COMPARATIVE STUDY OF TECHNICAL STANDARDS APPLIED TO CERAMIC TILES

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1. INTRODUCTION

Economic globalization has led to dissemination of products, information and commercial relations on a world-wide scale, shortening distances and opening up new horizons. This phenomenon has also occurred in the ceramic tile sector. In 2002, over 1000 million m^2 tile was marketed between countries, and different trade fairs fostered the integration of companies on the five continents. Uniformity and standardisation of ceramic floor and wall tile technical parameters are important. These parameters include properties, nomenclature, tile installation techniques and product specification, in order to facilitate trade and avoid the creation of technical obstacles between countries.

This study proposes to identify, compare and analyze the main technical standards relating to ceramic tiles in different countries. The study deals with an evaluation of the interpretation of each methodology described in the EN (European), ASTM (US) and ISO, standards. The tests performed at the Centro Cerâmico do Brasil-CCB, (amounting to approximately 10 thousand tests/year using the ISO 10545 Standard) have shown differences in the results and interpretations when these tests are conducted at different laboratories.

2. COMPARATIVE ANALYSIS OF THE STANDARDS

Ceramic tile standards evaluate the properties of the glazed or unglazed surface, and of the body. The comparison between the main standards has considered the test method (equipment, products, classifications) and the specifications. The tests refer to pressed and glazed ceramic tiles, as they are the main product types made in Brazil.

The tests for water absorption, linear thermal expansion, dimensional moisture expansion, Mohs scratch hardness, bending strength and breaking load, frost resistance, characteristics and surface appearance display no significant differences in test method and specifications.

The tests for crazing resistance, abrasion resistance, stain resistance, and resistance to acids and bases display differences in the procedures. (Table 1)

3. FINAL CONSIDERATIONS

The difference between the procedures of some tests of the analyzed standards is shown and the results for the same product properties may therefore vary. The standardization and harmonization approach of the standards needs to be accompanied by a revision of test classification criteria, since service conditions, environments, cleaning products, etc., undergo constant changes.

Product certification organizations like Centro Cerâmico do Brazil, AENOR in Spain and Centre Scientifique et Technique du Bâtiment (CSTB) in France can contribute to improving the correlation between the results determined by the tests and the product application context, through specifications systems. The already existing systems are set out in ISO 10545, but differences persist in the criteria: CCB adopts ISO 10545 whereas CSTB has created the UPEC system.

TEST	ISO	ASTM	EN
Crazing resistance	**Time 2 h at 5 atm**	**Time 1 h**	**Time 1 h at 5 atm**
Abrasion resistance (glazed)	**PEI METHOD** Abrasive Charge: 70 g of 5 mm steel balls 52.5 g of 3mm steel balls 43.75g of 2mm steel balls 8.75g of 1mm steel balls 3.0g fused aluminium oxide of grain size 80 Classification (revolutions) 0 – 100 I – 150 II – 600 III – 750 o 1500 IV – 2100 or 6000 V - 12000	**PEI METHOD** Abrasive Charge: 70 g bolas of 5 mm steel balls 52.5 g of 3mm steel balls 43.75g of 2mm steel balls 8.75g of 1mm steel balls 3.0g fused aluminium oxide of grain size 80 Classification (revolutions) 0 – 100 I – 150 II – 600 III – 750 o 1500 IV – 2100 or 6000 V - 12000	**WET (PEI) = SAME** Dry (Centro Ceramico of Italy) Abrasive Charge: Porcelain Jar and Silicon Carbide Classification: 1 – 500 rev 2 – 1000 rev 3 – 1500 rev 4 – 5000 rev By agreement: Mass Loss
Stain Resistance	Staining agent: chromium oxide, iron oxide and oil Time: 24 h Classification: 1 to 5 Staining agent: hot water, product of pH 7, abrasive, hydrochloric acid	Staining agent: methylene blue and potassium permanganate Time: 24 h Clasificación: 1 a 5 Staining agent: hot water, cleaning product: ammonium chloride and solution	Staining agent: methylene blue and potassium permanganate Time: 24 h Classification: 1 to 3 Staining agent: hot water, cleaning product: ammonium chloride and solution
Resistance to acids and bases	Solution / Time (h) Hydrochloric acid 96 Citric acid 24 Potassium hydr. 96 Sodium hypochlorite 24 Ammonium chloride 24 Classification: A, B and C	Solution / Time (h) Hydrochloric acid 24 Citric acid -- Potassium hydr. 24 Sodium hypochlorite -- Copper sulphate -- Ammonium chloride -- Classification: affected or non-affected	Solution / Time (h) Hydrochloric acid 168 Citric acid 6 Potassium hydr. 128 Sodium hypochlorite 6 Copper sulphate 6 Ammonium chloride 6 Classification: AA, A, B, C, D
Resistance to thermal shock	Temperature range 15 to 105°C Number of cycles: 10 Type of test: Immersion: Samples W. Water < 10% Without immersion: Samples with W. Water > 10%	Temperature range : 24 to 145°C Number of cycles: 5 Type of test: Immersion	Temperature range : 15 to 105°C Number of cycles: 10 Type of test: Immersion: Samples W. Water < 10% Without immersion: Samples with W. Water > 10%
Dimensional characteristics	Thickness: draw diagonals and measure maximum thickness in each of the four sections	Thickness. measure in each corner. The measuring point shall be between 6.4 to 19 mm from the edge	Thickness: draw diagonals and measure maximum thickness in each of the four sections

Table 1. Comparison of Ceramic Tile Standard Test Methods.

4. ACKNOWLEDGEMENT

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REFERENCES

[1] International Standard Organization (ISO) 10545 Part 1 a 14

[2] ASTM – American Society for Testing and Materials: C 1027, C 650, C 1378, ANSI A 137, C 1028, C 370, C 373, C 1026, ANSI A137, C1485/499/502, C 484

[3] EN – EUROPEAN NORM: 98, 99, 101, 102, 103, 106, 154, 155, 202