COMPARATIVE ANALYSIS OF ISO AND ASTM STANDARD TEST METHODS AND RESULTS

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ABSTRACT

With the potential ceramic tile consumer market in the North America greater interest has been aroused in studying the test methods in accordance with the ASTM standards. In most countries, including the European Community and Brazil, the ISO standards are used as references. In view of the growing volume of Brazilian ceramic tiles exported to North America (around 42% of export volume), it is fundamental to know how product properties perform when the ASTM standards are used. For this purpose, the present paper sets out a comparative analysis of a number of test methods and the results obtained after testing different types of Brazilian ceramic tiles in accordance with the procedures of the following standards: ASTM C1378/04 – Determination of the stain resistance, ASTM C650/04 – Resistance to chemical attack, ASTM C1027/04 – Determination of resistance to surface abrasion of glazed ceramic tiles, ISO 10545: Part 13 – Determination of chemical resistance, ISO 10545: Part 14 – Determination of resistance to stains, and ISO 10545: 7 Part – Determination of resistance to surface abrasion of glazed ceramic tiles. The results obtained indicate that there is a difference in the classification of the tested products depending on whether they are tested in accordance with the ISO or ASTM standards.

1. INTRODUCTION

The ceramic tile industry has dedicated great efforts to technological development and industrial management in order to attend to market demands, improve the productivity of its resources, and enhance the quality of product design. The increasing international competition, the process of economic globalisation, the emergence of substitute product and the development of civil construction in each country are factors that affect the ceramic tile industry. In this context, the use of standardised, internationally accepted procedures, nomenclatures and specifications of ceramic floor and wall tiles to facilitate business between countries while maintaining good technical quality in relation to other competitive products. The objective of this study has been to identify, compare and analyse the test methodologies, classifications and results of the ISO 10545 and ASTM technical standards on ceramic tiles. The studied tests were: resistance to surface abrasion, resistance to chemical attack, and resistance to stains.

2. RESULTS AND CONSIDERATIONS

The ISO staining agents are not always able to simulate the performance during service of glazed products in regard to stain resistance (cleanability). However, for unglazed products (such as polished porcelain tile), which are more susceptible to stains, the ISO standard method is able to perform this simulation with greater accuracy. Standard ASTM 1378-04 displays a greater and more representative range of staining agents (including dry agents, which are not envisaged in the ISO method), which provides a more realistic prediction of the possible cleanability during service of ceramic tiles. This can be verified by the results found for the matt products, which are generally harder to clean in service and which, according to the ISO method, are classified as class 5 (maximum stain removability), whereas in the ASTM method they displayed stains by the washable ink, non-washable ink, methylene blue and potassium permanganate. It is further to be noted that the potassium permanganate staining agent is very strong, since it produced stains that were not removed from any of the evaluated products, which does not coincide with reality in ceramic tile use. Standard ASTM 1378-04 does not have a numerical classification like the ISO standard. It is just necessary to inform whether the product is affected or not by the respective staining agent. This classification approach is very interesting, as it only communicates which staining agents are most critical for the products, without accompanying this with any numerical classification. The use of a convex watch glass, a procedure followed in ISO 10545-14, besides serving to spread the staining agent, also presses this against the tile surface. According to the results obtained in this study, the pressure exerted by the convex watch glass is stronger than that exerted by the test tube according to the procedure in standard ASTM 1378-04.

As far as the resistance to chemical attack is concerned, standard ASTM C-650-04 has a greater range of chemical reagents to be evaluated; however, the exposure time to these agents is short (24 hours). ISO 10545-13 establishes more aggressive attack condition for high and low concentration acids and alkalis (96 hours). In the case of unglazed products, ISO 10545-13 is even more demanding, because the product must remain partially submerged for 12 days in the evaluated chemical agents. The larger contact area between the chemical agent and the ceramic tile surface envisaged in ISO 10545-13 provides better visual analysis of the attack region. Generally speaking, the national products displayed optimum results in their

resistance to chemical attack when both test methods were used. The product that displayed low chemical resistance according to ISO 10545-13, also obtained the result 'affected' in the ASTM C650-04 test. It may be noted, once again, that a product can exhibit a class C chemical resistance to acids and alkalis, provided the manufacturer declares this on the packing or in the catalogue.

The results obtained in the test on the resistance to surface abrasion indicate the need to standardise the specifications, the suppliers of the steel wheels spheres and the electrofused alumina, as well as to find alternatives in order to reduce the differences due to the visual evaluation.

3. ACKNOWLEDGEMENTS

To FAPESP, CNPq and FINEP for the resources and help in performing this study.

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