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Microstructure evolution mechanism during post-bond heat treatment of transient liquid phase bonded wrought IN718 superalloy: an approach to fabricate boride-free joints

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Abstract

The microstructure of a transient liquid phase (TLP) bonded nickel base superalloy using B-containing filler metal after completion of isothermal solidification can usually be described by a eutectic-free joint centerline with extensive in-situ boride precipitation in the diffusion affected zone which in turn can affect the joint properties. Therefore, designing a proper post-bond heat treatment is needed to produce a robust joint. This paper addresses the microstructure evolution mechanism during post-bond heat treatment (PBHT) of TLP bonded wrought IN718 nickel base superalloy. PBHT at 1150 ^{o}C, which is lower than the solvus temperature of the borides, for 12 hrs resulted in boride-free joint with uniform chemical composition and enhanced aging response. The microstructure evolution of the bond during PBHT was featured by fragmentation, break up and dissolution of Cr-Mo-Nb rich borides. The dissolution of the borides at a temperature lower than their initial solvus temperature can be attributed to the modification of boride composition during diffusion-induced homogenization process associated with PBHT. Increasing PBHT time resulted in enhanced contribution of solid solution strengthening in the joint centerline and stronger response to aging treatment due to alloying elements homogenization.

Keywords
Transient liquid phase bonding; Superalloy; Boride; Post-bond heat treatment; Homogenization