

Fe-In-Te (Iron-Indium-Tellurium)

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The previous review of this system by [1992Rag] presented two pseudobinary sections along the Fe-InTe and Fe-In₂Te₃ joins from the results of [1990Bab]. More recently, [1994Abi] determined a pseudobinary section along the Fe₂Te₃-In₂Te₃ join and [2000Kon] studied the FeTe₂-In₂Te₃ section.

Binary Systems

The Fe-In system [1993Oka1] does not have any intermediate phases. The mutual solid solubility between the elements is very limited. The Fe-Te phase diagram [1993Oka2] contains a number of intermediate phases: (1) the rhombohedral high temperature phase β' (46.5-48.5 at.% Te); (2) its low temperature form β of tetragonal symmetry; (3) γ of unknown structure (54.2 at.% Te); (4) Cr₃Se₄ type monoclinic δ (54-59 at.% Te); (5) NiAs type hexagonal δ' (59.3-64.5 at.% Te); and (6) FeSb₂ type orthorhombic FeTe₂ (ε). The In-Te system was recently reinvestigated by [2001Zlo]. The confirmed intermediate phases of this system are In₄Te₃, InTe, In₂Te₃, and In₂Te₅. For structural details, see [Pearson3].

The Pseudobinary Sections

Abilov et al. [1994Abi] prepared alloy samples by heating mixtures in evacuated quartz tubes up to 1000 °C and then homogenizing at 500 °C for 400 h. The phase equilibria were studied by differential thermal analysis, x-ray diffraction, metallography, microhardness, and density measurements. The Fe₂Te₃-In₂Te₃ pseudo-binary section constructed by [1994Abi] depicts Fe₂Te₃ as having a melting point of 982 °C and as stable down to room temperature. The only phase which comes close to the composition of 60 at.% Te in the assessed Fe-Te phase diagram of [1993Oka2] is the δ' phase, which forms peritectically at 766 °C and decomposes eutectoidally at 519 °C. The discrepancy in the temperature range of stability of Fe₂Te₃ is too large to be ignored. In view of this uncertainty, the Fe₂Te₃-In₂Te₃ section of [1994Abi] is not considered any further.

Koneshova et al. [2000Kon] synthesized the binary phases FeTe₂ and In₂Te₃ from pure elemental powders. The FeTe₂-In₂Te₃ alloys were prepared by heating the mixtures in evacuated quartz tubes to 950 °C for 200 h. The phase

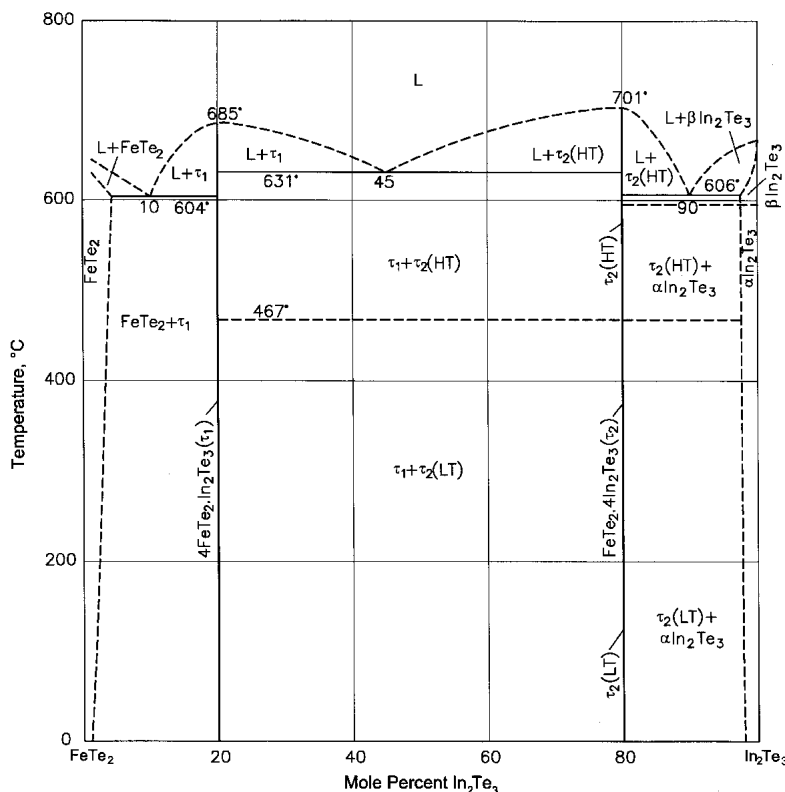


Fig. 1 Fe-In-Te pseudobinary section along the FeTe₂-In₂Te₃ join [2000Kon]

Section II: Phase Diagram Evaluations

equilibria were studied by differential thermal analysis, x-ray powder diffraction, scanning electron microscopy, and microhardness measurements. The FeTe₂-In₂Te₃ section constructed by [2000Kon] is redrawn in Fig. 1 to agree with the accepted binary data. There are two ternary compounds on this join. Fe₄In₂Te₁₁ (4FeTe₂·In₂Te₃), denoted τ_1 here, forms congruently from the melt at 685 °C. It has monoclinic symmetry with $a = 0.4808$ nm, $b = 0.5985$ nm, $c = 0.8921$ nm, and $\beta = 100.8^\circ$ [2000Kon]. The other ternary compound FeIn₈Te₁₄ (FeTe₂·4In₂Te₃), denoted τ_2 here, forms congruently from the melt at 701 °C. It has cubic symmetry with $a = 1.0685$ nm. For lattice parameter measurements, compositions corresponding to the ternary compounds were additionally synthesized by [2000Kon]. A heat effect at 467 °C in τ_2 was attributed to a polymorphic transformation. Since the lattice parameters were measured in samples very slowly cooled from 570-580 °C, it is presumed here that the structural details given above refer to the low temperature form. The β In₂Te₃-based solid solution and τ_2 form a eutectic at 90 mol% In₂Te₃ and at 606 °C. The eutectic between τ_1 and τ_2 occurs at 45 mol% In₂Te₃ and at 631 °C. The eutectic between τ_1 and FeTe₂ is at 10 mol% In₂Te₃ and 604 °C.

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