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Fe-Gd-Sb (Iron-Gadolinium-Antimony)

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Recently, [2008Liu] determined an isothermal section at 500 °C for this ternary system, which depicts no ternary phases.

Binary Systems

The Fe-Gd phase diagram [1998Zha] depicts the following intermediate compounds: $\beta Fe_{17}Gd_2$ (Th_2Ni_{17}-type hexagonal), $\alpha Fe_{17}Gd_2$ (Th_2Zn_{17}-type rhombohedral), $Fe_{23}Gd_6$ ($D8_a$, $Mn_{23}Th_6$-type cubic), Fe_3Gd (Ni_3Pu-type rhombohedral), and Fe_2Gd ($C15$, $MgCu_2$-type cubic). The Fe-Sb phase diagram [Massalski2] has two intermediate phases: $FeSb_{1-x}$ ($B8_1$, NiAs-type hexagonal) and $FeSb_2$ (orthorhombic). The Gd-Sb phase diagram [Massalski2, 2008Liu] has the following intermediate phases: Gd_5Sb_3 ($D8_8$, Mn_5Si_3-type hexagonal), Gd_4Sb_3 ($D7_3$, Th_3P_4-type cubic), βGdSb, αGdSb ($B1$, NaCl-type cubic), and $Gd_{16}Sb_{39}$ ($Gd_{16}Sb_{39}$-type monoclinic).

Ternary Compound

[1994Lei] identified a ternary compound at the composition $GdFe_{1-x}Sb_2$ in arc-melted samples annealed at 800 °C for 7 days. It has the $ZrCuSi_2$-type tetragonal structure (space group $P4/nmm$).

Ternary Isothermal Section

With starting metals of 99.9% Fe, 99.9% Gd and 99.99% Sb, [2008Liu] arc-melted 147 alloys under Ar atm. The final anneal was at 500 °C for 7 days, followed by quenching in liquid nitrogen. The phase equilibria were studied mainly by x-ray powder diffraction. The isothermal section constructed by [2008Liu] at 500 °C is redrawn in Fig. 1. The binary compound $Fe_{23}Gd_6$ was not found by [2008Liu] at this temperature. The conflicting results in the literature regarding the temperature range of stability of this compound were discussed by [1998Zha], who, however, concluded that the phase is stable down to room temperature. The third component solubility in the binary compounds is negligible [2008Liu]. The ternary phase $GdFe_{1-x}Sb_2$ found at 800 °C by [1994Lei] was not found by [2008Liu] at 500 °C.

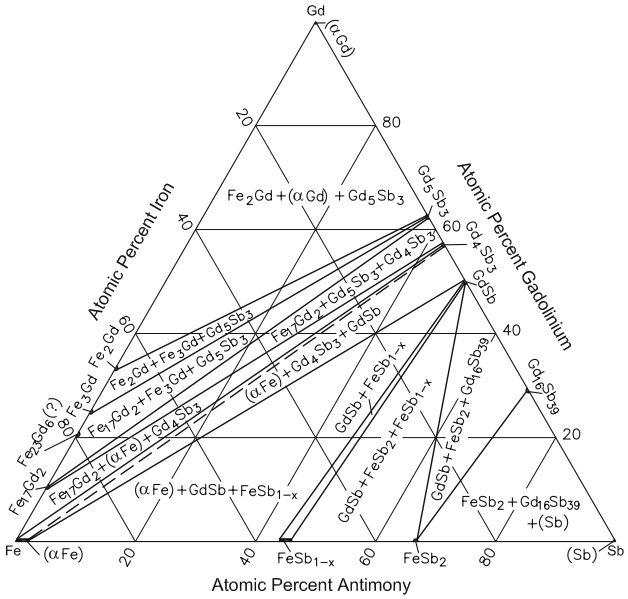

Fig. 1 Fe-Gd-Sb isothermal section at 500 °C [2008Liu]. Narrow two-phase regions are omitted

References

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