Preparation and properties of $MoSi_2$-based coatings on carbon fiber reinforced carbon-based aerogel

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Abstract

With the rapid development of aerospace technology, the high speed and long on-orbit time of reusable re-entry launch vehicles (RLV) are constantly improved[1,2], making the service environment of vehicles more severe, which puts forward higher requirements for its surface thermal protection system[3,4]. In order to meet the increasing thermal protection requirements in the field of aerospace, the anti-oxidant coatings with high temperature resistance and high emissivity were prepared on the surface of carbon fiber reinforced carbon-based aerogel by slurry brushing combined with embedding sintering process. The prepared $MoSi_2$-based coatings have good thermal radiation performance, whose total emissivity are more than 0.8 in the wavelength range of 300~2500 nm. The total emissivity of the coating with $MoSi_2$ content of 30 wt % in the wavelength range of 1270~1967 nm is as high as 0.9017. With the increase of heat-treatment temperature, the emissivity of coatings decreases gradually. The optical geometry model was used to clarify the relationship between the emissivity and surface roughness of the coatings. The static oxidation resistance of coatings with different composition and preparation temperature was tested at 1200 °C, respectively. Among all the coatings, the coating with $MoSi_2$ content of 40 wt% shows the best anti-oxidant property. The coating prepared at 1400 °C shows greater anti-oxidant property than those prepared at 1200 °C and 1300 °C.

Keywords

Carbon-based aerogel; Thermal protection; Coating; High emissivity; Oxidation resistance

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