Advances in high temperature protective coatings on gas turbine blades

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Abstract

Nowadays high temperature protective coatings have been widely used in the aircraft industries for the protection of hot section components of gas turbine engines, especially turbine blades, against oxidation and/or hot corrosion. This presentation have briefly reviewed the state of the art of the protective coatings on gas turbine blades, and then focused mainly on the developing concepts for the advanced high temperature protective coating. Several results of our efforts on advanced protective coatings for gas turbine blades were presented. The results showed that pulse biased arc ion plating (PBAIP) NiCoCrAlY coatings possessed excellent high temperature properties and optimized mechanical properties. During high temperature exposure, protective alumina scale formed on the coating surface, which made the coatings have excellent capability to resist high temperature oxidation, hot corrosion and thermal cycling. Adding Si and B elements into the coatings increased the chemical activity of the metallic coatings and the adherence of the alumina scale, and therefore improved the high temperature properties of the coatings. By AIP technique, Al-O-N and Cr-O-N diffusion barriers were successfully synthesized in the system of MCrAlY coated Ni-base superalloys. Both diffusion barriers can hold back the interdiffusion effectively. Especially the Cr-O-N film can act as the active diffusion barrier, which can offer a dense ceramic barrier in combination with good adhesive bonding. In the protective coating systems on Ti-Al alloys, the Al2O3/Al diffusion barrier inhibited the serious interdiffusion between the Ti-Al alloys and the NiCoCrAlY coatings. The multi-layered coatings exhibited excellent oxidation resistance and high temperature stability.