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

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The previous review of this system by [1992Rag] presented a tentative isothermal section at 1200 °C, depicting the liquid miscibility gap in the ternary region. Recently, [2004Sun] reported an isothermal section at 227 °C (500 K), where no ternary compounds were found.

Binary Systems

In the Fe-Pb system, there is very little mutual solubility between Fe and Pb in the liquid or solid state. There are two intermediate phases in the Fe-Sb system. The ε phase, with a NiAs-type hexagonal structure has a maximum homogeneity range of 40-47 at.% Sb [1993Oka]. $FeSb_2$ is a line compound with orthorhombic symmetry. The Pb-Sb phase diagram [Massalski2] is a simple eutectic type, with the eutectic composition and temperature at 17.5 at.% Sb and 251.7 °C, respectively. The maximum solubilities of Sb in Pb and of Pb in Sb are 5.8 and 1.9 at.%, respectively.

Ternary Isothermal Section

With starting metals of 99.5% Fe, 99.9% Pb, and 99.95% Sb, [2004Sun] arc-melted or induction-melted a limited number of ternary alloys under Ar atm. The samples were annealed at 227 °C for 200 h and quenched into liquid nitrogen. The phase equilibria were studied by metallography and x-ray powder diffraction. The isothermal section at 227 °C constructed by [2004Sun] is redrawn in Fig. 1 to agree with the accepted binary data. No ternary phases were found. The homogeneity range of ε at 227 °C is 45-47.2 at.% Sb. The maximum solubility of Sb in Pb is 3.3 at.% [2004Sun].

References

1992Rag: V. Raghavan, The Fe-Pb-Sb (Iron-Lead-Antimony) System, *Phase Diagrams of Ternary Iron Alloys. Part 6,* Indian Institute of Metals, Calcutta, India, 1992, p 1099-1100

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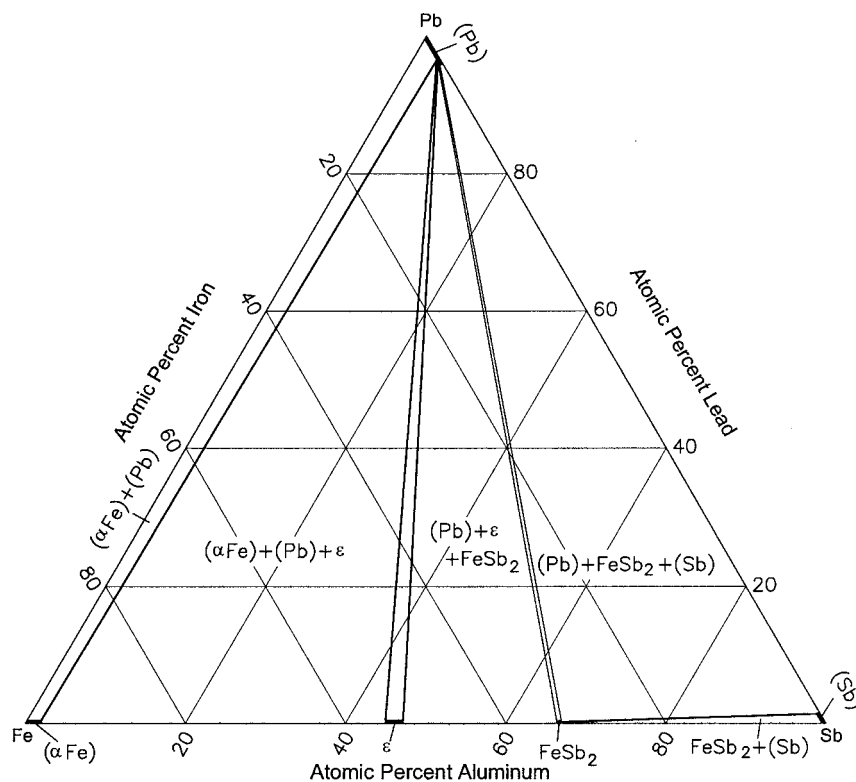
Fig. 1 Fe-Pb-Sb isothermal section at 227 °C [2004Sun]