MODELING AND EXPERIMENTAL STUDIES OF DIFFUSION BONDING OF INCONEL 600 TO PYROLYTIC GRAPHITE

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ABSTRACT

Modeling and experimental studies of diffusion bonding of Inconel 600/Nickel/Pyrolytic Graphite is investigated in this research. Modeling implies utilization of ANSYS package to predict axisymmetric thermoelastic finite element analysis from the above materials. The purpose from introducing axisymmetric model are: to achieve more accurate results and less analysis time; to calculate thermal stresses induced across diffusion bonded joints. Investigating thermal stress levels along the potential failure interface is extremely helpful; these residual stresses are mostly the deriving forces of joint failure. Axisymmetric finite element analysis involves applying external pressure on the joint and temperature as second main parameter.

Experimental study implies diffusion bonded joints of Inconel 600 to graphite using nickel was subjected to shear test to assess the bond strength. Based on shear testing results, a critical interlayer thickness as well as temperature, pressure and holding time give optimum diffusion bonding parameters. Furthermore the annealing of cold drawn interlayers and its effect on joint strength were investigated. Modeling and experimental results show that diffusion bonded joints of Inconel 600/ Nickel/ Pyrolytic graphite have optimum shear strength of 12.9 MPa at 850°C, 10 MPa for 30 min holding time using 0.15 mm nickel interlayer. Further studies of the joints were carried out using Metallography, Fractography, X-ray diffraction and microhardness measurements. Metallographic examination and X-ray diffraction demonstrate the formation of new phases and solid solutions.

KEYWORDS: Diffusion Bonding, Inconel 600/ Nickel/ Pyrolytic Graphite