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Dy-Fe-Tb (Dysprosium-Iron-Terbium)

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The previous review of this system by [1992Rag] summarized the results of [1990Wes] on the partial and schematic vertical section in the region of the Laves phase $(Dy,Tb)Fe_2$, which possesses excellent magnetostrictive properties. Recently, Mei et al. [1997Mei] reinvestigated the vertical section in the region of the Laves phase.

Binary Systems

The Dy-Fe phase diagram was updated by [1996Oka]. It depicts four intermediate compounds: the Th_2Ni_{17}-type hexagonal compound Dy_2Fe_{17}, the Th_6Mn_{23}-type cubic phase Dy_6Fe_{23}, the $PuNi_3$-type rhombohedral $DyFe_3$, and the $MgCu_2$-type cubic phase $DyFe_2$. In the Dy-Tb system [Massalski2], βDy and βTb [both body-centered cubic (bcc)] form a continuous solid solution. Also, αDy and αTb [both close-packed hexagonal (cph)] form a continuous solid solution. In the Fe-Tb system [Massalski2], there are four intermediate phases: Th_2Ni_{17}-type hexagonal and the Th_2Zn_{17}-type rhombohedral modifications of Tb_2Fe_{17}, the Th_6Mn_{23}-type cubic phase Tb_6Fe_{23}, the $PuNi_3$-type rhombohedral phase $TbFe_3$, and the $MgCu_2$-type cubic phase $TbFe_2$.

Ternary Vertical Section

With starting materials of purity of 99.99%, [1997Mei] arc melted 30 alloy buttons in the composition range of $Dy_{1-x}Tb_xFe_y$ ($x = 0.3, 0.5$; $y = 1.7$ to 2.1), which lies in the Laves phase region. Differential thermal analysis at a heating rate of 3-20 °C per min and annealing/quenching meth-

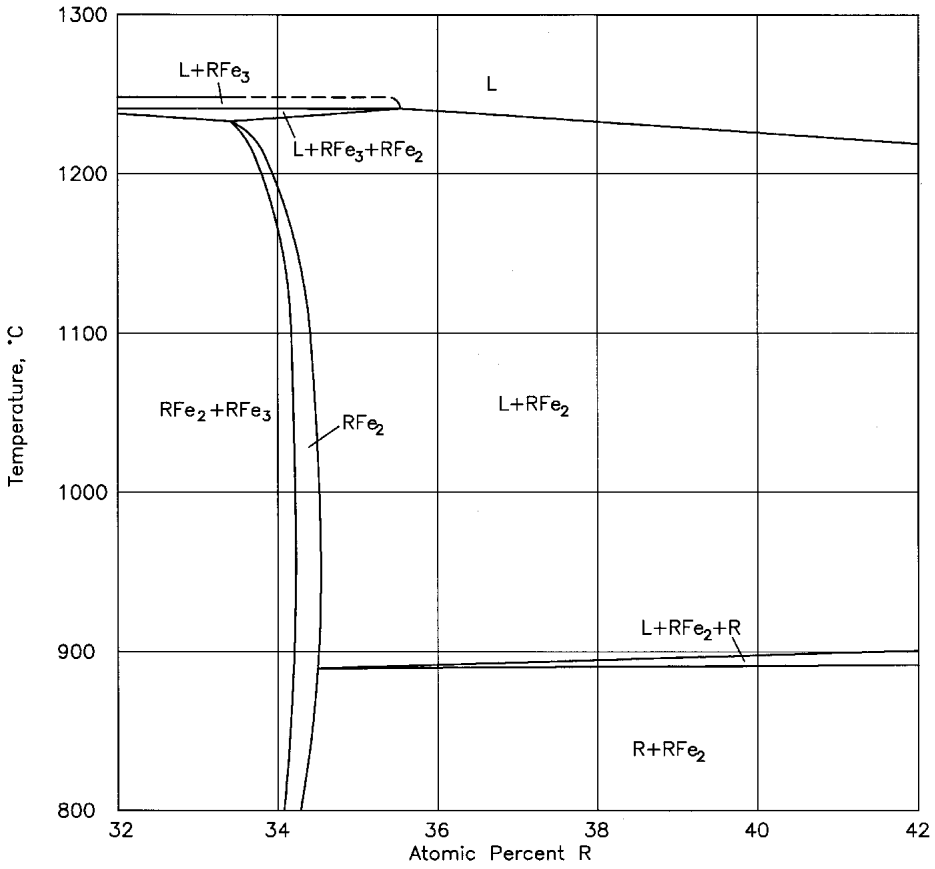

Fig. 1 Dy-Fe-Tb vertical section along the $Tb_{0.3}Dy_{0.7}$-Fe join [1997Mei]

ods were used. X-ray powder diffraction was used to study the phase structure. The vertical section along the $Tb_{0.3}Dy_{0.7}$-Fe join constructed by [1997Mei] is redrawn in Fig. 1. As found by [1990Wes], the Laves phase has a small homogeneity range, which is a function of temperature. This vertical section can form the basis for the selection of the composition and heat treatment to avoid the formation of the RFe_3 phase, known to be deleterious to the magnetostrictive and mechanical properties. By using the electron probe microanalysis on as-cast samples, [1997Mei] also measured the segregation of Tb and Dy within the grains of the Laves phase.

References

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