Fe-Sm-V (Iron-Samarium-Vanadium)

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[1996Sug] determined isothermal sections for this system at 1100 and 1200 °C for Fe-rich alloys, which depict the 3:29 and 1:12 ternary compounds.

Binary Systems

The Fe-Sm system was reviewed by [1982Kub]. There are three line compounds in this system: $Fe_{17}Sm_2$, Fe_3Sm, and Fe_2Sm. The addition of Sm lowers the melting point of Fe substantially, with Sm-rich alloys solidifying through a eutectic reaction at 720 °C. The Fe-V system was reviewed by [1993Smi]. The presence of a γ loop and the intermediate phase σ with a significant homogeneity range are the characteristic features of this system. The Sm and V do not dissolve in each other to any significant extent [Massalski2]. See [Pearson3] for structural data on the binary compounds.

Ternary Compounds

Two ternary compounds, $Sm_3(Fe,V)_{29}$ (denoted here the 3:29 phase) and $Sm(Fe,V)_{12}$ (denoted 1:12), were found in this system by [1996Sug]. In addition, the binary compound $Fe_{17}Sm_2$ was found to dissolve up to 5.5 at.% V at constant Sm content. $Sm_3(Fe,V)_{29}$ has the $Nd_3(Fe,Ti)_{29}$-type monoclinic structure. $Sm(Fe,V)_{12}$ has the $ThMn_{12}$-type tetragonal structure. The lattice parameters were not determined by [1996Sug].

Ternary Isothermal Sections

The purity of the starting metals was not stated by [1996Sug]. Twelve alloy compositions were prepared by induction melting in Ar atm. The alloys were annealed at 1100 and 1200 °C for 20 h and quenched in water. The phase equilibria were studied by x-ray powder diffraction, energy-dispersive x-ray analysis, and scanning electron microscopy techniques. The isothermal sections determined by [1996Sug] at 1100 and 1200 °C are redrawn in Fig. 1 and 2 to agree with the accepted binary data. At 1100 °C, both the 3:29 and 1:12 ternary phases are present. The V content of the 3:29 phase ranges from 5.6 at.% to at least 9.2 at.%. The homogeneity range of the 1:12 phase is from 10 to 14 at.% V at constant Sm content. $Fe_{17}Sm_2$, 3:29, 1:12, and (αFe) are in equilibrium with the Sm-rich liquid. At 1200 °C (Fig. 2), the phase distribution is the same as at 1100 °C, but the V ranges of the two ternary compounds are smaller, especially that of the 1:12 phase.

References

1982Kub: O. Kubaschewski: *Iron-Binary Phase Diagrams*, Springer-Verlag, Berlin, 1982, pp. 104-05.

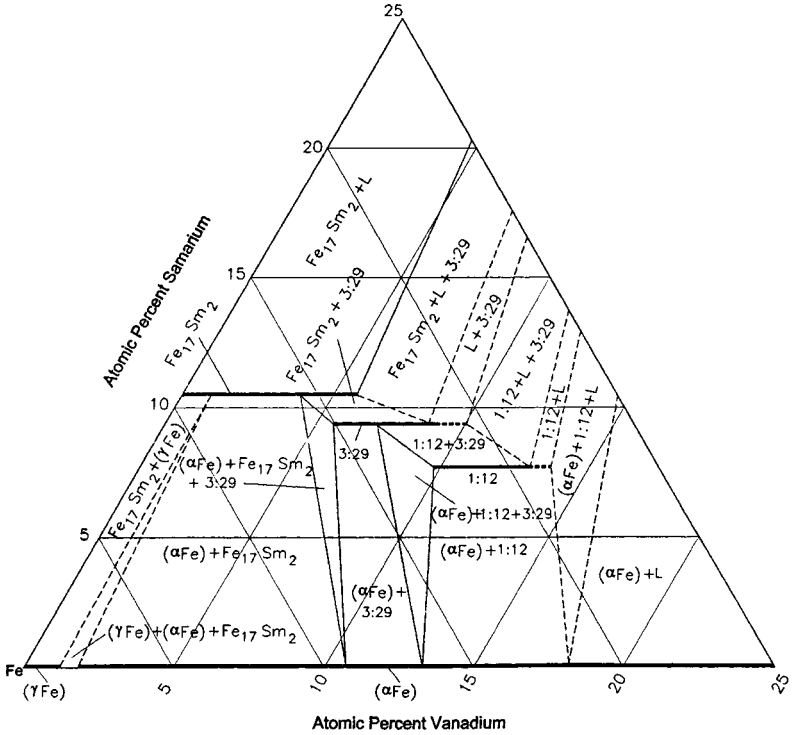

Fig. 1 Fe-Sm-V isothermal section for Fe-rich alloys at 1100 °C [1996Sug]

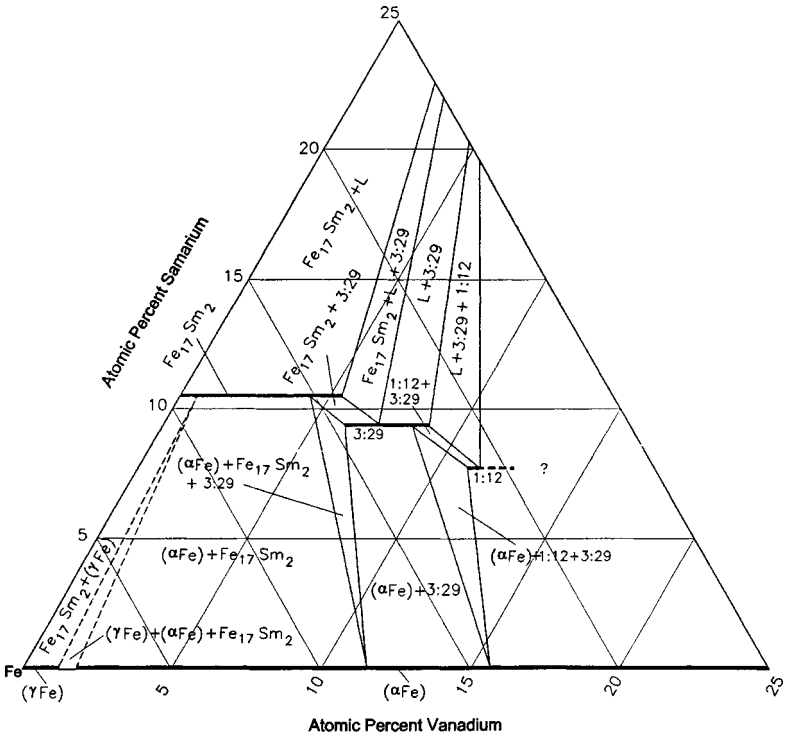

Fig. 2 Fe-Sm-V isothermal section for Fe-rich alloys at 1200 °C [1996Sug]

1993Smi: J.F. Smith: *Phase Diagrams of Binary Alloys,* H. Okamoto, ed., ASM International, Materials Park, OH, 1993, pp. 433-43.

1996Sug: S. Sugimoto, T. Shimono, H. Nakamura, T. Kagotani, M. Okada, and M. Homma: *Mater. Trans. Jpn. Inst. Met.*, 1996, vol. 37 (3), pp. 494-98.