JPEDAV (2010) 31:274
DOI: 10.1007/s11669-010-9676-x
1547-7037 ©ASM International

Al-C-Co (Aluminum-Carbon-Cobalt)

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The update on this system by [2008Rag] reviewed the experimental results of [1995Kim] and [2006Kim] on Co-rich alloys and presented a liquidus projection, an isothermal section at 1100 °C and three vertical sections at 3 at.% C, 10 at.% C and 30 at.% Al respectively. Recently, [2009Fri] reinvestigated the liquidus surface and proposed some modifications to the results of [1995Kim].

Binary Systems

In the Al-C system, a stoichiometric compound Al_4C_3 ($D7_1$-type rhombohedral) is known. The calculated Al-Co phase diagram [2004Oht] shows the following intermediate phases: CoAl (48-78.5 at.% Co; *B*2, CsCl-type cubic), Co_2Al_5 ($D8_{11}$-type hexagonal), $CoAl_3$ ($D0_{11}$, Fe_3C-type orthorhombic), Co_4Al_{13} (three crystal modifications), and Co_2Al_9 ($D8_d$-type monoclinic). A metastable phase Co_3Al with the $L1_2$-type of structure was suggested by [1995Kim], which is stabilized by C into the $E2_1$-type compound Co_3AlC_x (κ). The C-Co system is of the simple eutectic type, with the eutectic reaction at 1320 °C.

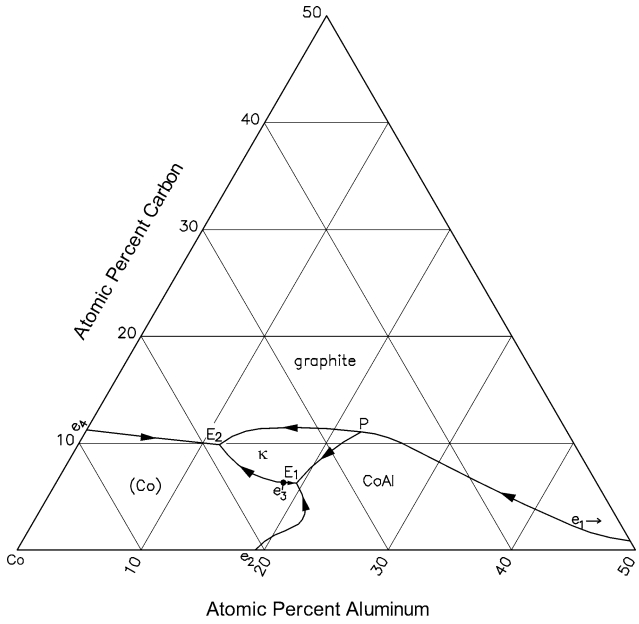

Fig. 1 Al-C-Co liquidus projection [2009Fri]

Ternary Phase Equilibria

With starting metals of 99.998% Al, 99.8% Co and reactor grade graphite, [2009Fri] melted alloys in an alumina crucible under Ar atm. Differential thermal analysis was carried out at a heating/cooling rate of 5 °C/min. The phase equilibria were studied mainly with optical microscopy and x-ray powder diffraction. The main finding of [2009Fri] is a eutectic maximum on the univariant liquidus line L + (Co) + Co_3AlC_x at 1343 °C and at 18.6Al-6.25C (at.%). The liquidus projection of [1995Kim] modified to include this eutectic maximum e_3 is shown in Fig. 1.

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