MEASUREMENT OF THE VARIATION IN STRENGTH OF THE ENGOBE-BODY INTERFACE DURING FIRING

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1. INTRODUCTION

Several characteristics and properties of ceramic tiles are strongly influenced by different behaviour of the glaze, engobe and body layers during firing. The individual behaviour of each layer is a consequence of its chemical and physical characteristics. The behaviour of the tile during firing will depend on the behaviour 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, which shall be strong enough to withstand 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 fitting temperatures[2] and at present there is not a method to work out the fitting temperature of the engobe-body interface and the method used to establish the fitting 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 engobe-body interface, during firing.

The suggested evaluation method consists in gluing metal peaces at the top and bottom surfaces of the specimen and subjecting 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 fracture surface interface has to be carefully analyzed to check that the fracture occurred at the interface. Only the results that met this condition are considered.

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

To evaluate the development of the strength of the engobe-body interface during firing, two engobes of different fusibility were prepared and applied on the surface of industrial bodies. 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. The mechanical strength of the sets was then evaluated as described previously. The results are presented in Figure 2.

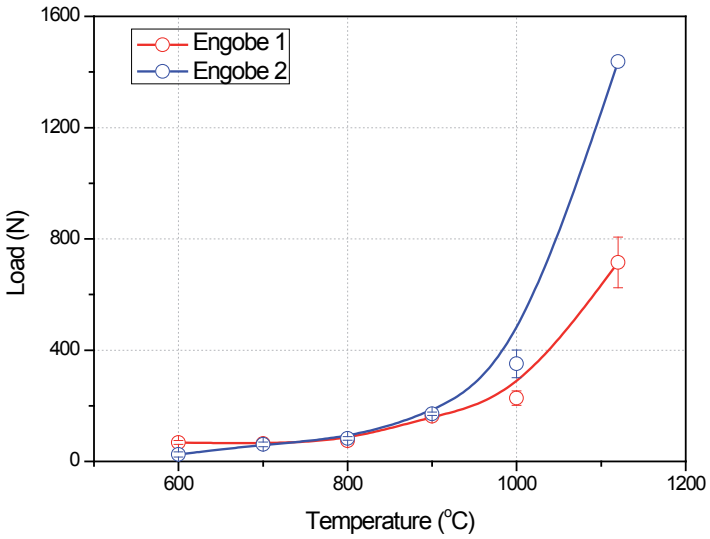

Figure 2. Variation of the mechanical strength of the engobe-body interfaces with firing temperature.

The results have shown that the strength of the engobe-body interface 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 have never been quantitatively shown before.

These results can also be used to work out the fitting temperature of the engobe-body interface, this being key information for the interpretation of dilatometric results, in order 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 glaze-engobe interface and to certify the validity of the method used to establish the fitting temperature of this interface.

The information provided by this simple method could also be useful for studying the influence of several variables that affect the variation in mechanical strength of glaze-engobe and engobe-body interfaces during firing, as well as in determining the maximum values of these characteristics in the final products and, through this knowledge, produce even better products.

REFERENCES

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