Development of Novel Environmental Barrier Coatings for SiC-based Ceramics to Enable Temperatures above 1450°C

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Abstract Environmental barrier coating (EBC) has been developed to protect SiC-based ceramics exposed to harsh environments, such as air and steam conditions. The conventional EBCs are composed of the Si bond coat and rare earth disilicate topcoat layers. However, as the operating temperature of advanced gas turbines typically exceeds 1400 °C, it has been required to replace conventional Si bond coat in EBC with materials possessing higher thermal stability. The HfO_2-SiO_2 was developed as the novel bond coat deposited on SiC substrate using atmospheric plasma spray in EBC, and the service temperature of EBC was improved to 1475 °C. Furthermore, novel $Y_xYb_{(2-x)}Si_2O_7$ (x = 0.3, 0.5, 0.8, and 1.0) topcoat layer were deposited using atmospheric plasma spray as the topcoat layer in EBC to reduce the thermal conductivity in EBC. The novel EBC of HfO_2-SiO_2/$Y_xYb_{(2-x)}Si_2O_7$ was conducted in air and steam conditions at 1475 °C for various times. The results showed that the novel EBC could effectively reduce the oxidation of EBC-coated SiC and improve the service temperature of EBC in air and steam conditions, which is a promising candidate for the next generation of EBC.

Keywords Environmental barrier coating; Atmospheric plasma spray; Service temperature; Oxidation.