

## STUDY OF EFFECTS FROM THE ADDITION OF POLYMER ON THE COMPRESSION RESISTANCE IN BULK USED IN THE CERAMIC INDUSTRY.

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**Abstract.** *The addition of polymers in the bulks of red ceramics was analyzed in relation to its mechanical behavior in pieces produced from those bulks with or without addition of polymers, having as objective the reduction of burning temperature. The polymer used has presented good results of compression resistance after burning in temperatures below the ones normally used in the ceramics industry.*

**Keywords:** *Red ceramics ,polymeric additive ,ceramic bulk, burning temperature, compression resistance.*

## 1. Introduction

The ceramic industry is a sector that grows in all the regions of the country, mainly in the Northeast area, due to raw material easiness and cheap laborer. The ceramic industries of that area still use firewood in the productive process of their products, which contributes to the deforestation and desertification, besides endearing the process, because the firewood is more and more distant from the ceramics (Schwartz, 2004). Since then, it was studied the possibility of the use of polymeric additive incorporated to the ceramic bulk having as main objective the reduction of the burning temperature of the ceramic products and nevertheless to obtain an appropriate product from the commercial point of view. The incorporation of that additive was done in a way that there was not any modification of the productive process, which is something interesting from the technical point of view. The additive was mixed in low proportions, but in enough quantity to prove its technical viability. The use of additives is not exactly an innovation. Several works have analyzed the effects of several types of additive incorporatee to the ceramic bulk, where one of the greatest concerns in the use of the same ones is the decrease in the energetic impact, mainly on the costs in the productive process (Moreli, 2003). The environmental impact of non biodegradable materials is another great concern and a probable use of those materials as additive is already being studied, just as it is the example of the granite sawdust (Moreira, 2003). The reject of glass has also been used for maturation in low temperatures (Moreli, 2003).

## 2. Materials and Methods

The bulk used for the study of the behavior of compression resistance of the proof bodies, in the case, the commercial bricks, are originated from one of the argilo-minerals deposits used by the industry. The system used for the mixture of the additive is shown in figure 1. After having been produced in the industry, the bricks were taken to the laboratory of UFPB and, initially, the bulk of which they were composed of was characterized. This bulk was dry in greenhouse to 110°C for 24 h, triturated in mill of balls and sieved in mesh 2 mm (ABNT n° 10). The bulk was tested in a way to obtain the granulometric summary, as shown in figure 2. It was also determined the plasticity index (27%) (NBR 7180, 1983). The tenor of Acronal S 650 additive of BASF, Ludwigshafen (Germany) was mixed in the own ceramics industry, in the place where the bulk is mixed to water. In the moment of the mixture there was not addition of water.



Figure 1 - System used in the mixer and detail of the mixture in the bulk.

The tenor of the additive was below the 2%, percentage in volume. The additive was inside of a tambour, provided with a small faucet. The bricks are extruded with commercial dimensions of 10 x 20 x 20 cm<sup>3</sup>, having nominal dimensions of 9 x 19 x 19 cm<sup>3</sup> (NBR 7171, 1983), and the proof bodies were dried in the environmental temperature (~25°C), in greenhouse to 110°C for 24 h and burned in the temperatures of 650°C, 750°C and 850°C in electric furnace, maintained in the landing temperature by 1 hour., where the heating rate was of 10°C min<sup>-1</sup>. The cooling was accomplished by natural convection, switching off the oven after the pieces have been maintained in the landing temperature by the determined time. It was then determined the Compression resistance (RC) (NBR 6461, 1983). the linear contraction (RL) was determined by the equation below.

$$RL(\%) = \frac{L_E - L_C}{L_E} \times 100 \quad (1)$$

where  $L_E$  is the initial length of the piece after the molding and  $L_C$  the length of the piece after the burning in the furnace. The values became were much stable in the three temperatures. In figure 2, the percentage of some of the studied principal constituents of the bulk are shown.

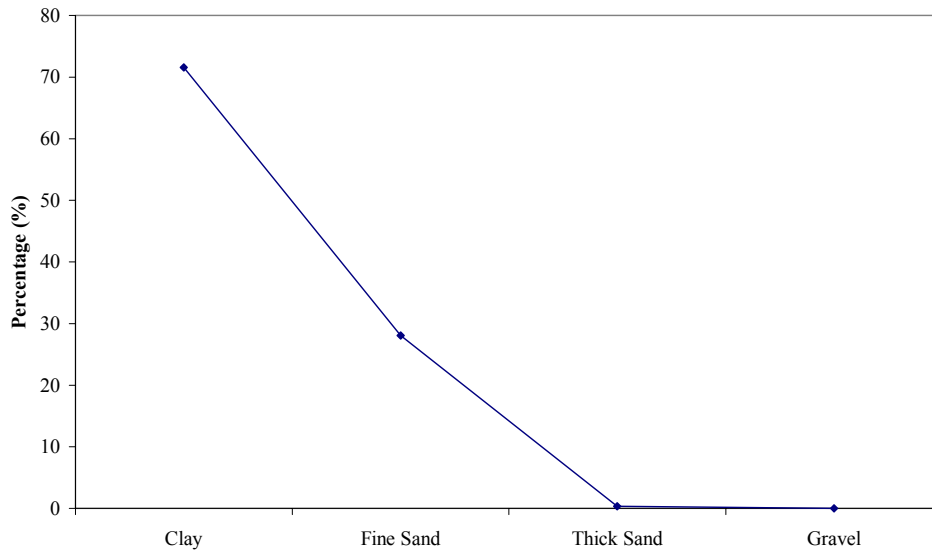


Figure 2 - Percentage of some constituents of the bulk.

