Fe-Nb-Zn (Iron-Niobium-Zinc)

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Recently, [2009Tu] determined an isothermal section for this ternary system at 450 °C.

Binary Systems

The Fe-Nb phase diagram has the following intermediate phases: Fe_2Nb ($C14$, MgZn_2 -type hexagonal) and Fe_7Nb_6 ($D8_5$, Fe_7W_6 -type rhombohedral; denoted μ). In the Fe-Zn system, the intermediate phases are: Γ ($\text{Fe}_3\text{Zn}_{10}$; Cu_5Zn_8 -type cubic), Γ_1 ($\text{Fe}_{11}\text{Zn}_{40}$; cubic), δ (FeZn_{10} -type hexagonal) and ζ (CoZn_{13} -type monoclinic). The following intermediate phases form by peritectic reactions in the Nb-Zn system [1992Mos]: NbZn , $\text{NbZn}_{1.5}$ (hexagonal), NbZn_2 ($C36$, MgNi_2 -type hexagonal), NbZn_3 ($L1_2$, AuCu_3 -type cubic), NbZn_7 , and NbZn_{15} . The stability of a reported phase at Nb_3Zn is not known [1992Mos].

Ternary Isothermal Section

With starting metals of 99.99% purity, [2009Tu] prepared 8 equilibrated alloys and Fe-Nb/Zn diffusion

couples. The time of equilibration was 60 days at 450 °C and the diffusion anneal was 30 days at the same temperature, followed water quenching. The phase equilibria were studied with scanning electron microscope equipped with wavelength-dispersive and energy-dispersive x-ray spectroscopy and x-ray powder diffraction. The measured compositions of the co-existing phases were listed. The isothermal section at 450 °C constructed by [2009Tu] is shown in Fig. 1. The ternary phase T, which is isostructural with the binary Γ_1 , has a homogeneity range. The binary Fe-Zn compounds δ , Γ_1 and Γ dissolve 0.1, 0.4 and 1.0 mass% Nb respectively. Fe_2Nb dissolves up to 6.2 at.% Zn.

References

- 1992Mos: Z. Moser, The Nb-Zn (Niobium-Zinc) System, *J. Phase Equilib.*, 1992, **13**(4), p 425-429
2009Tu: H. Tu, X. Su, F. Yin, X. Wang, and J. Wang, 450 °C Isothermal Section of the Zn-Fe-Nb Ternary System at the Zn-Rich Corner, *J. Alloys Compd.*, 2009, **485**, p 270-274

Fig. 1 Fe-Nb-Zn isothermal section at 450 °C [2009Tu]