Fe-Mo-Sm (Iron-Molybdenum-Samarium)

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Recently, an isothermal section at 500 °C was determined for this ternary system by [2010Aga], which depicts a ThMn₁₂-type ternary compound.

Binary Systems

In the Fe-Mo phase diagram [Massalski2], the σ phase ($D8_b$ -type tetragonal) and the R phase (rhombohedral) form through peritectic reactions and decompose above 1200 °C. Fe₇Mo₆ (denoted μ ; $D8_5$ -type rhombohedral) and Fe₂Mo ($C14$, MgZn₂-type hexagonal) form in the solid state. The iron-based bcc phase α and Mo show significant mutual solubility. The Fe-Sm phase diagram [Massalski2] has three intermediate compounds: Fe₁₇Sm₂ (Th₂Zn₁₇-type rhombohedral), Fe₃Sm (Ni₃Pu-type rhombohedral) and Fe₂Sm ($C15$, MgCu₂-type cubic). The interaction between Mo and Sm is negligible in the solid and liquid states.

Ternary Isothermal Section

With starting metals of 99.95% Fe, 99.9% Mo and 99.94% Sm, [2010Aga] arc-melted under Ar atm a number

of binary and ternary alloys. After homogenization, the alloys were given a final anneal at 500 °C and were quenched into ice-water mixture. The phase equilibria were studied with optical microscopy, x-ray powder diffraction and electron probe microanalysis. The isothermal section at 500 °C constructed by [2010Aga] is shown in Fig. 1. The ternary compound τ ($D2_b$, ThMn₁₂-type tetragonal) is present at a constant Sm content, with Mo content varying between 11 and 20 at.%. The constant Sm content is taken here to be 7.7 at.%, corresponding to the formula (Fe,Mo)₁₂Sm. The lattice parameters for τ determined by [2010Aga] are: $a \sim 0.856$ - 0.857 nm and $c \sim 0.477$ - 0.4785 nm.

Reference

2010Aga: F.A. Agaeva, N.I. Kaloev, I.M. Bigaeva, L.K. Esieva, and G.M. Chel'dieva, Isothermal Section of the Iron-Molybdenum-Samarium System at 773 K, *Zh. Neorg. Khim.*, 2010, **55**(2), p 294-298, in Russian; TR: *Russ. J. Inorg. Chem.*, 2010, **55**(2), p 286-290

Fig. 1 Fe-Mo-Sm isothermal section at 500 °C [2010Aga]. Narrow two-phase regions are omitted