Bi-Fe-Sm (Bismuth-Iron-Samarium)

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[2000Bod] determined an isothermal section at 400 °C for this system, which depicts a ternary compound of unknown structure.

Binary Systems

There is no mutual solubility between Bi and Fe and there are no intermediate phases in the Bi-Fe system [1993Oka]. In the Bi-Sm system, there are five line compounds: Bi_2Sm , BiSm , Bi_3Sm_4 , Bi_3Sm_5 , and BiSm_2 . See [Massalski2] for the phase diagram. The Fe-Sm phase diagram was reviewed by [1982Kub]. There are three line compounds in this system: $\text{Fe}_{17}\text{Sm}_2$, Fe_3Sm , and Fe_2Sm . See [Pearson3, Massalski2] for structural data on the binary compounds.

Ternary Compounds

A ternary compound $\sim\text{Sm}_5\text{FeBi}_2$ (τ_1) of unknown structure was found by [2000Bod] to be stable from the melting temperature down to 400 °C. An Fe-rich compound $\text{Sm}_6\text{Fe}_{13}\text{Bi}$ (τ_2) was found only in cast alloys and not after annealing at 400 °C. The phase τ_2 is of the $\text{Nd}_6\text{Fe}_{13}\text{Si}$ type (space group $I4/mcm$) with lattice parameters $a = 0.8060$ and $c = 2.3314$ nm [2000Bod].

Ternary Isothermal Section

Using starting materials of purity 99.99% Bi, 99.99% Fe, and 99.98% Sm, [2000Bod] melted 38 alloy compositions in an arc furnace under Ar atm. The alloys were annealed at 400 °C for 240 h and quenched in water. The phase equilibria were studied by x-ray powder diffraction and energy-dispersive x-ray analysis measurements. Their isothermal section at 400 °C is redrawn in Fig. 1 to agree with the accepted binary data. The metastable compound $\text{Fe}_{23}\text{Sm}_6$ is omitted and the phase relationships in this region are tentative. The ternary compound $\sim\text{Sm}_5\text{FeBi}_2$ (τ_1) is located about 2 at.% higher than indicated by the exact stoichiometry [2000Bod]. (αFe) forms tie-lines with four of the five Bi-Sm binary compounds.

References

- 1982Kub:** O. Kubaschewski: *Iron-Binary Phase Diagrams*, Springer-Verlag, Berlin, pp. 104-05.
1993Oka: H. Okamoto: *Phase Diagrams of Binary Iron Alloys*, ASM International, Materials Park, OH, 1993, pp. 62-63.
2000Bod: O. Bodak, J. Stepien-Damm, and E. Galdecka: *J. Alloys Compounds*, 2000, vol. 298, pp. 195-97.

Fig. 1 Bi-Fe-Sm isothermal section at 400 °C [2000Bod]. The thin two-phase fields around tie-triangles are omitted