

Dy-Fe-Mn (Dysprosium-Iron-Manganese)

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The previous review of this system by [1992Rag] was limited to a summary of the lattice parameter variation of the continuous solid solutions along the DyFe_2 - DyMn_2 and $\text{Dy}_6\text{Fe}_{23}$ - $\text{Dy}_6\text{Mn}_{23}$ joins. Recently, Ilyushin et al. [1996Ily] determined the phase relationships along the DyFe_2 - DyMn_2 join as a function of pressure up to 8 GPa.

Binary Systems

The Dy-Fe phase diagram was updated by [1996Oka]. It depicts four intermediate compounds: the $\text{Th}_2\text{Ni}_{17}$ -type hexagonal compound $\text{Dy}_2\text{Fe}_{17}$, the $\text{Th}_6\text{Mn}_{23}$ -type cubic phase $\text{Dy}_6\text{Fe}_{23}$, the PuNi_3 -type rhombohedral phase DyFe_3 , and the MgCu_2 -type cubic phase DyFe_2 . The Dy-Mn phase diagram [Massalski2] shows three intermediate phases: the ThMn_{12} -type tetragonal phase DyMn_{12} , the $\text{Th}_6\text{Mn}_{23}$ -type cubic phase $\text{Dy}_6\text{Mn}_{23}$, and the MgCu_2 -type cubic phase DyMn_2 . The Fe-Mn phase diagram [1993Oka] has no intermediate phases. The face-centered cubic phases γFe and γMn form a continuous solid solution.

Ternary Phase Equilibria

With starting metals of purity of 99.5%, [1996Ily] levitation melted under Ar atm about 10 alloy compositions along the DyFe_2 - DyMn_2 join. The samples were annealed

and powdered and then subjected to a pressure of 2.5, 3.0, 4.0, 6.0, and 8.0 GPa. The structure of the synthesized alloys was determined at ambient temperature by x-ray powder diffraction. At atmospheric pressure, all compositions were the MgCu_2 type C15 cubic phase, agreeing with the results reviewed by [1992Rag]. At the DyFe_2 end, no transition was observed for pressures up to 8 GPa. At the DyMn_2 end, the $\text{C15} \rightarrow \text{C14}$ transition started above 2 GPa. At 4 GPa, the entire sample was the C14 hexagonal type. The pressure-composition diagram constructed by [1996Ily] at room temperature is redrawn in Fig. 1.

References

- 1992Rag:** V. Raghavan: "Dy-Fe-Mn (Dysprosium-Iron-Manganese)" in *Phase Diagrams of Ternary Iron Alloys. Part 6*, Ind. Inst. Metals, Calcutta, India, 1992, pp. 790-91.
- 1993Oka:** H. Okamoto: "Fe-Mn (Iron-Manganese)" in *Phase Diagrams of Binary Iron Alloys*, H. Okamoto, ed., ASM International, Materials Park, OH, 1993, pp. 203-13.
- 1996Ily:** A.S. Ilyushin, I.A. Nikanorova, A.V. Tsvyashchenko, I.A. Avdeeva, I.V. Korchazhkin, V.S. Zasimov, and E.U. Yuldasheva: "Structure, Phase Transitions and Phase Diagram of $\text{Dy}(\text{Mn}_{1-x}\text{Fe}_x)_2$ System Synthesized at High Pressure," *Metally*, 1996, (1), pp. 169-71 (in Russian); TR: *Russ. Metall.*, 1996, 1, pp. 122-24.
- 1996Oka:** H. Okamoto: "Dy-Fe (Dysprosium-Iron)," *J. Phase Equilibria*, 1996, 17(1), pp. 80-81.

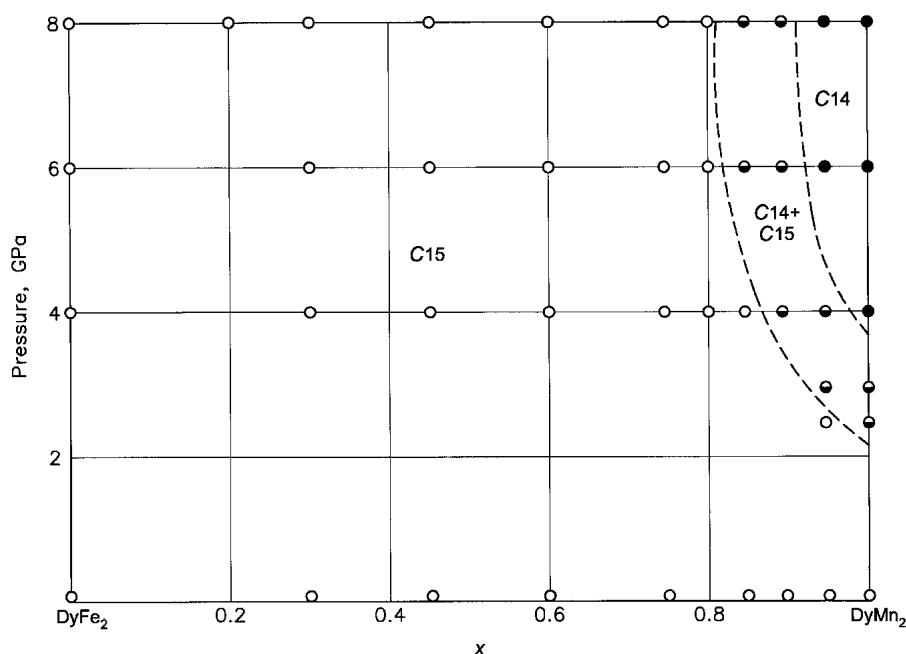


Fig. 1 Dy-Fe-Mn pressure-composition diagram for $\text{Dy}(\text{Fe}_{1-x}\text{Mn}_x)_2$ alloys at $\sim 20^\circ\text{C}$ [1996Ily]