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Al-Fe-Mo (Aluminum-Iron-Molybdenum)

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The previous review of this system by [1992Rag] presented two isothermal sections at 1050 and 800 °C from the work of [1970Mar]. Recently, [1999Eum] determined an isothermal section at 1000 °C.

Binary Systems

The Al-Fe phase diagram [1993Kat] shows that the face-centered cubic (fcc) solid solution based on Fe is restricted by a γ loop. The body-centered cubic (bcc) solid solution α exists in the disordered *A*2 form, as well as the ordered *B*2 and $D0_3$ forms. Apart from the high-temperature phase ε, there are three other intermediate phases in the system: $FeAl_2$ (triclinic), Fe_2Al_5 (orthorhombic), and $FeAl_3$ (monoclinic). The Al-Mo phase diagram [1997Sau] depicts seven intermediate phases: $Al_{12}Mo$ ($Al_{12}W$-type cubic), Al_5Mo (Al_5W-type hexagonal), Al_4Mo (Al_4W-type monoclinic), Al_8Mo_3 (monoclinic), $Al_{63}Mo_{37}$, AlMo (bcc), and $AlMo_3$ (Cr_3Si-type cubic). In an appendix to [1997Sau], editor Smith reviewed the results of [1991Sch] and redrew the Al-rich part of the diagram. At 1000 °C, the phases that are stable are Al_4Mo, Al_3Mo, Al_8Mo_3, and $AlMo_3$. In the Fe-Mo phase diagram [1982Gui], the σ phase ($D8_b$, tetragonal) and the *R* phase (rhombohedral) form through peritectic reactions and decompose at or above 1200 °C. The $D8_5$ type rhombohedral phase Fe_7Mo_6 (μ) and the *C*14 type Laves phase Fe_2Mo form in the solid state. The Fe-based bcc phase α and (Mo) show significant mutual solid solubility.

Ternary Compounds

Two Al-rich ternary compounds, Al_8FeMo_3 (τ_1) ($D0_{22}$, Al_3Ti-type tetragonal) and $Al_{12}Fe_7Mo$ (τ_2) (unknown structure), were found at 1050 °C by [1970Mar]. At 1000 °C, [1999Eum] found only the τ_1 phase. [1999Ste] found accidentally a tetragonal phase (*I*4/*mcm*, a = 1.2683 nm and c = 0.4838 nm) at the composition $Mo_9Fe_{4.75}Al_{0.25}$, when annealing alloys containing Fe and Al in Mo tubes.

Isothermal Section

Using starting metals of purity of 99.95% Fe, 99.999% Al, and 99.9% Mo, [1999Eum] prepared about 25 alloy compositions by levitation melting. The samples were given a final anneal at 1000 °C for 500 h and were quenched in brine solution. The phase equilibria were studied by metal-

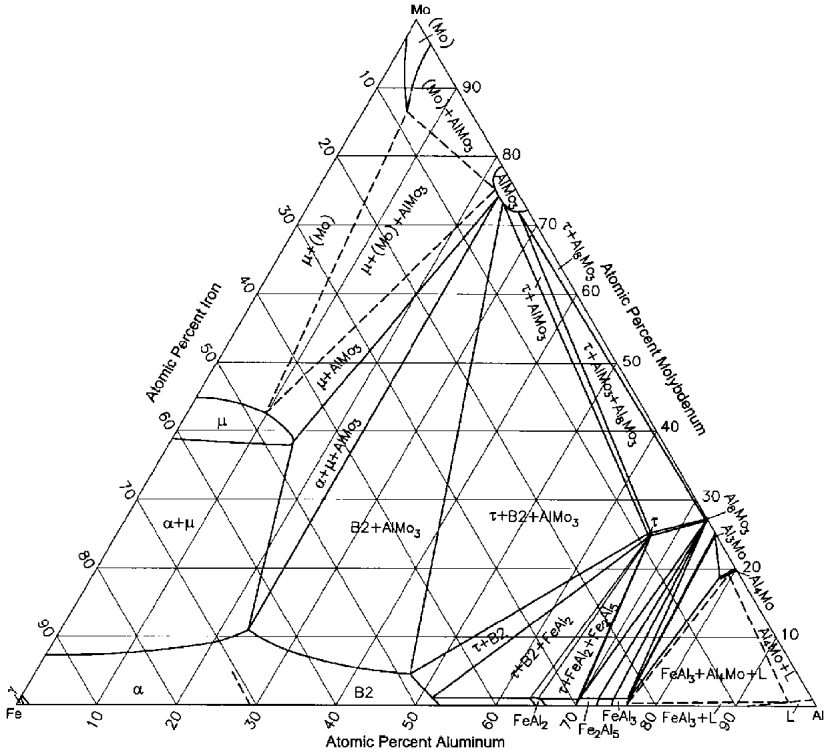

Fig. 1 Al-Fe-Mo isothermal section at 1000 °C [1999Eum]

lography, electron probe microanalysis, and x-ray powder diffraction. The compositions of the coexisting phases were listed. The isothermal section constructed by [1999Eum] is redrawn in Fig. 1 to agree with the accepted binary data. The Fe-based bcc phase and its ordered *B*2 form dissolve up to 11 at.% Mo. The Fe-Mo μ phase dissolves up to 15 at.% Al. Molybdenum dissolves about 8 at.% Fe and 13 at.% Al. The other binary phases show little solubility for the third component. The ternary phase Al_8FeMo_3 (τ_1) is present at the stoichiometric composition.

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