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Fe-P-Y (Iron-Phosphorus-Yttrium)

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A partial isothermal section for this system at 800 °C was determined recently by [2002Ori]. The section depicts two ternary compounds.

Binary Systems

A partial phase diagram is known for the Fe-P system [1982Kub]. The intermediate compound Fe_3P forms through a peritectic reaction at 1166 °C between liquid and Fe_2P. Fe_2P forms congruently at 1370 °C. Fe_3P is body centered tetragonal with the Ni_3P-type structure. Fe_2P has the hexagonal *C*22 structure. The other intermediate phases at higher P contents are FeP (orthorhombic MnP type), FeP_2 [orthorhombic FeS_2 (marcasite) type], and FeP_4 (monoclinic). The Fe-Y phase diagram [1992Zha] depicts four intermediate phases with limited or no homogeneity ranges: Y_2Fe_{17}, Y_6Fe_{23}, YFe_3, and YFe_2. See [1992Zha] for crystal structure data. The Y-P phase diagram is not known. The compound YP has the cubic NaCl type structure.

Ternary Isothermal Section

With starting materials of 99.95 Fe, 99.98 P, and 99.5 Y (all at.%), Orishchin et al. [2002Ori] melted 17 ternary alloy compositions in an arc furnace under Ar atm. The alloys were finally annealed at 800 °C for 500 h and quenched in water. The phase equilibria were studied mainly by x-ray powder diffraction, supplemented by metallography and electron probe microanalysis. The isothermal section at 800 °C determined by [2002Ori] up to 50 at.% P is redrawn in Fig. 1 to agree with the accepted binary data. Two ternary compounds are stable at this temperature. $Y_2Fe_{12}P_7$ (denoted τ_1 here) has the hexagonal $Zr_2Fe_{12}P_7$ type of structure. The crystal structure of YFe_5P_2 (the experimentally-determined composition is $YFe_{4.8}P_{1.8}$), denoted τ_2 in Fig. 1, was not resolved. The ternary compound YFe_5P_3 [1984Jei] was not found at this temperature. The compound YP forms tie lines with the two ternary compounds as well as with all the binary compounds (except Fe_3P). The solubility of the third component in the binary phases is negligible. Y_2Fe_{17}, which has two crystal modifications, was found to have the hexagonal Th_2Ni_{17} type structure at 800 °C [2002Ori].

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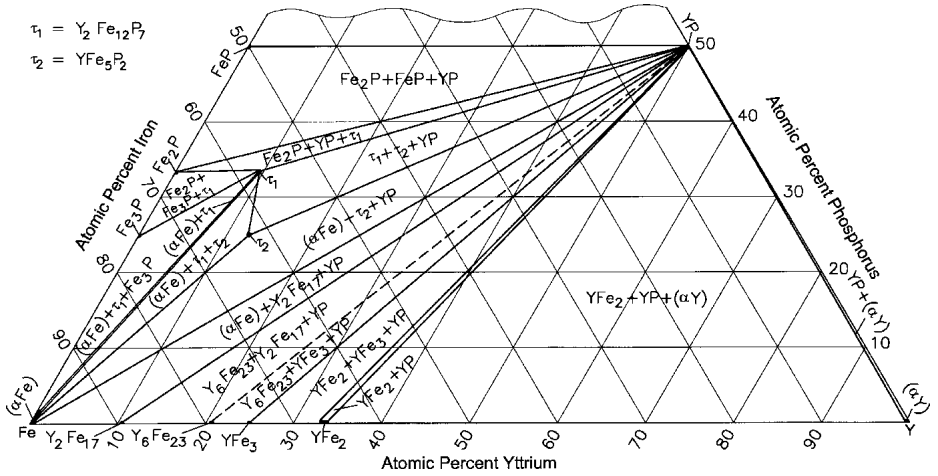

Fig. 1 Fe-P-Y isothermal section at 800 °C [2002Ori]. Narrow two-phase regions around tie-triangles are omitted