CATALYTIC OXIDATION INHIBITION OF CARBON-CARBON COMPOSITE MATERIALS BY SUPPLEMENTAL BORON-MIXTURE SOLUTION

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Abstract

Optimization protection of carbon-carbon (C/C) composite materials used in the aircraft disc-brakes system against catalytic oxidation of potassium formate (HCO_2K) at an isothermal temperature of 650℃. The potassium formate, a salt of formic acid, is a substitute to potassium acetate, is used as an airport runway deicer. It is less corrosive than chloride-based salt and have a lesser impact on the surrounding flora. However, it leads to rapid break ware because of catalytic oxidation occurring by catalyzed potassium on the surfaces of carbon substrate. The potassium's unique wetting ability and fast mobility on the carbon surfaces is responsible for a faster interfacial reaction that occurs in the form of $C-O_2$ reaction. A boron liquid mixture solution, K_{10}, was developed, is comprised of borate glass former such as boron oxide of 5-15 weight %, a network modifier such as potassium of 1-10 weight %, deionized water of 94-75 weight %, and up to 1 weight % of DF-16 surfactant. It is applied to the surfaces of C/C composites by dipping, brushing, or spraying as primer or overcoat. It is compatible with ceramic liquid antioxidants derived from heat treated boron and phosphorous precursors. The experimental results showed a significant increase in resistance and protection against catalytic oxidation at constant temperature of 650℃ for potassium formate, and sea water thermal oxidation at selected temperatures of 650℃ and 871℃.