JPEDAV (2008) 29:457
DOI: 10.1007/s11669-008-9383-z
1547-7037 ©ASM International

Fe-S-Zn (Iron-Sulfur-Zinc)

V. Raghavan

The previous review of this system by [1988Rag1] presented a schematic liquidus projection, a reaction scheme and four isothermal sections at 850, 700, 600, and 400 °C, mainly from the studies of [1966Bar]. An update by [2004Rag] gave an additional isothermal section at 927 °C. Recently, [2007Tan] determined an isothermal section for this system at 450 °C.

Binary Systems

The Fe-S system [1988Rag2] has two intermediate phases at 450 °C: $Fe_{1-x}S$ (NiAs-type hexagonal) is stable between 50 and 55 at.% S; FeS_2 (*C*2, pyrite-type cubic) forms peritectically at 743 °C and transforms to FeS_2 (*C*18, marcasite-type orthorhombic) at 425 °C. The intermediate phases in the Fe-Zn system are: Γ (Fe_3Zn_{10}; Cu_5Zn_8-type cubic), Γ_1 ($Fe_{11}Zn_{40}$; cubic, space group $F\bar{4}3m$, 408 atoms/cell), δ ($FeZn_{10}$; $FeZn_{10}$-type hexagonal), and ζ ($CoZn_{13}$-type monoclinic). In the Zn-S system, a congruently-melting compound ZnS (*B*4, wurtzite-type hexagonal) transforms to ZnS (*B*3, sphalerite-type cubic) at 1020 °C during cooling.

Ternary Isothermal Section

With starting metal powders of >99.99 % purity, [2007Tan] mixed and compacted powder samples, which were annealed in evacuated quartz tubes at 450 °C for 2 months and quenched in water. The phase equilibria were studied with x-ray powder diffraction, and a scanning electron microscope equipped with energy dispersive x-ray spectroscope. The isothermal section at 450 °C constructed by [2007Tan] is shown in Fig. 1. It is very similar to the section at 400 °C given by [1988Rag1], except for the presence of the Zn-rich liquid at 450 °C in place of (Zn). The solubility of S in Fe-Zn compounds and Zn in Fe-S compounds was found to be negligible.

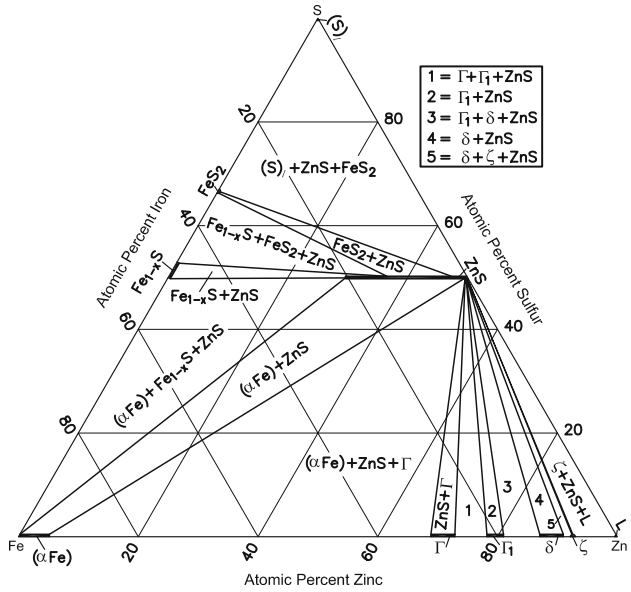

Fig. 1 Fe-S-Zn isothermal section at 450 °C [2007Tan]

References

1966Bar: P.B. Barton, Jr. and P. Toulmin, Phase Relations Involving Sphalertite in the Fe-Zn-S System, *Econ. Geol.*, 1966, **61**(5), p 815-849

1988Rag1: V. Raghavan, Fe-S-Zn (Iron-Sulfur-Zinc), *Phase Diagrams of Ternary Iron Alloys, Part 2: Ternary Systems Containing Iron and Sulfur*, Indian Institute of Metals, Calcutta, 1988, p 335-349

1988Rag2: V. Raghavan, Fe-S (Iron-Sulfur), *Phase Diagrams of Ternary Iron Alloys, Part 2: Ternary Systems Containing Iron and Sulfur*, Indian Institute of Metals, Calcutta, 1988, p 5-9

2004Rag: V. Raghavan, Fe-S-Zn (Iron-Sulfur-Zinc), *J. Phase Equilb. Diffus.*, 2004, **25**(4), p 382-383

2007Tan: Z. Tan, X. Su, Z. Li, Y. Liu, and J. Wang, Phase Equilibria in the Zn-Fe-S System at 450 °C, *Z. Metallkd.*, 2007, **98**(1), p 16-20