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Effects of Nb on hot tensile deformation behavior of cast Haynes 25 Co-Cr-W-Ni alloy

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Abstract

Effect of Nb on the hot tensile deformation behavior of cast Haynes 25 Co-Cr-W-Ni alloy was investigated in temperature range of 950-1200 ºC. In the base alloy, thermodynamic calculations showed that $M_{23}C_6$ and M_6C are the stable forms of carbides at temperatures below 1000 ºC and over 1050 ºC, respectively. For Nb-containing alloy, however, WC and NbC are observed below 1050 ºC. At higher temperatures, W carbides dissolve and tungsten diffuses into NbC particles to form complex carbides. The yield point phenomena (YPP) were observed in both alloys at temperatures over 1050 °C due to the immobilization of matrix dislocations by W, Cr and C. Addition of Nb increased the strength and elongation due to the precipitation of NbC carbides. Absorbing the solute atoms and favoring dynamic recrystallization (DRX) seems to be the possible mechanisms. Loss of hot ductility occurred in both alloys at 1050 °C. It was attributed to the dissolution of carbides into matrix and their negative effects on dynamic recovery (DRV) and recrystallization. DRX was the major microstructural mechanism at high temperature, e.g. 1150 °C. At low temperatures, e.g. 950 °C, only DRV occurred.

Keywords: Dynamic recrystallization; Dynamic recovery; Hot deformation; Carbide; Hot ductility trough;

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