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Al-Hf-Ir (Aluminum-Hafnium-Iridium)

V. Raghavan

Recently, [2005Miu] determined a partial liquidus projection and an isothermal section at 1650 °C for Ir-rich alloys of this system.

Binary Systems

The Al-Ir phase diagram in the Ir-rich region determined by [2005Miu] depicts a eutectic reaction between (Ir) and IrAl (*B*2, CsCl-type cubic) at 30.5 at.% Al and ~2020 °C. The other Al-Ir phases are: Ir_2Al_5 (cubic, space group $Pm\bar{3}n$), $IrAl_3$ ($D0_{18}$, Na_3As-type hexagonal), Ir_4Al_{13} (monoclinic), and Ir_2Al_9 ($D8_d$, Co_2Al_9-type monoclinic). The Hf-Ir phase diagram [Massalski2] has the following intermediate phases: Ir_3Hf ($L1_2$, $AuCu_3$-type cubic), IrHf, Ir_3Hf_5 ($D8_8$, Mn_5Si_3-type hexagonal) and $IrHf_2$ (Ti_2Ni-type cubic).

Ternary Phase Equilibria

With starting metals of 99.99% Al, 95% Hf, and 99.9% Ir, [2005Miu] arc-melted under Ar atm an Ir-rich alloy of composition 70Ir-20Al-10Hf (atomic percent). The sample was annealed at 1650 °C for 24 h. The phase equilibria were studied with scanning electron metallography, wavelength dispersive x-ray spectroscopy, and differential thermal analysis. The partial liquidus projection sketched by [2005Miu] is shown in Fig. 1. In the Ir-rich region, a U-type transition reaction L + Ir_3Hf ↔ (Ir) + IrAl was proposed by [2005Miu]. Figure 2 shows the partial isothermal section at 1650 °C. In the solid solution based on Ir_3Hf, Al substitutes for Hf up to 5.1 at.%. No ternary phases were found in this region. The previously known ternary compounds $Al_{16}Hf_6Ir_8$ ($Mn_{23}Th_6$-type cubic) and AlIrHf ($MgZn_2$-type hexagonal) fall outside the investigated range. In view of the very limited results of [2005Miu], the data in Figs. 1 and 2 may be considered tentative.

Reference

2005Miu: S. Miura, K. Ohkubo, Y. Terada, Y. Kimura, Y. Mishima, Y. Yamabe-Mitarai, H. Harada, and T. Mohri, Phase Equilibria in the Ir-Rich Portion of the Ir-Al-X (X: Ti, Zr and Hf) Ternary Systems, *J. Alloys Compd.*, 2005, **393**, p 239-247

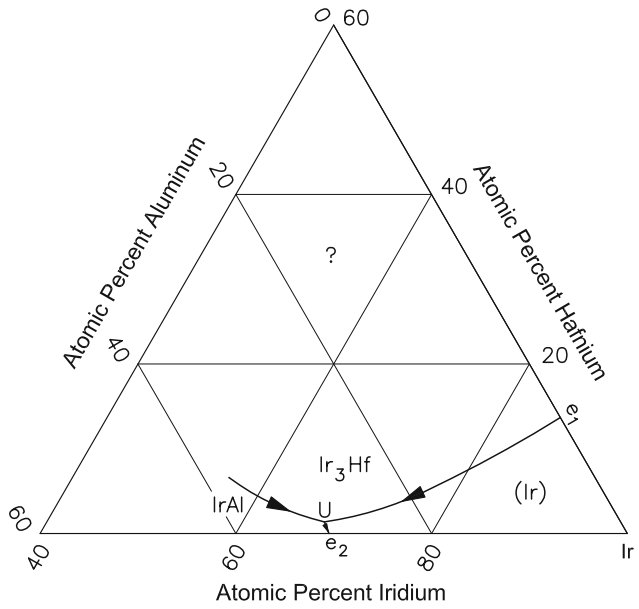

Fig. 1 Al-Hf-Ir partial liquidus projection for Ir-rich alloys [2005Miu]

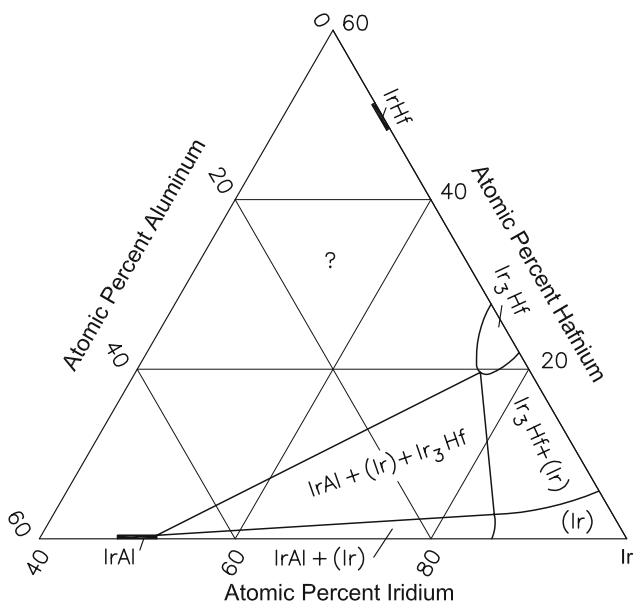

Fig. 2 Al-Hf-Ir partial isothermal section at 1650 °C for Ir-rich alloys [2005Miu]