

Experimental Investigation and Thermodynamic Assessment of the Fe-Base Alloy System

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Abstract: Experimental investigation of phase equilibria in the Fe-Mn, Fe-Si, Fe-Al and Fe-Mn-Si-C systems was carried out. In the Fe-Mn system, α/γ equilibrium at temperatures below 600°C was revised by equilibration of severely deformed powder samples in which the α/γ equilibrated microstructures at low temperatures could be realized. In the Fe-Si and Fe-Al systems, the miscibility gap between A2, B2 and D0₃ phases as well as the A2/B2/D0₃ transition boundaries were determined precisely. Phase equilibria in the Al-rich region of the Fe-Al system were determined in detail. The α/γ equilibria in the Fe-Mn-C, Fe-Mn-C and Fe-Mn-Si-C systems were determined by FE-EPMA, in which special consideration was given for analyzing the C content in the α and γ phases. Liquidus and solidus temperatures of Fe-Mn-Si alloys were determined by DSC.

Based on the present experimental results and experimental data in the literature, thermodynamic assessment of the Fe-Al-C-Cr-Mn-Si system was carried out.