MOISTURE EXPANSION: THE EVALUATION METHOD

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1. ABSTRACT

All solid materials undergo expansion when they enter into contact with water (vapour or liquid). Moisture expansion (ME) is one of the factors responsible for the detachment of ceramic tiles in building construction. This study seeks to contribute to the method of measuring ME. The results show that the combined method of autoclave and dilatometer is more reliable than the other methods used.

2. INTRODUCTION

Moisture expansion (ME) has been studied since the beginning of the 20th century. However there is still much discussion about the hydration method and how to measure the dimensional variation in order to determine the potential ME of ceramic tiles. As ME is inevitable, it is of fundamental importance that laboratories improve the measurement methods used to generate more reliable and reproducible results for use in construction projects [1,2].

3. MATERIALS AND METHODS

Eight samples of ceramic tiles for façade cladding were selected. The ME hydration and quantification methods are detailed in Table 1.

Method		Hydration		Expansion measurement	
		Boiling	Autoclave	Slide calliper	Dilatometer
1	ME_{ISO}	X		X	
2	ME_{AC-D}		X		X
3	ME_{Boil-D}	X			X

Table 1. *Methods used for ME measurement.*

4. RESULTS AND DISCUSSION

Table 2 lists the characteristics of the samples (WA = water absorption and OP = open porosity), as well as the ME values measured by the three methods described in Table 1.

The selected samples contained a wide range of porosity. It may be noted that, for the same sample, the ME values measured by the different methods varied considerably. The differences in ME between the products analysed were very small in the measurements made according to the ME_{ISO} method; for all samples, the results obtained by this method were below the limit set in standard ISO 10545-10, which is 0,6 mm/m. The ME measured with methods 2 and 3 varied significantly and, in general, the effect of the variation in porosity of the samples was reflected. In some cases, the ME significantly exceeded the limit set by the standard.

Sample	WA (%)	OP (%)	ME_{ISO}	ME_{AC-D}	ME_{Boil-D}
EN01	0,5	1,3	0,19	0,05	0,18
EN02	1,2	2,9	0,18	0,24	0,23
EN14	2,4	5,5	0,16	0,26	0,22
EN15	2,9	7,0	0,05	0,25	0,13
EN09	4,8	11,0	0,23	1,30	1,02
EN12	5,0	10,9	0,33	0,78	0,92
EG01	5,8	12,8	0,23	0,37	0,25
EG02	6,5	14,2	0,33	1,02	0,61

Table 2. *Characteristics of the samples and ME measured by the three methods.*

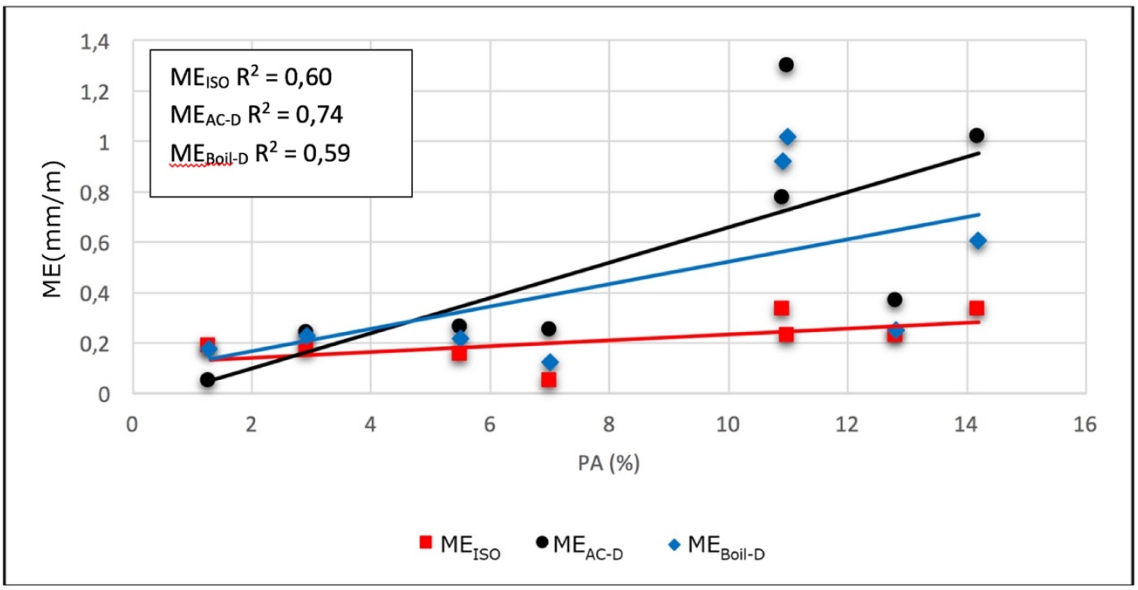

Figure 1. *Correlations between OP (%) and ME measured by the three methods.*

5. CONCLUSIONS

The results obtained in this study show that the ME measurements were affected to a great degree by the method used. In the ME measurements made in this study, the selection of the method for measuring dimensional variation, slide calliper versus dilatometer, was shown to be of greater importance than the accelerated hydration method, boiling versus autoclave. Although porosity was not the only or main variable related to ME, the results obtained point to a greater correlation between sample porosity and the ME determined by method 2, ME_{AC-D}.

REFERENCES

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