Bi-Fe-Sn (Bismuth-Iron-Tin)

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Recently, [2010Hua] determined two isothermal sections for this system at 500 and 390 °C, which depict no ternary phases.

Binary Systems

The Bi-Fe phase diagram shows very little solubility between Bi and Fe in the solid state. The Bi-Sn phase diagram is a simple eutectic system, with the eutectic at 139 °C and 57 mass% Bi. The Fe-Sn system has the following intermediate phases: Fe_5Sn_3 ($B8_2$, Ni_2In -type hexagonal), Fe_3Sn_2 (rhombohedral), FeSn ($B35$, CoSn -type hexagonal) and FeSn_2 ($C16$, CuAl_2 -type tetragonal). See [Massalski2] for the above binary diagrams.

Ternary Isothermal Sections

With starting metals of 99.9% Bi, 99.99% Fe and 99.9% Sn, [2010Hua] prepared diffusion couples of

Fe/Sn-57 mass% Bi, which were annealed at 500 °C for 3 days and quenched in water. The Sn-Bi alloy was liquid at the annealing temperature. Three ternary alloys were also prepared and given a final anneal at 500 or 390 °C for 4 months and quenched in water. Using the CALPHAD method, the Fe-Sn phase diagram and three isothermal sections of the ternary system at 500, 395 and 390 °C were computed by [2010Hua]. The computed isothermal sections at 500 and 390 °C agree with the experimental results and are shown in Fig. 1 and 2. There is no ternary solubility in the binary phases and no ternary phase was found.

Reference

2010Hua: Y.C. Huang, W. Gierlotka, and S.W. Chen, Sn-Bi-Fe Thermodynamic Modeling and Sn-Bi/Fe Interfacial Reactions, *Intermetallics*, 2010, **18**, p 984-991

Fig. 1 Bi-Fe-Sn isothermal section at 500 °C [2010Hua]

Fig. 2 Bi-Fe-Sn isothermal section at 390 °C [2010Hua]