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Innovating Minds For Excellence

Virtual Congress on
Materials Science & Engineering

Theme: Materials Science contribution towards future growth November 09-10, 2020

Structural evolution of an Al_2O_3-$MgO{\cdot}Al_2O_3$ castable in the range 1000-1600°C

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Thermal and structural characteristics of an alumina-spinel castable (containing 2.5 wt.% CaO) was studied. The specimens were cast (8.0 wt.% water), cured in air at ambient temperature (48 h), then dried at 100°C (24 h) and prefiring at 500°C (3 h). Thermal behavior was analyzed by dilatometries at constant heating rate (5°C/min) up to 1600°C, and at constant temperature (range: 1000-1500°C). Crystallographic phases were determined by XRD and microstructures were analyzed by SEM/EDS.

Specimens heat treated at 1000°C and 1200°C showed Al2O3 (A) and $MgAl_2O_4$ (MA) as main phases. Between 1200-1300°C, the $2Al_2O_3{\cdot}CaO$ (CA2) formation is promoted. Calcium hexaluminate $6Al_2O_3{\cdot}CaO$ (CA6) is detected from 1400°C. The presence of CA6 increases at 1500°C and 1600°C. From dilatometric curves, alternating expansion contraction zones were observed in the range 1000-1600°C. This behavior is associated to (i) the CA2 and CA6 formation, and (ii) the sintering/densification of ceramic grains with probable liquid phase assistance.

Thus, considering the temperature profile, generated in service, through this material, both the formation of CA2 and CA6 and the sintering evolution during the first hours, lead to volumetric contractions and expansions in different zones. These volumetric changes generate mechanical stresses that can cause faults in the material.

Biography

Edgardo Benavidez received his doctorate in Physics from the National University of Rosario (Argentina). He entered the National Technological University (UTN) in 1998, where he became a professor of Materials Science in 2010. He is currently Director of the Materials Development and Technology Center (DEYTEMA) and Deputy Director of the Research and Transfer Center (CIT-San Nicolás). His research expertise includes: (1) Traditional and advanced ceramic materials: fabrication and characterization techniques, (2) Refractory materials: evaluation of mechanical properties and corrosion by metallurgical slags, and (3) Characterization of physicochemical properties of steelmaking slags.

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