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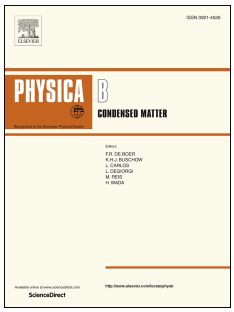

On the correlation between Ta/W ratio and γ′-Ni_3(Al,Ta) lattice ordering

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On the correlation between Ta/W ratio and γ'-Ni_3(Al,Ta) lattice ordering

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Abstract

Evolution of lattice characteristics in ordered γ′ and γ phases affected by Ta/W ratio was investigated in experimental Ni-base superalloys. Experimental analysis using Energy Dispersive Spectroscopy (EDS) and X-Ray Diffraction (XRD) and theoretical calculations illustrated that the ordering degree can be enhanced by the substitution of Ta for Al sites in the γ'-Ni_3(Al,Ta) lattice. A gradual increase in Ta/W ratio led to a noticeable increase in atomic ordering degree of γ'-Ni_3(Al,Ta) precipitates and the intensity values of the γ′ superlattice peaks normalized to that of the γ+γ' fundamental peaks in XRD patterns. EDS elemental analyses indicated that this phenomenon was associated with Ta atoms occupying Al sites in $Ni_3(Al_x,Ta_{1-x})$ superlattice and raise its ordering tendency. Deconvolution of overlapped γ+γ' XRD peaks indicated that γ′ lattice constant varies with the concentrations of Ta and Al. Furthermore, increasing Ta/W content up to 0.5 leads to substitution of Al and Ta for W atoms in the ordered γ′ lattice. Also, by increasing Ta/W ratio far from 0.5, Ta atoms substitute for Al and W atoms. Meanwhile, γ/γ' lattice misfit and lattice parameters of ordered γ′ varied systematically with Ta, W and Al contents of γ′ superlattice.

Keywords: Ni-base superalloy; ordering transformation; ordered γ′; lattice misfit; superlattice