

Microstructure and Oxidation Behaviors of Al, Y Modified Silicide Coatings Prepared on an Nb-Si Based Ultrahigh Temperature Alloy

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Abstract : The microstructure of an Si-Al-Y co-deposition coating prepared on an Nb-Si based ultra high temperature alloy by pack cementation process at 1250°C for eight hours was studied. The results showed that the coating was composed of a (Nb,X)Si₂ (X represents Ti, Cr and Hf elements) outer layer, a (Ti,Nb)₅Si₄ middle layer and an Al, Cr-rich inner layer. For comparison, the oxidation behaviors of the coating at 800, 1050 and 1350°C were investigated respectively. Linear oxidation kinetics was found with the parabolic rate constants of 5.29×10^{-2} , 9×10^{-2} and $5.81 \text{ mg}^2 \text{ cm}^{-4} \text{ h}^{-1}$, respectively. Catastrophic peeling oxidation has not been found at 800°C even for 100 h. The surface of the scale was covered by compact glassy SiO₂ film. The coating was able to effectively protect the Nb-Si based alloy from oxidation at 1350°C for at least 100 h. The formation process of the scale was testified following an epitaxial growth mechanism. The mechanism responsible for the oxidation behavior of the Si-Al-Y co-deposition coating at 800, 1050 and 1350°C was proposed.

Keywords : Nb-Si based ultra high temperature alloy, oxidation resistance, pack cementation, silicide coating, Al and Y modified

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