### 3. Results and discursion

In Figure 3 the values of linear contraction of the bricks are shown. Such values were shown very uniform in the three temperatures.

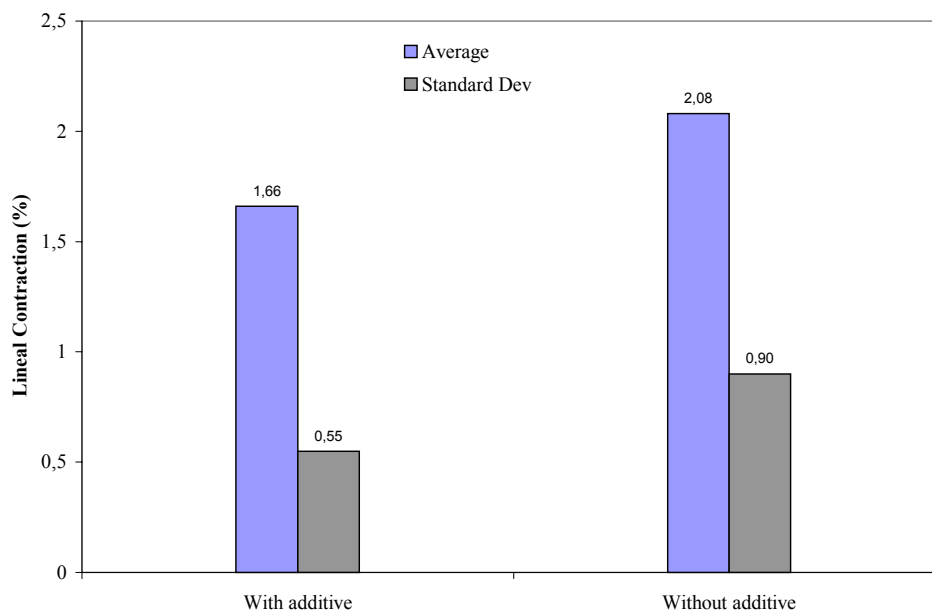


Figure 3 - Linear contraction of the proof bodies in form of bricks.

In Figure 4 the values from the compression resistance of the proof bodies in form of bricks in function of the temperature are presented. The values for the proof bodies without additive present larger standard deviations, which show us that the proof bodies that had the bulk mixed with additive are more stable and also have larger resistance values, except for the temperature of 750°C, where there was a small decrease of the value of the resistance of the proof body, but nevertheless, it is more stable than the proof body without additive, also presenting smaller contraction value. For the proof bodies with additive, it is observed that with a temperature of 650°C it is still possible to obtain a medium resistance of 3,15 Mpa, that allows the brick to be used as “vedante” (NBR 7171, 1983). For the temperatures of 750°C up to 850°C the resistance values to the compression for the proof bodies with additive are growing reaching the maximum of approximately 4,71 MPa.

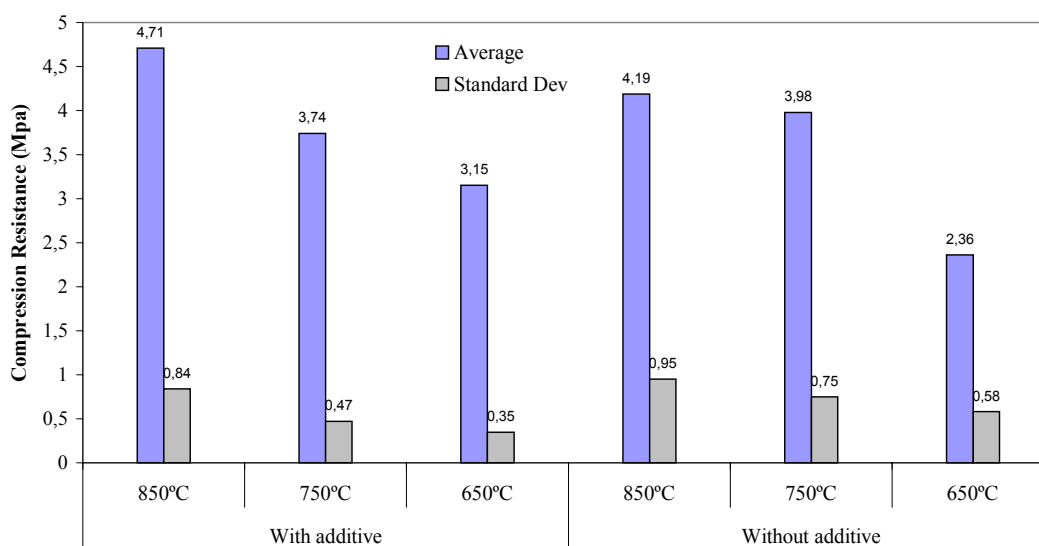


Figure 4 – Compression resistance of the proof bodies in form of bricks in function of the temperature.

#### **4. Conclusions**

The proof bodies obtained with additive added in the bulk ceramic are more resistant and more stable than the proof bodies without additive, in the burning temperatures used. With the low teor of the additive used it is already possible to lower the burning temperature in at least 100°C and nevertheless obtain a product that can be used as “portante” (NBR 7171). We can also observe in the results of the rehearsals that in the burning temperatures used the proof bodies with additive also have a lineal contraction more stable than the bricks done without additive.

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