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Dy-Fe-Sn (Dysprosium-Iron-Tin)

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Recently, [2005Per] reported an isothermal section at 800 °C for this system, which depicts two ternary phases, one of them based on the binary compound $DySn_2$.

Binary Systems

In the Dy-Fe system [Massalski2], there are four intermediate compounds of fixed stoichiometry: $Fe_{17}Dy_2$ (Ni_{17} Th_2-type hexagonal), $Fe_{23}Dy_6$ ($D8_a$, Mn_{23} Th_6-type cubic), Fe_3Dy (Ni_3Pu-type rhombohedral), and Fe_2Dy ($C15$, $MgCu_2$-type cubic). The Dy-Sn phase diagram [2005Oka, 2005Per] depicts a number of intermediate phases: Dy_5 Sn_3 ($D8_8$, Mn_5Si_3-type hexagonal), Dy_5 Sn_4 (Sm_5Ge_4-type orthorhombic), Dy_{11} Sn_{10} ($Ho_{11}Ge_{10}$-type tetragonal), DySn (unknown structure), Dy_4 Sn_5 (unknown structure), $DySn_2$ ($C49$, $ZrSi_2$-type orthorhombic), and $DySn_3$ (orthorhombic). The Fe-Sn phase diagram [1993Oka] depicts a miscibility gap in the liquid state and a γ loop at the Fe end. The intermediate phases are: Fe_5 Sn_3 ($B8_2$, Ni_2In-type hexagonal), Fe_3 Sn_2 (rhombohedral), FeSn ($B35$, CoSn-type hexagonal), and $FeSn_2$ ($C16$, $CuAl_2$-type tetragonal).

Ternary Phases

The two established ternary phases are: $Dy_xFe_6Sn_6$ ($0.32 < x \leq 1$; denoted τ here) and $DyFe_xSn_2$. ($0 < x \leq 0.2$) [2005Per]. $Dy_{0.3\text{-}0.5}Fe_6Sn_6$, with $SmMn_6Sn_6$ as the prototype, has hexagonal parameters a = 0.53175−0.53347 nm and c = 0.88890−0.88946 nm. $DyFe_6Sn_6$, with $HfFe_6Ge_6$ as the prototype, has hexagonal parameters: a = 0.53848 nm and c = 0.89027 nm. $DyFe_6Sn_6$, with YFe_6Sn_6 as the prototype, has orthorhombic parameters: a = 0.89027 nm, b = 7.4597 nm and c = 0.53848 nm [2005Per]. $DyFe_{0.05\text{-}0.3}Sn_2$ is an insertion type orthorhombic compound with $CeNiSi_2$ as the prototype, and parameters a = 0.43946−0.44111 nm, b = 1.62498−1.62700 nm and c = 0.43139−0.43440 nm [2005Per].

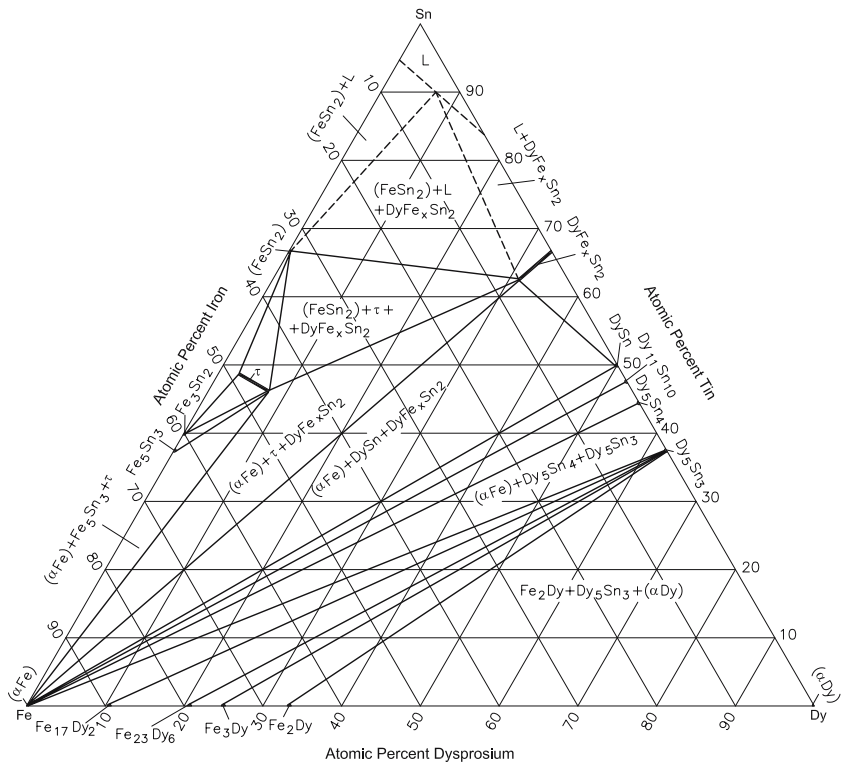

Fig. 1 Dy-Fe-Sn isothermal section at 800 °C [2005Per]. Narrow two-phase regions are omitted

Isothermal Section

With starting metals of 99.9% purity, [2005Per] arc-melted about 25 ternary alloys. The samples were annealed at 800 °C for 14 days and quenched in water. The phase equilibria were studied by x-ray powder diffraction. The isothermal section at 800 °C constructed by [2005Per] is redrawn in Fig. 1. [2005Per] did not detect Dy_4Sn_5 at 800 °C. $FeSn_2$ shown in Fig. 1 is probably stabilized at 800 °C by minute quantities of Dy [2005Per].

References

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