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B-Cu-Fe (Boron-Copper-Iron)

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Recently, [2006Tag1] determined the miscibility gap at 1600 °C between Fe-rich and Cu-rich liquids in the presence of B.

Binary Systems

The B-Cu phase diagram is of the simple eutectic type, with no intermediate phases. The B-Fe phase diagram depicts two intermediate compounds: Fe_2B (*C*16, $CuAl_2$-type tetragonal) and FeB (*B*27-type orthorhombic). There are no intermediate phases in the Cu-Fe system. A metastable liquid miscibility gap is known in this system. See [Massalski2] for the above phase diagrams.

Ternary Liquid Miscibility Gap

With starting metals of 99.8% B, 99.0% Cu and electrolytic Fe, [2006Tag1] mixed Cu with Fe-B master alloys (with B up to 9 mass %), to melt samples in an alumina crucible under Ar atm. The molten bath was kept at 1600 °C for 5 h, followed by rapid cooling. The formation of two separate layers of liquid was confirmed in all the experiments. The compositions of the solidified layers were measured with inductively-coupled plasma emission spectrometry and listed. The B-content of the Cu-rich layer was below 0.001 mass %. A partial isothermal section at 1600 °C constructed by [2006Tag1] is shown in Fig. 1. Selected tie-lines between the two immiscible liquids are shown, using the listed values of [2006Tag1].

The liquid miscibility gap in the same system at 1250 °C was investigated by [2006Tag2]. They found that the Cu-content of the Fe-rich liquid and the Fe-content of the Cu-rich liquid were about 1 to 2 mass % lower at 1250 °C, as compared to 1600 °C.

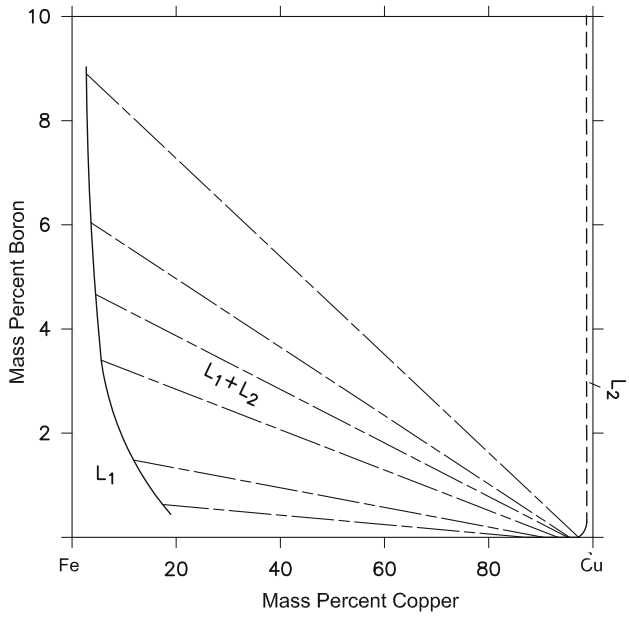

Fig. 1 B-Cu-Fe partial isothermal section at 1600 °C, depicting the miscibility gap between the Fe-rich liquid L_1 and the Cu-rich liquid L_2 [2006Tag1]

References

2006Tag1: K. Taguchi, H. Ono-Nakazato, and T. Usui, Liquid Immiscibility in Fe-Cu-B System, *ISIJ Int.*, 2006, **46**(1), p 29-32

2006Tag2: K. Taguchi, H. Ono-Nakazato, and T. Usui, Liquid Immiscibility in Fe-Cu-B-C System, *ISIJ Int.*, 2006, **46**(5), p 633-636