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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<sub>2</sub> by reducing its equilibrium partial pressure (g), and formed a dense  $ZrO_2$ -SiO<sub>2</sub> 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<sub>2</sub> and CO<sub>2</sub>) 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°C. The addition of Zr created a  $ZrO_2$ -SiO<sub>2</sub> 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

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