TECHNOLOGICAL EVOLUTION OF CERAMIC TILES IN THE CERAMIC POLE OF SANTA GERTRUDES-BRAZIL

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ABSTRACT

The production and consumption of ceramic tiles in Brazil grew in the 1990s at a rate of approximately 10% a year. This increase in the domestic market was related to various factors which drove production from 200 million square metres in 1992 to 565.6 million square metres in 2004. In 2004 the installed capacity at the end of the year was 622 million square metres. A growth of 10% is anticipated for 2005, which will lead to a production capacity of 684 million square metres.

In 2004, the domestic market absorbed approximately 78% of national production, making Brazil the world's second largest tile consumer. In the last few years, the domestic market has lost tile market share to exports. In 2004, Brazilian exports reached 128.5 million square metres, i.e. an increase of 170% in relation to 2001.

The State of São Paulo has the largest industrial park for ceramic manufacture, and accounts for approximately 60% of national production, in which the Ceramic Pole of Santa Gertrudes plays a key role, currently contributing 45% of total production, i.e. around 21.3 million square metres a month. Most of the production of the Santa Gertrudes Ceramic Pole is practically made by the dry milling process.

The objective of the present work has been to study the technological evolution of the ceramic tiles produced in the Ceramic Pole of Santa Gertrudes-Brazil. A study of around 1123 products fabricated in the Santa Gertrudes Pole has been performed. The main evaluated properties were: water absorption, mechanical strength, resistance to chemical attack, stain resistance, scratch hardness, surface abrasion, dimensional characteristics, crazing resistance and moisture expansion.

1. METHODOLOGY USED

In conducting the work two product samplings were performed of different producers. The first sampling was made in 2003 and the second was conducted in the period from January 2004 to January 2005. As the products of water absorption BIIb are the most widely fabricated in the Santa Gertrudes/Cordeirópolis District, this group has been chosen for the study.

The following properties were selected in order to evaluate the technological evolution of the products under study: water absorption (NBR 13818/1997 - annex B/ISO 10545-Part 3), mechanical strength (NBR 13818/1997 - annex C/ISO 10545-Part 4), resistance to chemical attack (NBR 13818/1997 - annex H/ISO 10545-Part 13), stain resistance (NBR 13818/1997 - annex G/ISO 10545-Part 14), scratch hardness (NBR 13818 - annex V/EN 101), surface abrasion (NBR 13818/1997 - annex D/ISO 10545-Part 7), dimensional characteristics (NBR 13818/1997 - annex S/ISO 10545-Part 2), crazing resistance (NBR 13818/1997 - annex F/ISO 10545-Part 11) and moisture expansion (NBR 13818/1997 - annex J/ISO 10545-Part 10).

2. RESULTS AND CONSIDERATIONS

It is important to note that the companies in the Santa Gertrudes/Cordeirópolis region use a differentiated production process, i.e. use the dry milling process, unlike the well-known wet milling processes. This option is the result of the nature of the local raw materials (clays from the Corumbataí Formation), which adapt very well to dry processing. However, the types of resulting products are not as diversified as those made by the wet milling process. Products of all the water absorption classes are made in Brazil using the wet process (BIa, BIb, BIIa, BIIb and BIII). However, with the dry milling process only BIIb and BIIa products have been made.

The products made in the Santa Gertrudes/Cordeirópolis District region have displayed a tendency to reduce the water absorption values. As result of this study, a trend has been verified of product migration toward a water absorption limit below 6%. Some companies are already working with water absorptions lower than 6% (i.e., BIIa); however, many still declare products as BIIb.

The values for the breaking load of the studied products show there is great conformity to Standard NBR 13818/1997.

A worrying situation has been noted in regard to moisture expansion (ME). An increase in non-conformity was observed in the period from 2003 to 2004. This non-conformity is related to environmental problems with some clay deposits in the region of Santa Gertrudes, as result of which mining was temporarily halted. The companies then began a fast search for other raw materials to replace the clays they lacked. The companies then used little known clays, since that did not have time to study the technological adaptation of the new raw materials to the industrial process. This led to a rise in the values of moisture expansion. The increase in moisture expansion also caused an increase in the non-conformity of crazing resistance.

Another important result verified in this study has been the non-conformity observed for products declared as PEI 5. The resistance to surface abrasion is still widely used in the commercialisation of ceramic tiles. In general a PEI 5 product is

more successful in sales than a product that is declared PEI 4. However, as it is a subjective test, there is a very high probability of differences occurring in the results between laboratories.

The Brazilian consumer has a preference for glazed products with high surface gloss. Glossy products, in general, have a low scratch hardness (Mohs 3 to 5). This fact was verified in the study. The manufacturer needs to inform the end-consumer of the susceptibility to scratching of glossy products.

The results of the dimensional characteristics indicate that most products from the Santa Gertrudes/Cordeirópolis District region conform and that the companies work within the permissible deviations established in Standard NBR 13818/ISO 13006. Only floor tile thickness displayed notable non-conformity. This fact is related to variations in the production process, which cause variations in floor tile thickness, and the manufacturers do not inform in their packing of the correct thickness of the product.

The results indicate, essentially, that the products made in the Santa Gertrudes/ Cordeirópolis region have a very good quality, which verifies the great technological evolution of the local companies.

3. ACKNOWLEDGEMENTS

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