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: $Fe_{17}Sm_2$, Fe_3Sm, and Fe_2Sm. See [Pearson3, Massalski2] for structural data on the binary compounds.

Ternary Compounds

A ternary compound $\sim Sm_5FeBi_2$ (τ_1) of unknown structure was found by [2000Bod] to be stable from the melting temperature down to 400 °C. An Fe-rich compound $Sm_6Fe_{13}Bi$ (τ_2) was found only in cast alloys and not after annealing at 400 °C. The phase τ_2 is of the $Nd_6Fe_{13}Si$ type (space group *I*4/*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 $Fe_{23}Sm_6$ is omitted and the phase relationships in this region are tentative. The ternary compound $\sim Sm_5FeBi_2$ (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.

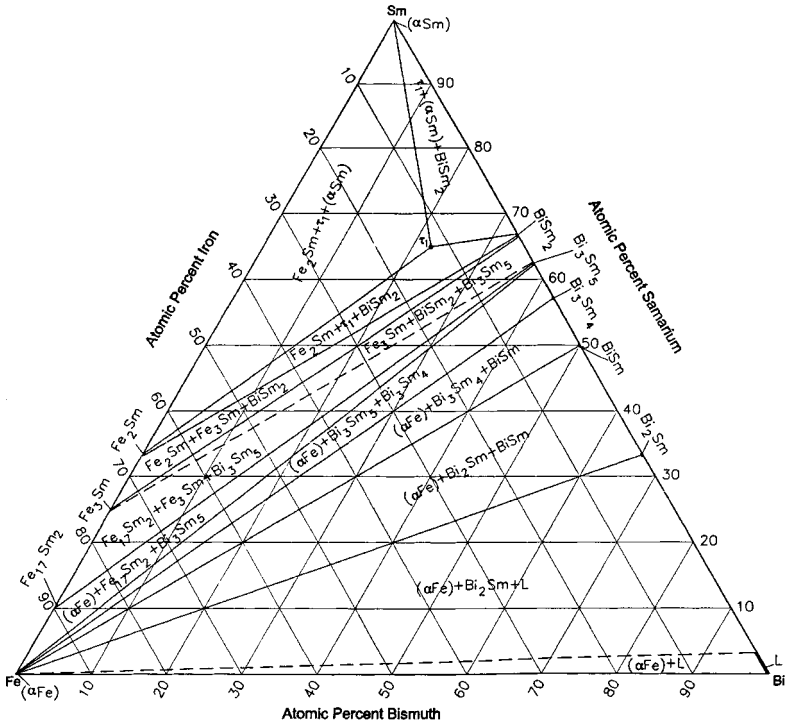

Fig. 1 Bi-Fe-Sm isothermal section at 400 °C [2000Bod]. The thin two-phase fields around tie-triangles are omitted