Poster ref. 132

MEASURING THE VARIATION OF THE STRENGTH OF THE ENGOBE-SUPPORT INTERFACE DURING FIRING

Geocris R. Dos Santos, Ronaldo C. Gennari, Fábio G. Melchiades, Anselmo O. Boschi*

Laboratório de Revestimentos Cerâmicos (LaRC) – Departamento de Engenharia de Materiais – Universidade Federal de São Carlos - Brasil

daob@ufscar.br

Keywords: engobe, glaze, interface strength

Several characteristics and properties of ceramic tiles are strongly influenced by different behavior of the glaze, engobe and support layers during firing. The individual behavior of each layer is a consequence of its chemical and physical characteristics. The behavior of the tile during firing will depend on the behavior of the individual layers and the characteristics of the interfaces, where stresses will be developed[1]. The integrity of the system will depend on the strength of the interfaces that shall be strong enough to support the stresses. So, to keep the system under control it's important to be able to work out the stresses and the strength of the interface. The stresses can be estimated through the dilatometric curves of the layers. However, this procedure requires the establishment of the coupling temperatures[2] and at present there is not a method to work out the coupling temperature of the interface engobe-support and the method used to establish the coupling temperature for the glaze-engobe interfaces is questionable. In this context, the objective of the present work was to develop a method to evaluate development of the strength of the interface engobe-support, during firing.

The suggested evaluation method consists in gluing metal peaces at the top and bottom surfaces of the specimen and submitting the set to an increasing traction stress until the ceramic sample break in two parts, as shown in Figure 1. To ensure that the measured corresponds to the strength of the interface the fracture surface has to be carefully analyzed to check that the fracture occurred at the interface. Only the results that attended this condition are considered.

Figure 1: Sets of ceramic samples (engobe + support) with the metal pieces, left, and the fracture interfaces after the mechanical test.

To evaluate the development of the strength of the interface engobe-support during firing, two engobes of different fusibility were prepared and applied on the surface of industrial supports. After drying, the tiles were fired at different temperatures in a laboratory furnace. Small samples of the tiles were cut and the metal pieces were glued to the top and bottom surfaces. In the sequence, the mechanical strength of the sets was evaluated as described previously. The results are presented in Figure 2.

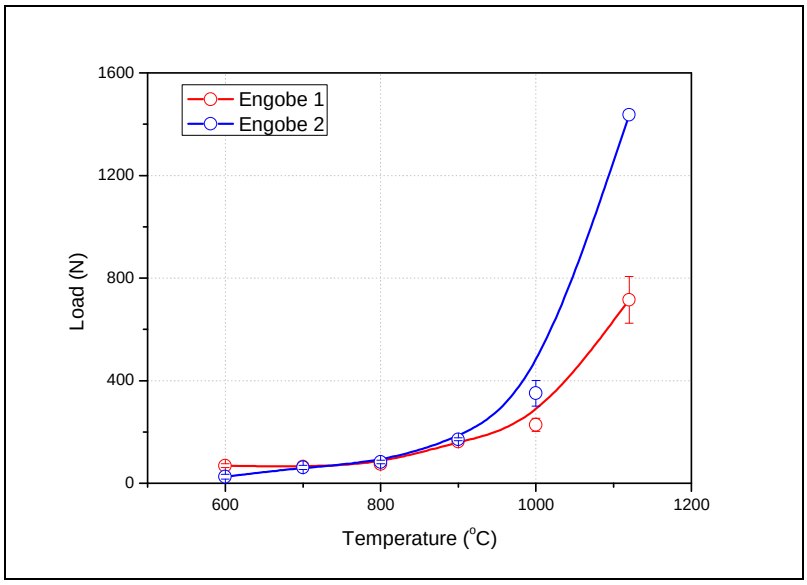

Figure 2: Variation of the mechanical strength of the engobe-support interfaces with the firing temperature.

The results have shown that the strength of the interface engobe-support of engobe 2 (higher fusibility) starts to increases at a lower temperature and increases considerably stronger than engobe 1. Despite the fact that these results were expected, mainly due to the higher reactivity of engobes of elevated fusibility, the actual differences has never been quantitatively shown before.

These results can also be used to work out the coupling temperature of the interface engobe-support, a very important information for the interpretation of dilatometric results to calculate the total stresses developed in the system on cooling.

A similar procedure can be used to evaluate the evolution of the strength of the interface glaze-engobe and to certify the validity of the method used to establish the coupling temperature of this interface.

The informations provided by this simple method could also be usefull to study the influence of several variables that affect the variation of the mechanical strengh of the interfaces glaze-engobe and engobe-support during firing as well as the maximum values of these characteristics in the final products and, through this knowledge, produce even better products.

REFERENCES

(1) AMORÓS, J.L. et al. Acordo esmalte-suporte (I): A falta de acordo como causa do empenamento. **Cerâmica Industrial**, v. 1, no 4/5, p. 06-13, 1996.

(2) AMORÓS, J.L. et al. Acordo esmalte-suporte (II): Expansão térmica de suportes e esmaltes cerâmicos. **Cerâmica Industrial**, v. 2, no 1/2, p. 08-16, 1997.