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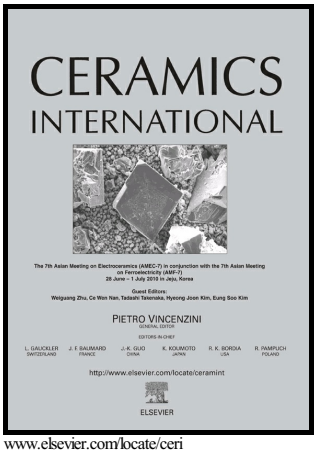

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Preparation and properties of $TaSi_2$-$MoSi_2$-ZrO_2-borosilicate glass coating on porous SiCO ceramic composites for thermal protection

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Abstract: A $TaSi_2$-$MoSi_2$-ZrO_2-borosilicate glass (TMZG) coating was prepared by a slurry method on a carbon fibre-reinforced porous silicon oxycarbide (SiCO) ceramic composite for thermal protection. The coating was well adhered to the substrate and showed a uniform thickness of approximately 375 μm. After thermal cycling from 1873 K to room temperature six times (total oxidation time of 180 min), the shape and dimension of the TMZG remain almost unchanged with no cracking or peeling of the coating surface. The TMZG-coated sample exhibits good oxidation resistance because of a molten SiO_2 film with $ZrSiO_4$ particles distributed on the outer layer of the coating. After ablation testing under an oxyacetylene flame at 1927 K for 90 s, the linear ablation rate of the TMZG coated sample are 8.33×10^{-4} mm/s. The whole coating retains integrity, preventing substrate ablation during the test. The TMZG coating with excellent temperature resistance shows broad applicability in thermal insulation materials.

Keyword: porous SiCO ceramic composites, $TaSi_2$-$MoSi_2$-ZrO_2-borosilicate glass coating, anti-oxidation, ablation resistance

1. Introduction

With the development of hypersonic aircraft for which the flight Mach number can exceed 10, the aerodynamic heating of windward surfaces has become increasingly serious, reaching temperatures of 1873 K [1-4]. Therefore, thermal insulation materials with anti-oxidation, anti-ablation, and high temperature resistance are urgently required. Porous ceramics, especially SiCO ceramic composites reinforced with carbon fibres, are suitable for this application and exhibit outstanding properties such as high-temperature endurance, low thermal conductivity, and high mechanical strength [5-11]. However, their poor oxidation resistance at high temperatures limits the application of porous SiCO ceramic composites [12-14].

Previous studies have shown that surface coatings are effective in improving the anti-oxidation performance of porous SiCO ceramic composites for aerospace

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