

Er-Fe-Sb (Erbium-Iron-Antimony)

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Recently, two isothermal sections were reported for this ternary system: one at 897 °C by [2004Mor] and the other at 500 °C by [2006Cai].

Binary Systems

The Er-Fe phase diagram [Massalski2] shows four line compounds: $\text{Fe}_{17}\text{Er}_2$ ($\text{Ni}_{17}\text{Th}_2$ -type hexagonal), $\text{Fe}_{23}\text{Er}_6$ ($D8_a$, $\text{Mn}_{23}\text{Th}_6$ -type cubic), Fe_3Er (rhombohedral), and Fe_2Er ($C15$, MgCu_2 -type cubic). Two intermediate phases are known in the Er-Sb system: Er_5Sb_3 (Y_5Bi_3 -type orthorhombic [2004Mor]) and ErSb ($B1$, NaCl -type cubic). The Fe-Sb phase diagram [1997Ric] has two intermediate phases: FeSb_{1-x} (41-49 at.% Sb; $B8_1$, NiAs -type hexagonal) and FeSb_2 ($C18$, marcasite-type orthorhombic).

Ternary Isothermal Sections

With starting metals of 99.8% Er, 99.9% Fe, and 99.99% Sb, [2004Mor] arc-melted 8 ternary alloys under Ar atm. The samples were annealed at 897 °C (1170 K) for 2 weeks and quenched in water. The phase equilibria were studied with x-ray powder diffraction, local composition analysis, and metallography. The isothermal section at 897 °C (1170 K) constructed by [2004Mor] is shown in Fig. 1. A ternary compound Er_6FeSb_2 (Zr_6CoAs_2 -type hexagonal, denoted τ here) is present. There is no measurable solubility of the third component in the binary compounds.

With starting metals of 99.9% Er, 99.9% Fe, and 99.95% Sb, [2006Cai] arc-melted under Ar atm 12 binary and 11 ternary alloy samples. The final anneal was at 500 °C for 1 week, followed by quenching in liquid

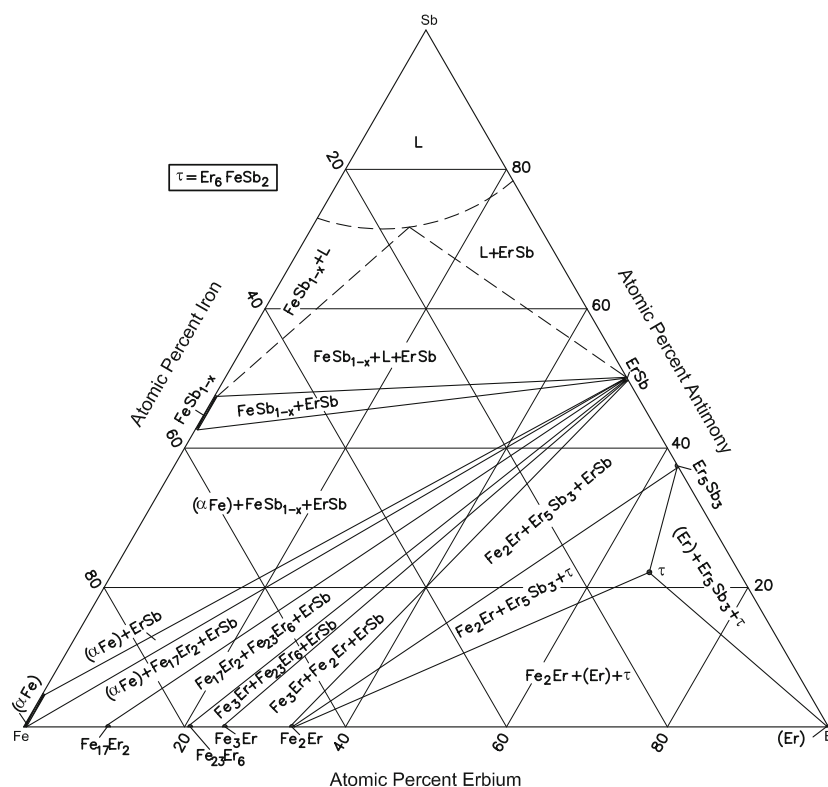


Fig. 1 Er-Fe-Sb isothermal section at 897 °C (1170 K) [2004Mor]. Narrow two-phase regions are omitted

Section II: Phase Diagram Evaluations

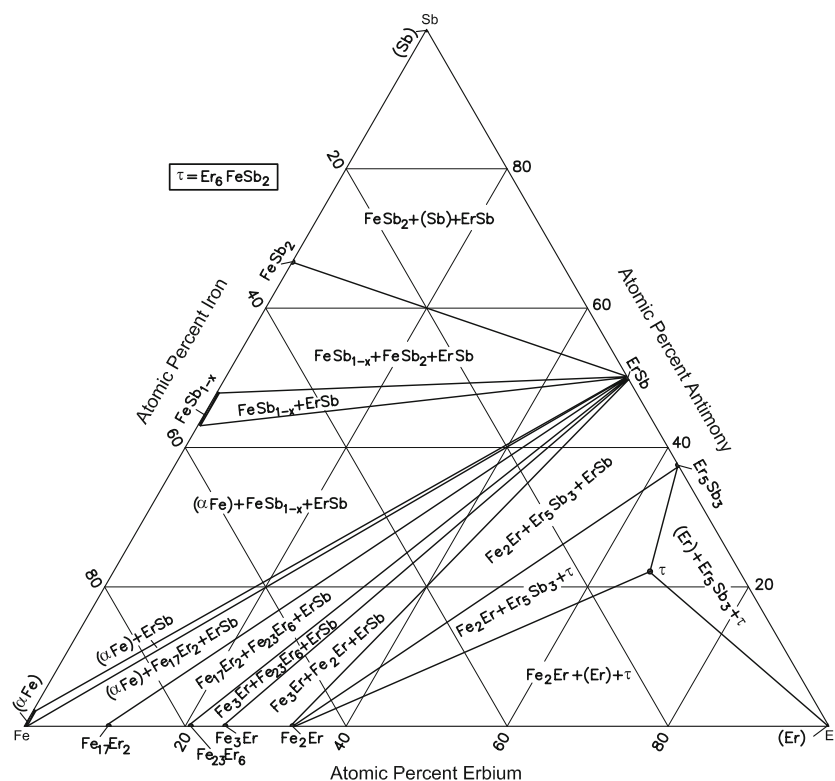


Fig. 2 Er-Fe-Sb isothermal section at 500 °C [2006Cai]. Narrow two-phase regions are omitted

nitrogen. The phase equilibria were studied with metallography and x-ray powder diffraction. The isothermal section at 500 °C constructed by [2006Cai] is shown in Fig. 2. It is similar to the one at 897 °C (Fig. 1), except for the solidification of the Sb-rich liquid and the presence of FeSb₂. The ternary compound Er₆FeSb₂ (τ) is present. The solubility of the third component in the binary compounds is negligible.

References

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- 2006Cai:** G. Cai, X. Wei, and L. Zeng, The Isothermal Section of the Er-Fe-Sb Ternary System at 773 K, *J. Alloys Compd.*, 2006, **420**, p 133-135