Influence of crystallite size of alumina aggregates on the thermomechanical behaviour of refractories

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Abstract

Alumina is a popular mineral widely used in the ceramic industry providing good mechanical properties and high temperature resistance. Refractories based on alumina are however complex, ceramic materials that need to be designed based on specific applications. Placed in the working lining of steel ladles, these alumina-based refractories undergo cycles of thermal shock during service conditions which eventually leads to their failure, needing repairs or replacements. Tabular and white fused alumina are two polycrystalline grains used in alumina refractories with the former of quite small crystal sizes and the latter of rather large crystal sizes. Other differences in the alumina aggregates lies in their crystallography and porosities due to their different processing routes.
This work conducted as part of the European CESAREF (Concerted European Action on Sustainable Applications of REFractories) consortium, aims to study the influence of crystallite sizes on thermomechanical behaviour of the alumina refractories. High temperature ultrasonic technique measuring the Young's modulus is applied to investigate the microstructural changes during heat treatments. Acoustic emissions during cooling will also be monitored. The acoustic emissions will provide information on microcracks formed in the microstructure during thermal cycling. The above-mentioned techniques will help design the microstructures of alumina-based castables with improved non-linear thermomechanical behaviour suitable for thermal shock applications.

Keywords: Alumina aggregates, Crystal size, Thermomechanical behaviour, Young's modulus, Microcracks

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