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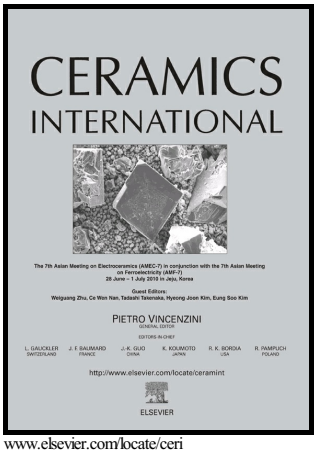

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Incorporating Zr to achieve self-protecting and enhancement of silica sol bonded SiC castables at active oxidation condition

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Abstract: SiC castables exhibit degraded properties in static air at 1700°C, due to the formation of gaseous products. The efficiency of different contents of Zr in SiC castables was evaluated by considering sintered properties, mechanical performance, isothermal oxidation behavior, and microstructural analysis of the SiC castables. Specimens with more Zr exhibited enhanced mechanical behavior and anti-oxidation capability. The addition of Zr decreased the evaporation of SiO_2 by reducing its equilibrium partial pressure (g), and formed a dense ZrO_2-SiO_2 protective layer (e.g., the sample with 0.9 wt% Zr) to prevent further degradation of the SiC castable. The Zr that was preferentially oxidized to ZrO_2 reduced the partial pressure of the oxidizing gases (O_2 and CO_2) in the matrix, and increased SiO (g) content, which facilitates formation of SiC fibers, which, in turn, improves the anti-oxidation capability and mechanical behavior of SiC castables, preventing their degradation in static air at 1700℃. The addition of Zr created a ZrO_2-SiO_2 protective layer on the surface and prevented the decrease in SiC content, by forming SiC fibers. This made the silica sol bonded SiC castable a self-protecting refractory.

Keywords: SiC castable; oxidation resistance; equilibrium partial pressure; self-protecting mechanism; Zr