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The Effect of the Re-Ni Diffusion Barrier on the Adhesion Strength and Thermal Shock Resistance of the NiCoCrAlY Coating

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Abstract

The duplex coating system consisted of electroplated Re-Ni as the diffusion barrier layer and the thermally sprayed NiCoCrAlY coating deposited. The adhesion strength and thermal shock resistance of the NiCoCrAlY coatings with and without the diffusion barrier were evaluated. Thermal shock resistance was investigated by quenching the coated samples in cold water from the temperature of 1100 ˚C. Also, the capability of Re-Ni as the diffusion barrier layer was investigated by isothermal oxidation at 1100 ˚C. The results showed that application of the thin interlayer of Re-Ni as a diffusion barrier beneath the NiCoCrAlY coating could slightly decrease the thermal shock and the adhesion strength of the NiCoCrAlY coating. The thermal expansion coefficient mismatch between the Re-Ni diffusion barrier and the NiCoCrAlY coating and the reduction of the substrate surface roughness due to Re-Ni deposition were the two main mechanisms limiting the lifetime of the NiCoCrAlY coating. But with significant improvement in oxidation resistance, these limitations could be compensated.

Keywords: NiCoCrAlY, Diffusion barrier, Interdiffusion, Adhesion strength, Thermal shock, Oxidation.