IMPROVED OXIDATION RESISTANCE FOR THERMAL BARRIER CERAMIC COATING PROTECT

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ABSTRACT

The oxidation resistance of Ni base super alloy (Monel 400) can be improved by thermal sprayed coatings produced by the high velocity oxygen fuel (HVOF), In this work, (Monel 400) is coated with two different types of coatings, the first one is Al_2O_3+5% TiO_2 and the second is Al_2O_3 +15% (7-8YSZ), these layers were made of 350-400 μm as top coat, pre-sprayed with 50-100 μm of 4NiCr5Al as a bond coat. The results revealed that the Al_2O_3+5% TiO_2 have higher oxidation resistance than Al_2O_3 +15% (7-8YSZ) in the temperature range (600-800)^{0}C in air for 15 h at 3h cycle. X-Ray diffraction (XRD) was used to identify phase formed in the surface layer of as-coated specimens before and after oxidation test. Phase transformation is accompanied by volume expansion, leading to compressive stress during oxidation. It is mentionable that the compressive stresses lead to increase of the hardness. Hardness of Al_2O_3 +15% (7-8YSZ) at (600-700 and800)^{0}C is (723,765 and812) HV $_{0.3}$ respectively is more than Al_2O_3 +5% TiO_2 at the same conditions (610,645 and 690) HV $_{0.3}$ respectively. Porosity transferred oxygen from top coat layer toward the bond coat (4NiCr5Al). Hence, a thermally grown oxide layer ( ) was formed on the metallic bond coat and internal oxidation of the bond coat occurred during oxidation. Microstructural characterization of coatings demonstrated that the growth of the TGO layer with Al_2O_3+15%YSZ is more rapid than TGO with Al_2O_3+5%TiO_2. To assess Adherence Index ,porosity and the hardness for the Al_2O_3 +5% TiO_2 coating are 84%,9% and 454 HV $_{0.3}$ respectively while for the Al_2O_3 +15% (7-8YSZ) coating are 80.1, 17% and483 HV $_{0.3}$ respectively.

KEYWORDS: Sprayed Coatings, Oxidation Resistance, Alumina - Titania, Alumina - Zirconia