Study on CMAS corrosion resistance of Gd_2O_3-Yb_2O_3-Y_2O_3-Nb_2O_5-ZrO_2 composite coating

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Abstract: The high temperature oxide corrosion of environmental deposits (CaO-MgO-Al_2O_3-SiO_2, CMAS) has become one of the important reasons for the premature failure of thermal barrier coatings (TBCs) on aero-engine turbine blades. The CMAS corrosion attached to the surface of the TBCs will quickly penetrate the coating, causing the martensitic transformation of ZrO_2 in the thermal barrier coating, and a large amount of stress is accumulated inside the coating, which leads to the rapid failure of the coating. In this work, Gd_2O_3-Yb_2O_3-Y_2O_3-Nb_2O_5-ZrO_2 (GYYNZO) composite ceramics was prepared with 8YSZ and Gd_2O_3, Yb_2O_3, Y_2O_3 as well as Nb_2O_5 by ball milling. The GYYNZO composite ceramic coatings were prepared by atmospheric plasma spraying (APS). Gd_2O_3, Yb_2O_3, Y_2O_3 and Nb_2O_5 reacted with calcium-magnesium-aluminum-silicate (CMAS) at high temperature to form dense composite oxides, which inhibited the corrosion path of CMAS to the interior of the coating, so as to achieve the purpose of resisting CMAS corrosion.

Keywords thermal barrier coating, CMAS corrosion, atmospheric plasma spraying (APS), GYYNZO composite ceramics

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