

Al-Mo-Ni-W (Aluminum-Molybdenum-Nickel-Tungsten)

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Two vertical sections in the solidification range of Ni-rich alloys were determined for this quaternary system by [1992Mas].

Lower Order Systems

The phase diagrams of the binary subsystems can be found in [Massalski2]. [2006Rag] presented an update of the Al-Mo-Ni system. An update of the Al-Ni-W system appears in this issue. A review of the Mo-Ni-W was done by [1991Gup]. There are no ternary phases in any of these systems in the Ni-rich region.

Quaternary Phase Equilibria

Starting with high purity metals, [1992Mas] arc-melted under Ar atm 10 quaternary alloys with 14 at.% Al and 7 at.% Mo, or 17 at.% Al and 7 at.% Mo, with W content varying from 2 to 7.5 at.%. To construct vertical sections, the alloys were annealed at a number of temperatures and quenched in water. The phase equilibria were studied with optical metallography, transmission electron microscopy,

x-ray powder diffraction, and x-ray microspectral analysis. The vertical sections at 14Al-7Mo and 17Al-7Mo (atomic percent) constructed by [1992Mas] are shown in Fig. 1 and 2, respectively. The nomenclature used in the figures are: γ (fcc), γ' (Ni_3Al) and α (Mo,W). The liquidus is raised by the addition of W in both the sections, more at the lower Al content (Fig. 1). The liquidus reaches a maximum at 2-3 at.% W. The solubility of Mo or W in γ' at 1200 °C in Al-Mo-Ni or Al-Ni-W alloys is about 5 at.%. The analysis of the phase composition of γ' in the quaternary alloys showed that the solubility of (Mo + W) remains at about 5 at.%, but the ratio of Mo/W in γ' changes significantly with alloy composition [1992Mas].

References

- 1991Gup:** K.P. Gupta, The Mo-Ni-W (Molybdenum-Nickel-Tungsten) System, *Phase Diagrams of Ternary Nickel Alloys, Part 2*, Indian Institute of Metals, Calcutta, 1991, p 134-147
- 1992Mas:** S.B. Maslennikov, N.N. Burova, V.A. Rodimkina, M.D. Bespalova, and O.O. Oldakovskaya, Phase Equilibria in Ni-Al-Mo-W Alloys, *Metally*, 1992, (1), p 227-233, in Russian; TR: *Russ. Metall.*, 1992, (1), p 200-206
- 2006Rag:** V. Raghavan, Al-Mo-Ni (Aluminum-Molybdenum-Nickel), *J. Phase Equilib. Diffus.*, 2006, **27**(4), p 393-396

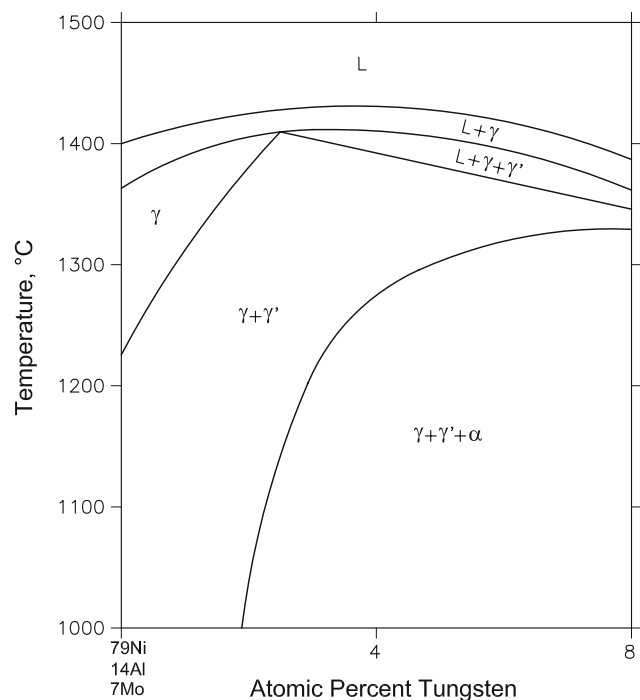


Fig. 1 Al-Mo-Ni-W vertical section at 14 at.% Al and 7 at.% Mo [1992Mas]

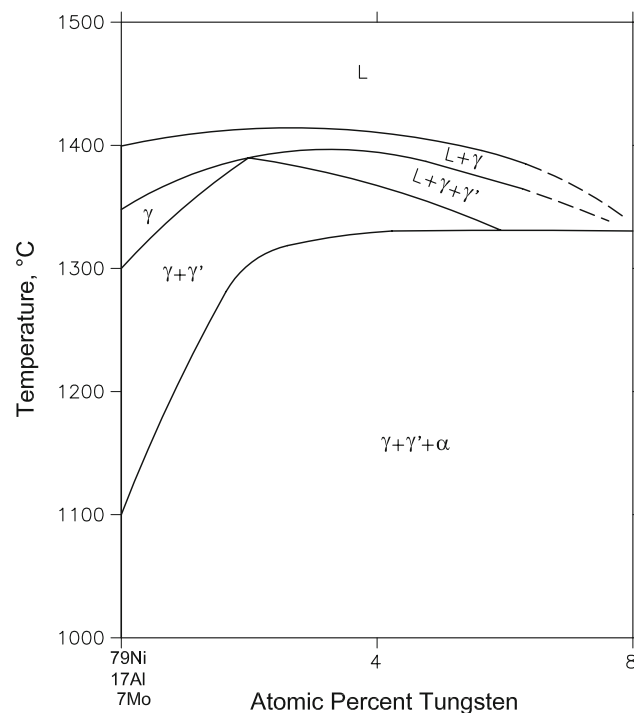


Fig. 2 Al-Mo-Ni-W vertical section at 17 at.% Al and 7 at.% Mo [1992Mas]