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

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Recently, [2006Tag] determined the miscibility gap between an Fe-rich and a Cu-rich liquid in this quaternary system at 1250 and 1152 °C.

Lower Order Systems

The binary phase diagrams relevant to this quaternary system can be found in [Massalski2]. The B-Cu-Fe ternary system is reviewed in this issue. The results of [1991Sch] on the C-Cu-Fe system showed a stable miscibility gap between Fe-rich and Cu-rich liquids.

Quaternary Liquid Miscibility Gap

With starting metals of 99.8% B, 99.0% Cu, and 99.98% Fe, [2006Tag] mixed Cu with previously made Fe-B-C master alloys (with 0.5-3.5 mass % B and a constant 3 mass % C), to melt quaternary samples in alumina crucibles under Ar atm. The samples were kept at 1250 or 1152 °C for over 5 h, followed by rapid cooling. The formation of two separate layers of liquid was confirmed in all the experiments. The liquidus temperatures of the Fe-rich layer were determined further by differential thermal analysis, to ensure that they were below 1152 °C. The compositions of the solidified layers were measured with inductively coupled plasma emission spectrometry and listed. The C content of the Fe-rich phase was determined by the combustion method using a C analyzer. The B-content of the Cu-rich layer was found to be very small, not more than 0.013 mass %. No carbon was found in the Cu-rich layer. A partial isothermal section at 1250 °C constructed by [2006Tag] is shown in Fig. 1. Selected tie-lines between the two immiscible liquids are shown, using the listed values of [2006Tag]. The C content in the Fe-rich layers was about

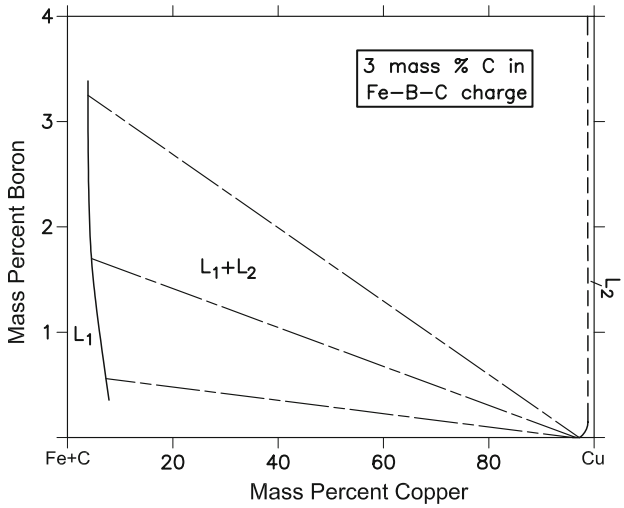

Fig. 1 B-C-Cu-Fe miscibility gap between the Fe-rich liquid L_1 and the Cu-rich liquid L_2 at 1250 °C [2006Tag]

3 mass %. A couple of experiments at 1152 °C by [2006Tag] indicated that, for the same Cu content, the B content of the Fe layers was smaller at 1152 °C. The results of [2006Tag] showed that a more efficient separation of Fe and Cu layers occurs, when B is used in conjunction with C.

References

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