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Silicon Carbide Oxidation and Environmental Barrier Coating Investigation

Silicon Carbide (SiC) fiber-reinforced SiC matrix ceramic matrix composites (SiC/SiC CMCs) have high temperature properties that make them great candidates for the next generation of jet turbine components. They have improved high temperature mechanical properties compared to nickel superalloys. The use of SiC/SiC CMCs is currently restricted by reaction with water vapor that causes surface recession, and eventually leads to failure. At high temperatures, typically over 1000°C, the CMC material will form a silicon oxide (SiO₂) layer that can volatilize to silicon oxy-hydroxide (Si(OH)₄) upon contact with water vapor. This project is a fundamental step in addressing this problem using an environmental barrier coating (EBC) approach. In a similar manner, SiC tubes (Hexoloy™) have potential applications in the poly-crystalline silicon industry. To meet purity requirements, the Hexoloy cannot outgas any significant amount of boron (B) under exposure to chlorine-containing gasses. We have developed a testing procedure to flow hydrogen (H₂) and hydrogen chloride (HCl) over the Hexoloy samples to determine outgassing characteristics. This setup has yielded valuable information on boron outgassing, and provides a basis for developing a procedure to evaluate CMC high temperature corrosion.