

Fe-Pb-Sb (Iron-Lead-Antimony)

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The review of the previous work on this ternary system by [1992Rag] presented a tentative isothermal section at 1200 °C. The miscibility gap between an Fe-rich liquid and a Pb-rich liquid at 1200 °C was determined by [1990Esp] (not reviewed by [1992Rag]). Recently, [2004Sun] determined an isothermal section for this ternary system at 227 °C.

Binary Systems

In the Fe-Pb system, the mutual solid solubility between Fe and Pb is very limited. The Fe-Sb phase diagram has two intermediate phases: FeSb_{1-x} (41-49 at.% Sb; $B8_1$, NiAs-type hexagonal) and FeSb_2 (C18, marcasite-type orthorhombic). By lattice parameter measurements, [2004Sun] determined the homogeneity range of FeSb_{1-x} at 227 °C as 45-47.2 at.% Sb. There are no intermediate phases in the Pb-Sb system. The solubility of Sb in Pb at 227 °C is 3.3 at.% [2004Sun].

Ternary Isothermal Sections

Using the inductively-coupled plasma spectrometry, [1990Esp] determined the compositions of co-existing liquids and the critical point on the miscibility gap at 1200 °C. The three-phase region, where the two liquids

coexist with solid Fe was also delineated. The isothermal section at 1200 °C constructed by [1990Esp] is redrawn in Fig. 1 to agree with the accepted binary data. The compositions of the liquids in the three-phase equilibrium in Fig. 1 differ from those shown on the tentative isothermal section of [1992Rag]. Figure 1 gives the updated values.

With starting metals of 99.5% Fe, 99.9% Pb, and 99.95% Sb, [2004Sun] arc-melted alloys under Ar atm. The final anneal was at 227 °C for 200 h, followed by quenching in liquid nitrogen. The phase equilibria were studied with optical microscopy and x-ray powder diffraction. The isothermal section constructed by [2004Sun] at 227 °C (500 K) is redrawn in Fig. 2 to agree with the accepted binary data. No ternary phase was found.

References

- 1990Esp: A.K. Espeleta, M. Hino, and T. Azakami, Phase Separation and Silver and Gold Distribution in the Pb-Fe-Sb and Pb-Cu-Sb Systems at 1200 °C, *J. Min. Mater. Process. Inst. Jpn.*, 1990, **106**(13), p 825-830, in Japanese
- 1992Rag: V. Raghavan, Fe-Pb-Sb (Iron-Lead-Antimony), *Phase Diagrams of Ternary Iron Alloys, Part 6B*, Indian Institute of Metals, Calcutta, 1992, p 1099-1100
- 2004Sun: Z. Sun and L. Zeng, The Phase Relationship in the Fe-Pb-Sb Ternary System at 500 K, *J. Alloys Compd.*, 2004, **370**, p 133-136

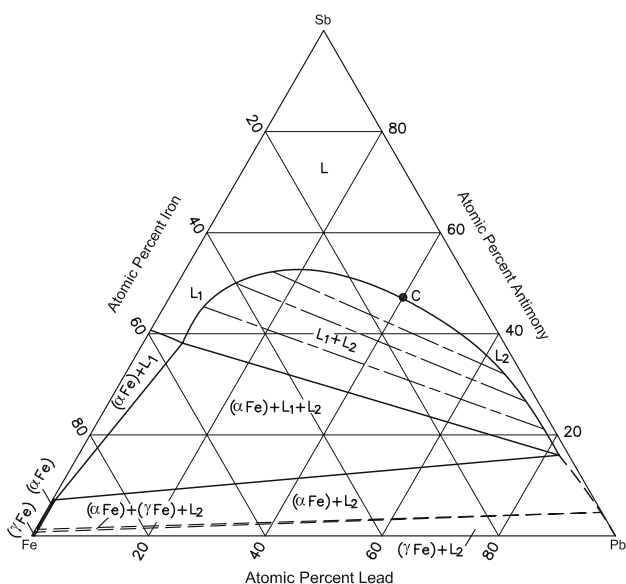


Fig. 1 Fe-Pb-Sb isothermal section at 1200 °C [1990Esp]

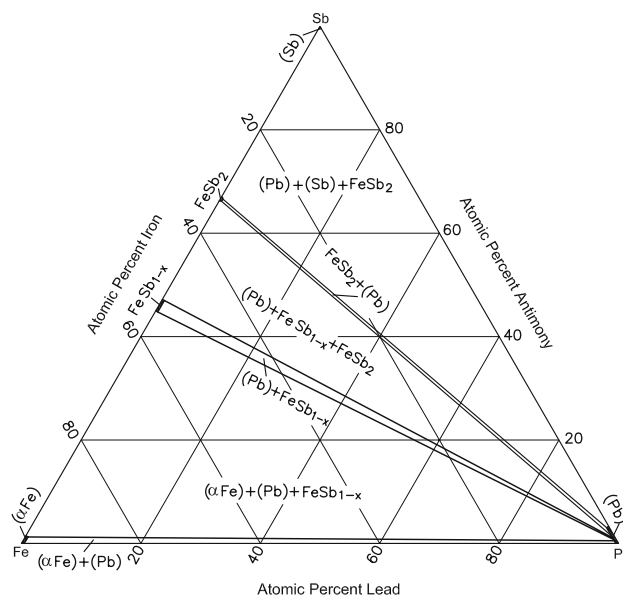


Fig. 2 Fe-Pb-Sb isothermal section at 227 °C (500 K) [2004Sun]