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Au-Fe-Sn (Gold-Iron-Tin)

V. Raghavan

An isothermal section at 400 °C was determined for this system by Neumann et al. [1996Neu].

Binary Systems

The Au-Fe binary diagram by [1993Oka1] depicts a peritectic reaction at 1173 °C between (γFe) and liquid containing 56.8 at.% Fe, which yields (Au) containing 74.1 at.% Fe. The Fe solubility in (Au) decreases with decreasing temperature reaching 9 at.% at 400 °C. The Au solubility in (αFe) is negligible at 400 °C. There are no intermediate phases in Au-Fe system. The update by [1993Oka2] of the Au-Sn system depicts a number of intermediate phases: $Au_{10}Sn$ (β), ζ (9.1-17.6 at. %Sn), ζ′ (Au_5Sn), δ (AuSn), ε ($AuSn_2$), and η ($AuSn_4$). For crystal structure data, see [Pearson3] or [1993Oka2]. Among these phases, β ($D0_{24}$), ζ ($A3$), and δ ($B8_1$) are stable at 400 °C. The Fe-Sn phase diagram [1993Oka3] depicts a miscibility gap in the liquid state and a γ loop at the Fe end. The intermediate phases are the hexagonal Ni_2In-type Fe_5Sn_3, rhombohedral Fe_3Sn_2, hexagonal CoSn-type FeSn, and tetragonal $CuAl_2$-type $FeSn_2$. The first two phases decompose eutectoidally at 765 and 607 °C, respectively. FeSn and $FeSn_2$ are stable at the temperature of interest here (400 °C).

Ternary Isothermal Section

With starting materials of 99.95% Au, 99.998% Fe and 99.98% Sn, [1996Neu] melted alloy compositions in evacuated silica tubes. The samples were annealed at 400 °C for 2-7 d and quenched in water. The phase equilibria were studied by metallography, x-ray powder diffraction and electron probe microanalysis. Differential thermal analysis measurements were also carried out between 20 and 1000 °C at a heating rate of 5 °C/min. The isothermal section at 400 °C determined by [1996Neu] is redrawn in Fig. 1 to agree with the accepted binary data. The solubility of Fe in β, ζ, and δ phases of the Au-Sn system is less than 2 at.%. The two liquid phases along the Au-Sn side dissolve not more than 2 at.% Fe. In FeSn and $FeSn_2$ phases, less than 1 at.% Au dissolves [1996Neu]. The solubility of Au in Fe_5Sn_3 in the temperature range of its stability (765-910 °C) is not appreciable

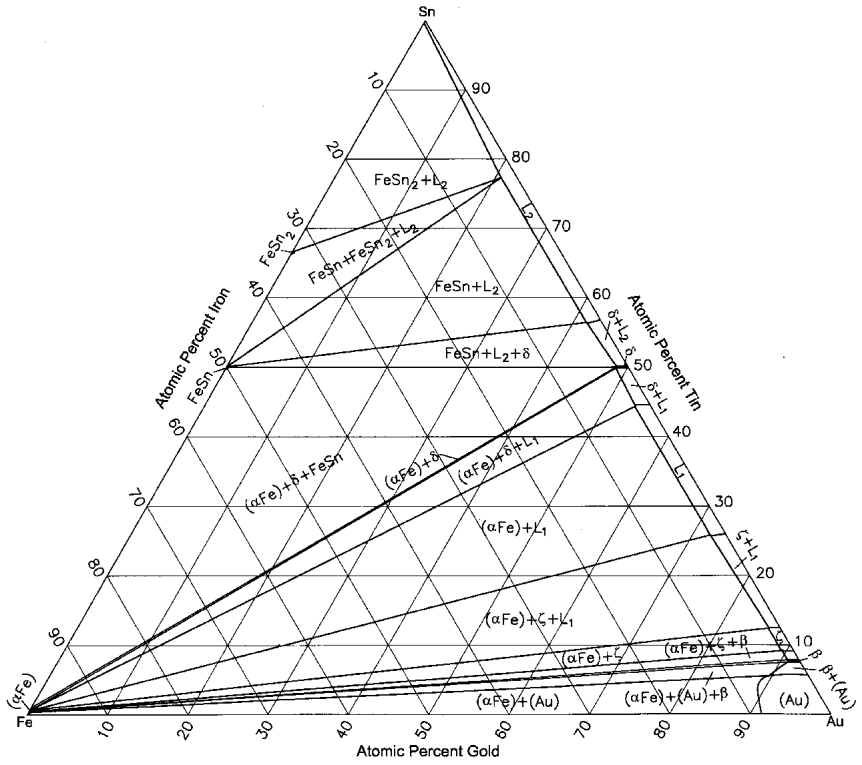

Fig. 1 Au-Fe-Sn isothermal section at 400 °C [1996Neu]

[1996Neu]. No ternary phases were found in the system between 850 and 200 °C

References

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