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

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Recently, [2005Voi] determined the liquid miscibility gap and the distribution of Sb between the Fe-rich and the Pb-rich liquids at 1200 °C in C saturated melts of this quaternary system.

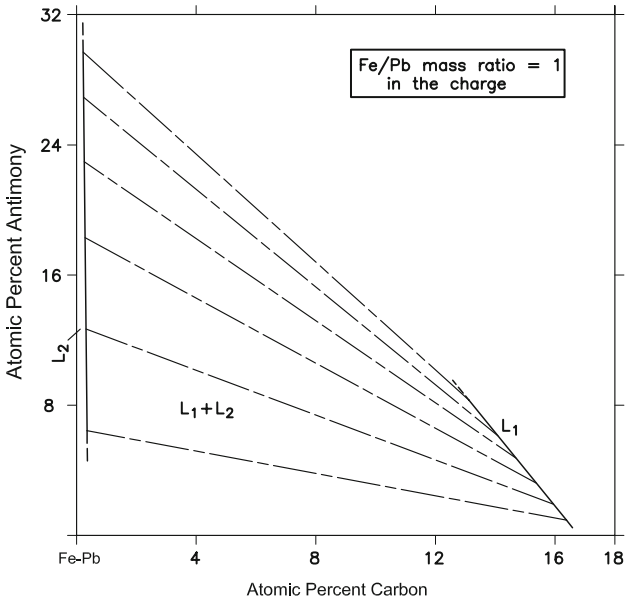

Fig. 1 C-Fe-Pb-Sb distribution of C and Sb between C-saturated Fe-rich liquid L_1 and Pb-rich liquid L_2 at 1200 °C [2005Voi]

Lower Order Systems

In the C-Fe system, the C content at saturation in Fe melts increases from 17.1 at.% at 1152 °C to ~21 at.% at 1600 °C. The C solubility in Pb melts is between 0.41 and 1.6 at.% in the temperature range of 1170 to 1555 °C. The C solubility in Sb melts increases from 0.33 at.% at 1055 °C to 0.94 at.% at 1327 °C. In the Fe-Pb system, there is very limited mutual solubility between Fe and Pb in the liquid and the solid states. The Fe-Sb phase diagram has two intermediate phases: $FeSb_{1-x}$ (NiAs-type hexagonal) and $FeSb_2$ (marcasite-type orthorhombic). There are no intermediate phases in the Pb-Sb system. The known phase diagrams for the above systems are given by [Massalski2].

The limited results on the shift of the Pb-rich boundary of the Fe-Pb system at carbon saturation were reviewed by [1992Rag]. The Fe-Pb-Sb system is updated in this issue. There appear to be no data on the phase equilibria in the C-Fe-Sb and C-Pb-Sb systems.

Quaternary Phase Equilibria

[2005Voi] prepared elemental mixtures with a constant mass ratio of Fe/Pb = 1 and varying C and Sb contents. The samples were sealed in quartz ampules, melted and kept at 1200 °C for 12 h, before quenching in water. The presence of two clearly-separated liquids was confirmed by metallography and electron probe microanalysis (EPMA). The composition was determined by combustion infrared spectrometry for carbon and by EPMA and inductively coupled

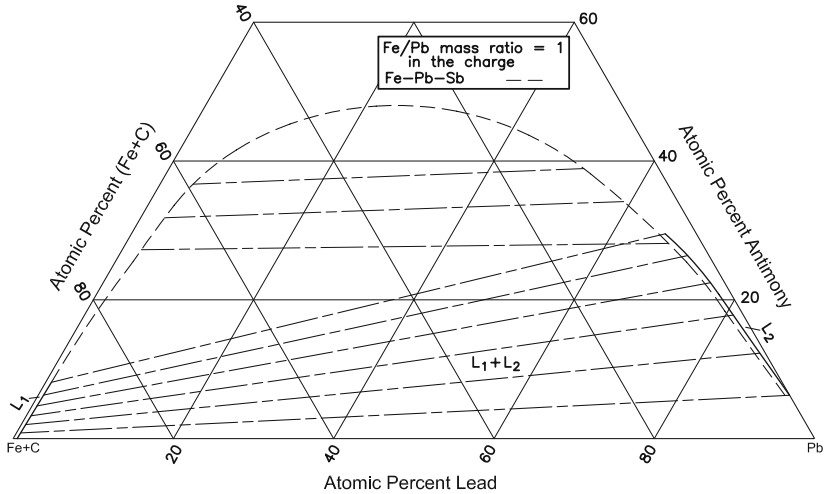

Fig. 2 C-Fe-Pb-Sb partial isothermal section at 1200 °C and at C saturation [2005Voi]

plasma spectrometry (ICP) for the other elements. The measured compositions of the coexisting liquids were listed. The C and Fe contents of the Pb-rich liquid were very small, up to 0.02 and 1 mass %, respectively. The Fe-rich phase had a very small Pb content. Sb was more or less evenly distributed between the two phases. The observed variation in the C and Sb contents of the C-saturated co-existing Fe-rich liquid L_1 and Pb-rich liquid L_2 at 1200 °C is shown in Fig. 1 [2005Voi]. Figure 2 shows the partial isothermal section at 1200 °C and at C-saturation. Superimposed on Fig. 2 is the liquid miscibility gap of the ternary Fe-Pb-Sb system from Fig. 1 of the Fe-Pb-Sb update in this issue.

The effect of minor additions of Ag, Au, Cu and Pt at 1200 °C was also studied by [2005Voi]. It was found that Ag segregated in the Pb-rich phase, Pt segregated in the Fe-rich phase and Au and Cu distributed almost evenly between the two phases.

References

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2005Voi: L. Voisin, H.M. Henao, M. Hino, and K. Itagaki, Phase Relations, Activities and Minor Elements Distribution in Fe-Pb-As and Fe-Pb-Sb Systems Saturated with Carbon at 1473 K, *Mater. Trans.*, 2005, **46**(12), p 3030-3036