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Experimental Study on the Correlation between Intermediate Temperature Embrittlement and Equi-Cohesive Temperature

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Abstract

Intermediate temperature embrittlement is a general phenomenon in Ni-based superalloys and is frequently attributed to the equi-cohesive temperature. In this paper, the correlation between intermediate temperature embrittlement and equi-cohesive temperature is studied by the tensile ductility of high-purity Ni and binary Ni(Bi) alloy. Elevated-temperature tensile ductility of the Ni(Bi) alloy shows evident intermediate temperature embrittlement with minimum ductility between 700°C and 750°C, while that of high purity Ni does not. Room-temperature tensile ductility of Ni(Bi) alloy reveals clear minimum after a critical time of isothermal pre-annealing at 650°C or 750°C. The fracture morphologies of tensile samples are well consistent with the changes of their corresponding tensile ductility. Based on these results and reported results of Ni-based superalloys, it is clear that equi-cohesive temperature is insufficient to be a general interpretation for intermediate temperature embrittlement.

Keywords: Ni alloys; Intermediate temperature embrittlement; Equi-cohesive temperature; Tensile test;

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