

Effectiveness of Nanocrystalline Ceria for Better High Temperature Oxidation Protection

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Development of high temperature coating is very important to impart oxidation resistance on stainless steels for various applications at elevated temperatures. Stainless steel suffers from scaling loss at elevated temperatures in air. Cerium oxide has been investigated to be an effective coating material for high temperature applications for various chromia- and alumina- forming alloys. The present study compares the effectiveness of nano-sized CeO<sub>2</sub> coating to that of the large particle sized CeO<sub>2</sub> coating to enhance high temperature oxidation resistance of stainless steel. Cerium oxide nanoparticles with particle size of 3 nm were prepared by using a microemulsion method. For comparing the particle size effect, other cerium oxide samples, one 20nm and the other micron-sized ceria, were also used. The oxidation resistance of steel was found to be improved to a great extent with the 3 nm sized CeO<sub>2</sub> particles compared to that of the 20nm and micron sized ceria coated steel specimens. The oxide scale formed on the substrate after oxidation was very compact and adherent in the case of steel with 3nm sized ceria coating. The scale characterization was done using SEM, EDS, XPS and FIB studies.