STUDY OF DIFFERENT TEST METHODS FOR DETERMINING WATER ABSORPTION IN CERAMIC TILES

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Ceramic tile water absorption plays an important role in classifying tile products in the different water absorption groups (Ia, Ib, IIa, IIb, and III) and in determining their breaking load, bending strength, and deep abrasion in each group. The test for determining water absorption in ceramic tiles is a measure of the product's apparent porosity and involves impregnating the dry ceramic tiles with water and then weighing them. The relationship between ceramic tile wet and dry mass allows water absorption to be calculated. Standard ISO 10545-3 defines two test methods for determining water absorption: by boiling and by using vacuum. The boiling method enables the open pores to be impregnated, which fill readily, while the vacuum method causes almost all the open pores to fill with water. The boiling method needs to be used for tile classification and product specifications, while the vacuum method is to be used to determine porosity, bulk density, and water absorption for different classification purposes. However, despite this focus of the standard with regard to the purpose of each test method, ISO/TC 189 is studying the use of the vacuum method for tile classification. There is furthermore the ASTM C 373-14 method of the determination of tile water absorption, which also uses the boiling method but requires longer tile residence times in boiling and cooling (5 hours and 24 hours, respectively) than the method described in standard ISO 10545-3.

This study was undertaken to compare the different test methods to determine the water absorption of 11 products belonging to the following water absorption groups: AIb, BIa, BIIa, and BIIb (Figure 1).

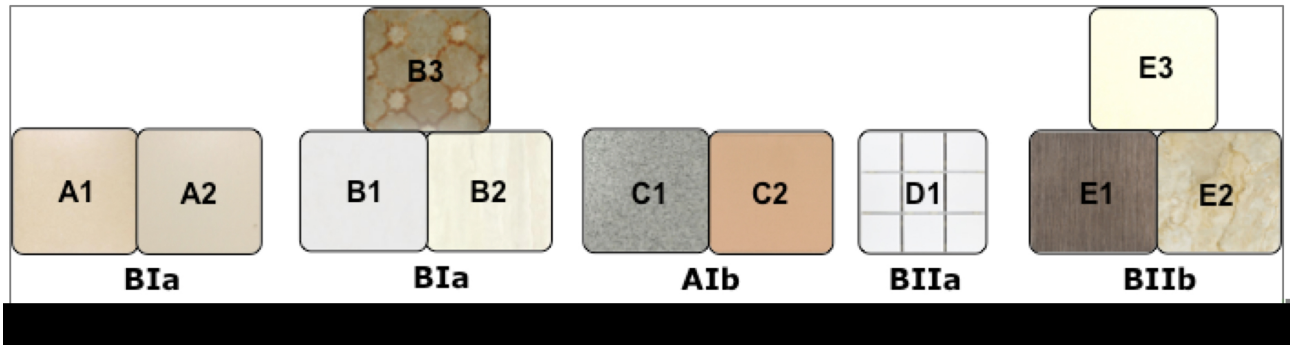

Figure 1. *Tested products with different water absorption classes.*

The test methods described in standard ISO 10545-3:1995 (boiling and vacuum) and ASTM C-373-14 were used.

Figure 2 shows the water absorption results for the tested products.

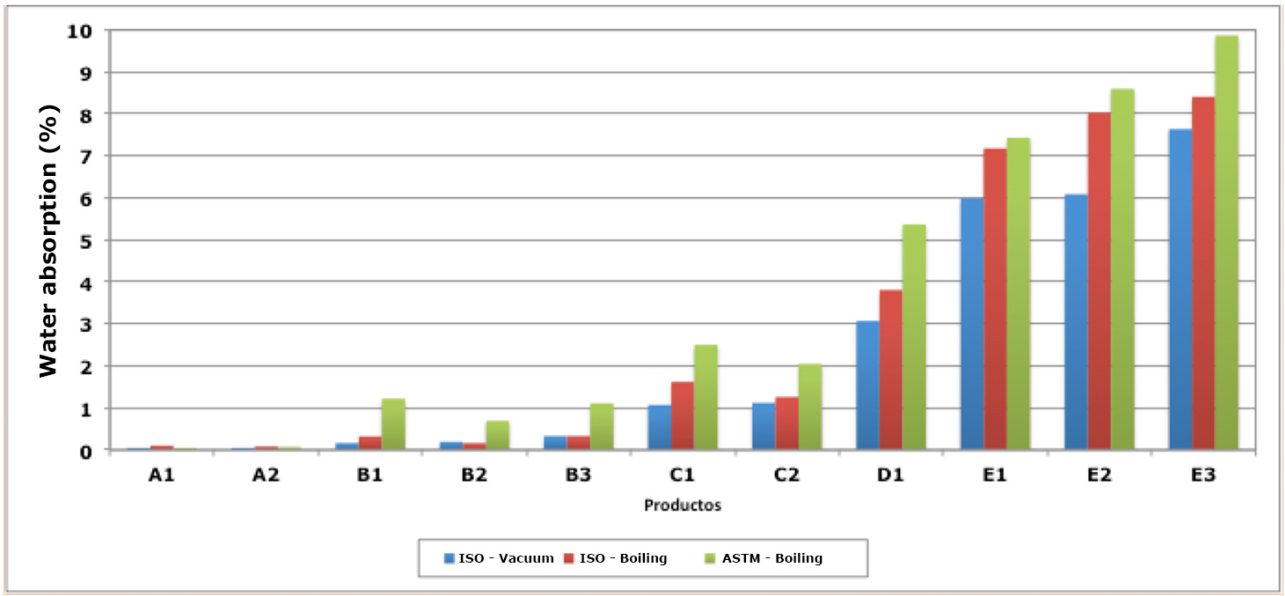

Figure 2. *Water absorption results of the different test methods.*

The results show that the water absorption values of the ISO 10.545-3 - Vacuum method were lower than the others and that the values of the ASTM C-373-14 method were always higher.

The advantages and disadvantages of each test method are set out in Table

Test method	Advantages	Disadvantages
ISO 10545-3 - Boiling	•Well-known method, simple and easy; •Internationally accepted.	•Amount of water used incooling the tiles.
ASTM C-373-14	•ASTM C-373-14 - Simple and easy; •No need to replace the water in tile cooling.	•Long test; •Cutting samples for the test; •Difference in the method for extruded and pressed products; •Only used in the U.S.A.
ISO 10545-3 – Vacuum	•Simple, easy, and fast; •Little water for the test.	•Adaptation/purchase of equipment.

Table 1. *Advantages and disadvantages of each test method.*