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Corundum and Bauxite Refractory Shotcretes based on Activated Waste Coal Ash: Investigation of Thermally Induced Properties Change

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The necessity for application of activated secondary raw materials in refractory industry is caused by a growing demand for refractory castables with advanced properties and continuous technological evolution of high-temperature materials. In this investigation, refractory shotcretes with the same matrix composition were prepared from 15 wt.% of high aluminate cement and 45 wt.% of bauxite aggregate + 30 wt.% of chamotte filler, i.e. 75% of corundum aggregate. The request for obtaining a low-cement castable is fulfilled by application of 10 wt.% of mechanically activated coal ash as the cement substitution in the shotcretes. The ash was activated by means of various high energy mechano-activators. Results were compared in order to choose the most efficient activation procedure. The properties have been studied at temperatures ranging from room temperature to adopted maximal temperature 1400°C. Mechanisms of hydration and sintering were investigated by means of differential thermal analysis at three different heating rates. The measurements showed different activation energies for ordinary shotcretes and shotcretes with activated ash. The evolution of the refractory shotcretes properties was investigated and correlated to microstructural changes induced by temperature and microfiller addition. The combination of advantages in investigated refractory shotcretes makes them suitable for use in severe conditions at high temperature applications especially in refractory industries.

Keywords: waste ash, ceramics, composites, refractories, ceramics, sintering, ecology.

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