

B-Fe-U (Boron-Iron-Uranium)

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The previous review of the phase equilibria of this system by [1992Rag] gave an isothermal section at 800 °C, based mainly on the results of [1978Vol]. Recently, [2007Dia] reinvestigated this system and presented an isothermal section at 950 °C.

Binary Systems

The B-Fe phase diagram [Massalski2] depicts two intermediate phases: Fe₂B (C16, CuAl₂-type tetragonal) and FeB (*B*27, FeB-type orthorhombic). The B-U phase

Table 1 B-Fe-U crystal structure and lattice parameter data [2007Dia]

Phase	Composition, at.%	Pearson symbol	Space group	Prototype	Lattice parameter, nm
UFe ₃ B ₂ (τ_1 or B)	33.3 B 50.0 Fe 16.7 U	<i>hP</i> 6	<i>P6/mmm</i>	CaCu ₅	$a = 0.5049$ $c = 0.29996$
UFeB ₄ (τ_2 or A)	66.7 B 16.7 Fe 16.7 U	<i>oP</i> 24	<i>Pbam</i>	YCrB ₄	$a = 0.5887$ $b = 1.1412$ $c = 0.34355$
UFe ₄ B (τ_3 or C)	16.7 B 66.7 Fe 16.7 U	...	<i>P6/mmm</i>	...	$a = 0.4932$ $c = 0.7037$
U ₂ Fe ₂ B ₆ (τ_4 or D)	20.7 B 72.4 Fe 6.9 U	<i>cF</i> 116	<i>Fm</i> $\bar{3}m$	Cr ₂₃ C ₆	$a = 1.0766$

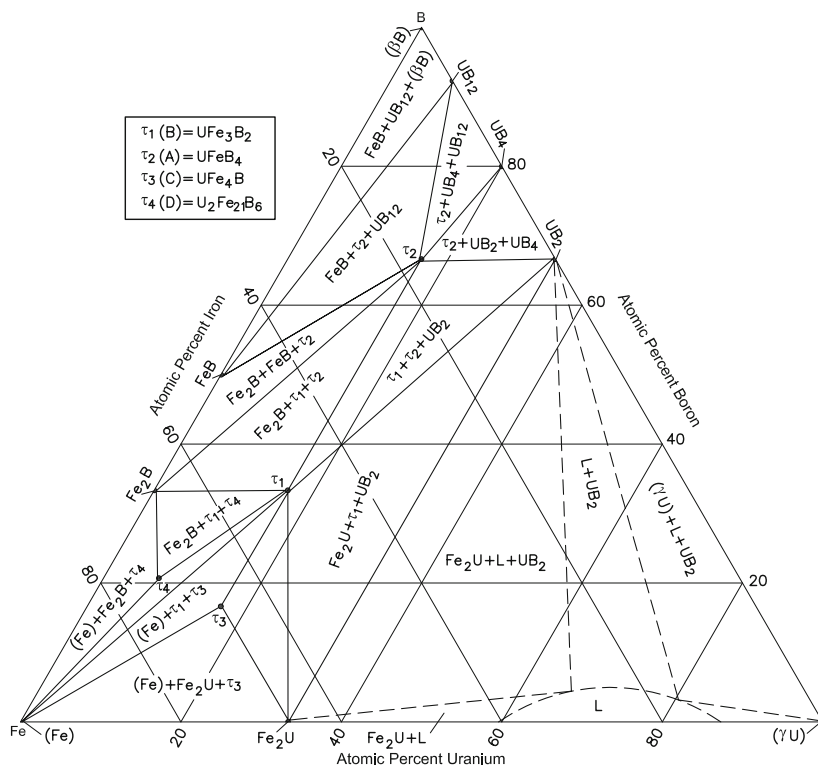


Fig. 1 B-Fe-U isothermal section at 950 °C [2007Dia]. Narrow two-phase regions are omitted

diagram [2001Che] shows the following compounds: $B_{12}U$ ($D2_f$ -type cubic), B_4U ($D1_e$, ThB_4 -type tetragonal) and B_2U ($C32$, AlB_2 -type hexagonal). The Fe-U phase diagram [2003Cha] has two intermediate phases: Fe_2U ($C15$, $MgCu_2$ -type cubic) and FeU_6 ($D2_e$, MnU_6 -type tetragonal).

Ternary Compounds

The isothermal section at 800 °C reviewed by [1992Rag] depicts two ternary compounds: UFe_3B_2 (τ_1) and $UFeB_4$ (τ_2). In the Fe-rich region of the system, [2007Dia] identified two more compounds: UFe_4B (CeCo₄B-related hexagonal, denoted τ_3 here) and $U_2Fe_{21}B_6$ ($Cr_{23}C_6$ -type cubic, denoted τ_4). Table 1 lists the structural characteristics of the four ternary compounds τ_1 , τ_2 , τ_3 and τ_4 , denoted as B, A, C, and D respectively by [2007Dia].

Isothermal Section

A total of 40 ternary compositions were melted by [2007Dia] in an arc furnace under an Ar atm. The alloys were annealed at 950 °C for 60-120 days and quenched. The phase equilibria were studied with X-ray powder

diffraction, scanning electron microscopy, and electron probe microanalysis. The isothermal section at 950 °C constructed by [2007Dia] is shown in Fig. 1. All the four ternary compounds listed in Table 1 are present. The binary compound FeU_6 is not stable at this temperature. The other binary compounds show no third component solubility.

References

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