ALTERNATIVES TO INCREASE THE SPREADABILITY OF GLAZES AND REDUCE THE SURFACE ROUGHNESS OF CERAMIC TILES

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In the manufacture of glossy ceramic tiles today, the aim is to produce surfaces with smooth textures devoid of irregularities and with a high gloss. The purpose of this work was to develop a methodology to quantify the surface roughness of ceramic tiles and identify the factors responsible for that characteristic. The surface roughness of ceramic tiles directly affects the following properties of interest of the finished product: its optical properties, chemical durability, abrasive wear resistance, easy cleaning, retention of dirt, and slip resistance.

To this end, an analytical method was developed to quantify the surface roughness of ceramic tiles, using a mechanical contact profilometer[1,2,3]. Figure 1 shows the device and the parameters that can be determined based on the roughness profile obtained.

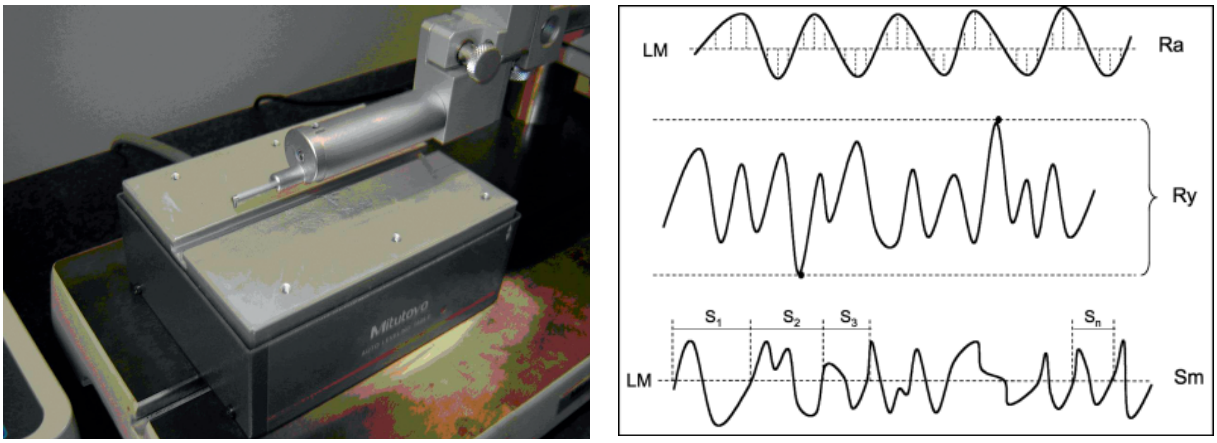

Figure 1. Mechanical contact profilometer and roughness indicator parameters that can be obtained from the measured profiles

Table 1 presents the roughness differences found among Brazilian commercial ceramic tiles manufactured by the dry and wet process, with polished surface, quantified by the proposed methodology.

PRODUCTS	PARAMETERS			
	Ra (µm)	Ry (µm)	Rz (µm)	Sm (µm)
Dry route	1.74	9.43	6.05	2,730
Wet route	0.69	3.12	1.71	1,080
Polished porcelain tiles	0.36	13.5	7.41	300

Table 1. Mean results of the roughness indicators obtained from Brazilian commercial products

We then determined the manufacturing steps responsible for the development of the surface roughness of a commercial ceramic tile produced by the dry route. We also evaluated the influence of the processing variables, such as conformation conditions and thickness and composition of the glaze layer, on the surface roughness of products fabricated under standard conditions.

The evolution of surface roughness through the manufacturing steps indicates that it develops along different stages of the productive process. The surface roughness of a finished product depends on the initial roughness of the pressed workpiece, as

well as on the reduction of roughness promoted by the application of engobe and glaze and by bisque firing, basically through spreading of the glaze.

The particle-size distribution of the mass directly affects the surface roughness of pressed pieces. This is one of the main factors that explain the difference in the surface roughness of ceramic tiles produced by the dry and wet route in Brazil. The thickness of engobe and glaze layers is also very important variables for obtaining products with low surface roughness. Generally speaking, the application of these layers tends to cover the surface irregularities of the underlying clay body, resulting in smoother textures.

The results obtained in this study confirm the sensitivity of the proposed methodology, offering an aid in the qualitative control of the surface texture and the development of ceramic tiles with the desired surface roughness.

REFERENCES

[1] CARPINETTI, L.C.R. et al. Rugosidade Superficial. Conceitos e princípios de medição. Serviço Gráfico USP – EESC, São Carlos, 2000, 51 p.

[2] Universidad de Zaragoza. Calidad Superficial: Rugosidad, Tecnología Mecánica II, Zaragoza, 2003. Available at: http://www.unizar.es/euitiz/areas/areingpf/21206/desc/medrug.pdf. Retrieved 02/06/2007.

[3] ESCARDINO, A., et al. Empleo del rugosímetro para el estudio cuantitativo de la degradación, por abrasión, de vidriados cerámicos. In: Proceedings of the II World Congress on Ceramic Tile Quality. Castellón, 1992; p.228-253.