Seminar

Institute for Plasma Research

Title : Development of Coating for Hot Corrosion Resistance of AISI 304 Stainless Steel and High Temperature Oxidation Resistance of Inconel 718

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Date : 7th October 2015 (Wednesday)

Time : 11.00 AM

Venue : Seminar Hall, IPR

Abstract:

The present work aims at development of coating for (a) hot corrosion resistance of AISI 304 stainless steel (C 0.08%, Cr 18%, Fe 66%, Mn 2%, Ni 8%, P 0.04%, S 0.03%, Si 1%) and (b) high temperature oxidation resistance of Inconel 718 (Ni-18.8Fe-14Cr-7.3Nb-1.7Mo-1.3Ti-0.7Al) by thermal spray deposition technique. Thermal spray deposition of nickel based hard faced alloy (68.4Ni-17Cr-3.9B-4.9Si-5.8Fe) has been carried out on sandblasted AISI 304 stainless steel by flame spraying and HVOF spraying techniques. A detailed microstructural investigation of flame sprayed layer shows the formation of γ-Ni and refined Ni_3B precipitates. HVOF deposition led to development of Ni_3B and Cr_2B dispersion in partially amorphous γ-Ni matrix. Finally, the hot corrosion behaviour of thermal spray deposited AISI 304 stainless steel with NiCrBSi has been undertaken in a 70%Na_2SO_4+30%NaCl molten salt media in the temperature ranges between 700 °C to 900 °C by cyclic test with total number of 18 cycles of heating and subsequent air cooling. Comparative studies between flame spraying and HVOF spraying show that HVOF spray deposition of NiCrBSi provides lower defect content, denser and better adherent coating than that of coating deposited by flame spraying. The appropriate reaction and mechanism of degradation of AISI 304 stainless steel and NiCrBSi coating in presence of salt mixture of Na_2SO_4 and NaCl are established for the salt mixture of 70 wt% and 30 wt% composition, respectively.

In another effort, an innovative initiative on the development of rare earth modified YSZ (La_2O_3 added (with a maximum of 50 mol%)-YSZ) composite coating has been undertaken on CoNiCrAlY coating applied as the bond coat on INCONEL 718 substrate. The bond coating was deposited by high velocity oxy-fuel spray technique prior to plasma spraying of ceramic top coating. The performance of the coating has been evaluated by evaluation of oxidation resistance property (under both isothermal and cyclic condition) at temperature ranging from 900 °C -1000 °C. There is a marginal improvement in isothermal oxidation resistance and a significant improvement in cyclic oxidation resistance with addition of La_2O_3 in the La_2O_3-YSZ composite TBC. The enhanced cyclic oxidation resistance and reduced failure rate of the TBC coatings by plasma spray deposition of La_2O_3 added YSZ top coating and CoNiCrAlY bond coating deposition by HVOF spray process was attributed to (a) reduced growth kinetics of TGO between bond coat and top coat, (b) increased sintering resistance of top ceramic coating due to La_2O_3 addition in conventional YSZ, (c) reduced in-plane tensile residual stress on the top coat surface and (d) reduced thermal expansion mismatch between Al_2O_3 TGO layer and ceramic top coat.