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**Hot corrosion resistant improvement of Nimonic alloy after Ni-Al-N ions implantation using a small plasma focus device**

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In this work the results of Ni-Al-N ions implantation onto the Nimonic 75 samples by a 4 kJ plasma focus device (PFD) for 5, 10 and 20 shots number are reported. Nimonic alloy is one of the most suitable materials for the gas turbine blade and we aimed to improve the hot corrosion resistance of the blades by a simple and low cost PFD. FESEM images indicate changes in surface morphology before and after ion implantation. XRD results reveal the formation of a nano-crystalline nickel nitride and aluminum nitride coating on the surface of the samples. The electrochemical impedance spectroscopy and hot corrosion results show that the corrosion resistances are significantly improved when NiAlN films are deposited into the Nimonic 75 samples. The increase in hot corrosion weight gain of the coatings follows the following trend: 30 shot < 10 shot < 20 shot < Bare. Hot corrosion tests show that the 30 shots sample has the best hot corrosion resistance behavior compared with other samples. We know that NiAlN ions implantation onto the Nimonic 75 causes the formation of more protective oxide layer at high temperature. The generations of more protective corrosion products limit the access of corrosive species including S, Na and Cl to the interface of metal/oxide layer which ultimately reduces the hot corrosion rate of Nimonic 75. The results of this work confirm that the PFD with its highly energetic ions of nitrogen gas and energetic Nickel and Aluminium plasma (ablated from the Nickel and Aluminium anode tips of the device) provides a useful method for deposition of NiAlN films on the Nimonic alloy as gas turbine blade material.

**Keywords**

Nickel-based alloy

Plasma focus device(PFD)

Turbines

Electrochemical impedance spectroscopy

Hot corrosion