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INFLUENCE OF ALUMINATE CEMENT ON HMoR BEHAVIOR OF REFRACTORY COMPOSITES

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Summary

Samples (MA) of self-flow refractory composites (SFRC) without cement (100% alumina) were formed by 47.5 wt% matrix (three fine particle size classes: "-230" and "-500" mesh of tabular alumina, and CT3000SG reactive alumina), and 52.5 wt% aggregate (three coarse particle size classes of commercial tabular alumina: 0.2-0.6 mm, 0.5-1.0 mm and 1.0-3.0 mm). This composition was optimized in previous works using the response surface methodology (Statistica software, module DOE), with minimum added water content (28 mg/m^2), high flowability as fresh paste (FI, ASTM C230) and high mechanical strength after sintering (CMoR, ASTM C133). To evaluate the influence of the presence of calcium aluminate cement (CA25, Almatis) on the SFRC mechanical strength (three-point bending tests), similar samples were also prepared, replacing 1 wt.% of CT3000SG alumina by aluminate cement (CA25) (MAC).

The aim of this work was to compare the room temperature MoR (CMoR, ASTM C133), as well as the hot MoR at 300, 600, 900, 1200 and 1500ºC (HMoR, ASTM C583) for both sets of samples. Every test was carried out with a minimum of five specimens.

The results obtained in this study were analysed using the Statistica Software (DOE module) to estimate the response surfaces for both cases. The SFRC without cement show a loss in HMoR, relative to CMoR, at 600, 900, 1200 and 1500ºC of 28%, 22%, 34% and 58%, respectively. Contrary to the results at room temperature, the preliminary studies with the SFRC containing aluminate cement show a better behavior, illustrated by a reduction of mechanical strength at 600, 900 and 1200ºC of 10%, 8% and 14% respectively, which might be attributable to the phenomena of "crack closing" or filling of defects and voids, due to atom diffusion in the glass phase during the high temperature testing, thus promoting a higher mechanical strength.