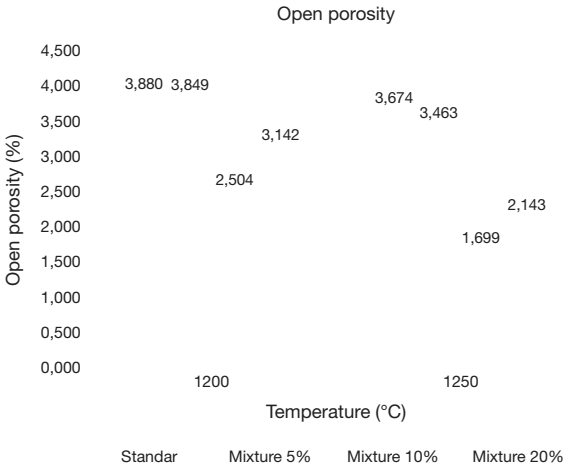

Fig. 8 – Open porosity.

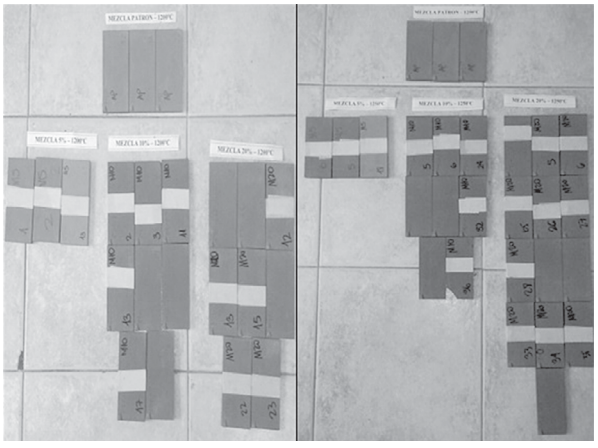

Fig. 9 – Sintered specimens to 1200 °C and 1250 °C.

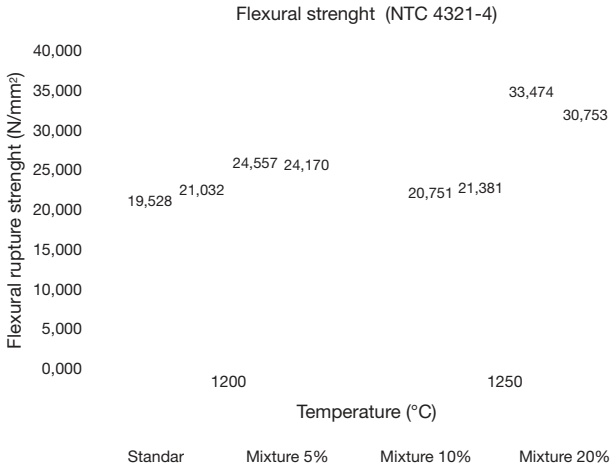

Fig. 10 – Flexural strength (NTC 4321-4).

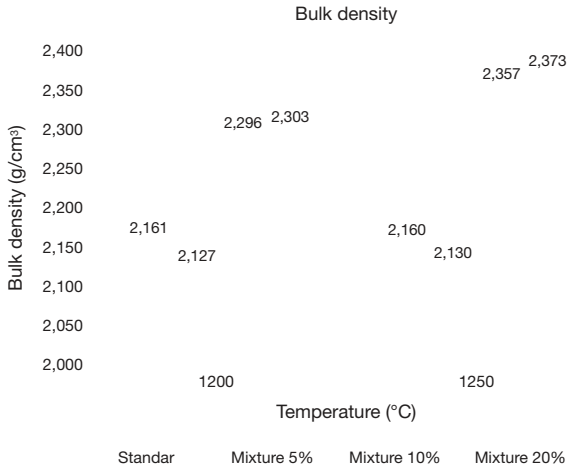

Fig. 11 – Bulk density.

Conclusions

The worked clay is a complex mixture of minerals. Among laminar minerals, the kaolinite and illite dominate, micaceous minerals exist in a portion of about 15.93% and the kaolinitic minerals reach a value of 36.13%. These minerals are accompanied by quartz, carbonates and iron oxides.

The crystal structure from the carbonate is calcite and from the iron oxide is goethite as seen in the diffractogram, with weight percentages of 0.40% and 5.33% respectively. The free quartz is present in an amount of 40.85%.

The clay studied here is appropriate for the manufacture of baked clay, as shown by its size distribution and mineralogical constitution but should be placed attention and care to its plasticity considering that because of its high value generates a contraction in cooking which may cause excessive dimensional problems in the pieces and cracking. This problem can be minimise with the addition of corundum to the clay material.

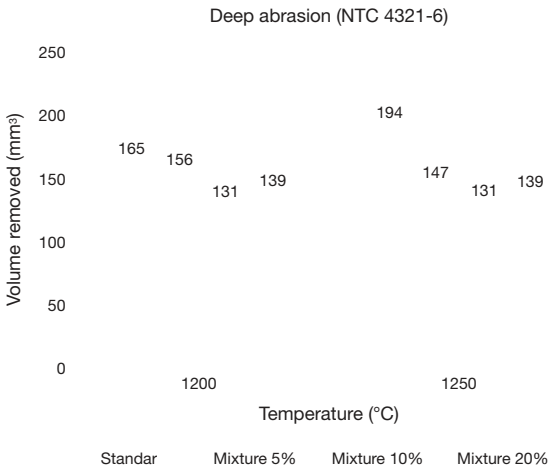

Fig. 12 – Deep abrasion determination (NTC 4321-6).