Fe-Gd-S (Iron-Gadolinium-Sulfur)

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Due to lack of data, this system has not been reviewed before. Recently, [91And] determined a pseudobinary section for this system along the FeS-Gd₂S₃ join.

Binary Systems and Phases

For a brief review of the Fe-S system, see [88Rag]. [Massalski2] has reviewed the Fe-Gd phase diagram. For a partial Gd-S diagram between GdS-Gd₂S₃, see [Massalski2]. Gd₂S₃ forms congruently at ~1850 °C. The βGd₂S₃ → αGd₂S₃ transition occurs at ~950 °C. βGd₂S₃ has the Th₃P₄-type cubic structure. αGd₂S₃ forms the La₂S₃-type orthorhombic structure with $a = 0.7339$ nm, $b = 0.3932$ nm, and $c = 1.5273$ nm [Pearson3].

The FeS-Gd₂S₃ Pseudobinary Section

Using metallography, x-ray powder diffraction, and DTA measurements, [91And] determined a pseudobinary section for this system along the FeS-Gd₂S₃ join. Their section is redrawn in Fig. 1. No ternary compounds were found on this section. Solidification is complete through a eutectic reaction at 13 mol% Gd₂S₃ and at 1057 °C. The solubility of Gd₂S₃ in FeS at the eutectic temperature is 2.5 mol%. The lattice parameter of βGd₂S₃ decreases linearly from $a = 0.8377$ nm for pure Gd₂S₃ to $a = 0.8366$ nm at 9.5 mol% FeS (solubility limit) [91And].

[91 And] indicate the β → α transition in Gd₂S₃ at ~1190 °C, not in agreement with the Gd-S binary data of [Massalski2] quoted above.

Fig. 1 FeS-Gd₂S₃ pseudobinary section [91And].

Cited References

- 88Rag:** V. Raghavan, "The Fe-S System," *Phase Diagram of Ternary Iron Alloys. Part 2*, Indian Institute of Metals, Calcutta, 5-9 (1988). (Review; #)
- 91And:** O.V. Andreev and V.M. Andreeva, "Phase Diagrams of the Systems FeS-Ln₂S₃ (Ln = Nd, Gd)," *Izv. Akad. Nauk SSSR, Neorg. Mater.*, 27(11), 2261-2264 (1991) in Russian; TR: *Inorganic Mater.*, 27(11), 1927-1930 (1991). (Experimental; #)

Indicates presence of a phase diagram.