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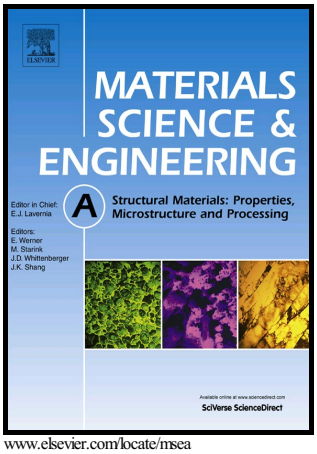

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Effect of Cr content on the microstructures and stress rupture properties of a directionally solidified Ni-based superalloy during long-term thermal exposure

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ABSTRACT

The effects of Cr addition on the microstructure and stress rupture property during long-term thermal exposure have been investigated in a directionally solidified Ni-based superalloy. The increment of Cr content resulting in the excessive precipitation of σ phase is the principal reason for the catastrophic reduction in stress rupture properties. The amounts of rounded cuboidal γ′ and its coalescence increase, but the tendency of γ′ alignment decreases with the increment of Cr content, which leads to the reduction of the stress rupture property to some degree. The change of lattice misfit shows a good agreement with the change of γ′ morphology and the tendency of γ′ alignment. The shape change of γ′ is accompanied by the increase of the misfit dislocation density, which causes the rise of γ′ coalescence. The increase of Cr content can promote the formation of $M_{23}C_6$ or M_6C in the vicinity of primary MC degeneration. Thus, the increased Cr content facilitates the decomposition of primary MC, which deteriorates the stress rupture properties. In addition, the increase of Cr content can promote the formation $M_{23}C_6$ and M_6C along gain boundaries (GBs), facilitating the formation of a semicontinuous chain to some degree and

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