JPEDAV (2009) 30:206–207
DOI: 10.1007/s11669-009-9473-6
1547-7037 ©ASM International

Al-Ir (Aluminum-Iridium)

H. Okamoto

The Al-Ir phase diagram in [Massalski2] was redrawn from [1989Axl]. [2000Oka] revised this phase diagram based on [1998Hil]. A major revision was the change in the melting reaction of $Al_{2.7}Ir$ from a peritectic type to a congruent type.

Since then new compounds $Al_{45}Ir_{13}$ and $Al_{28}Ir_9$ were discovered by [2005Bos] and [2006Kat], respectively. In the [2000Oka] phase diagram, $Al_{13}Ir_4$ existed at a composition very close to both $Al_{45}Ir_{13}$ and $Al_{28}Ir_9$. [2008Pav] investigated the Al-Ir phase diagram in the range 10-35 at.% Ir and 1700-600 °C using DTA and X-ray diffraction analysis, and confirmed the existence of these two new compounds. It is likely that $Al_{45}Ir_{13}$ or $Al_{28}Ir_9$ were identified as $Al_{13}Ir_4$ earlier, and accordingly the crystal structure has not been reported for this compound. More recently, [2008Ode] investigated the Al-Ir system up to ~35 at.% Ir by using DTA and various other means. They reported the existence of Al_9Ir_2, $Al_{13}Ir_4$, Al_3Ir, and $Al_{2.7}Ir$ only, but this report appears to have been superseded by another report [2008Abe] published by the same group of authors (see below).

Table 1 Al-Ir crystal structure data

Phase	Composition, at.% Ir	Pearson symbol	Space group	Strukturbericht designation	Prototype
(Al)	0	*cF*4	$Fm\bar{3}m$	*A*1	Cu
Al_9Ir_2	18.2	*mP*22	$P2_1/c$	$D8_d$	Co_2Al_9
$Al_{45}Ir_{13}$	22.4	*oP*232	*Pnma*	…	…
$Al_{28}Ir_9$	24.3	*tP**	*P*31*c*	…	…
Al_3Ir	25	*hP*8	$P6_3/mmc$	$D0_{18}$	Na_3As
$Al_{2.7}Ir$	26.7-27.5	*cP*32	*P*23	…	…
AlIr	47.5-52.5	*cP*2	$Pm\bar{3}m$	*B*2	CsCl
(Ir)	80-100	*cF*4	$Fm\bar{3}m$	*A*1	Cu

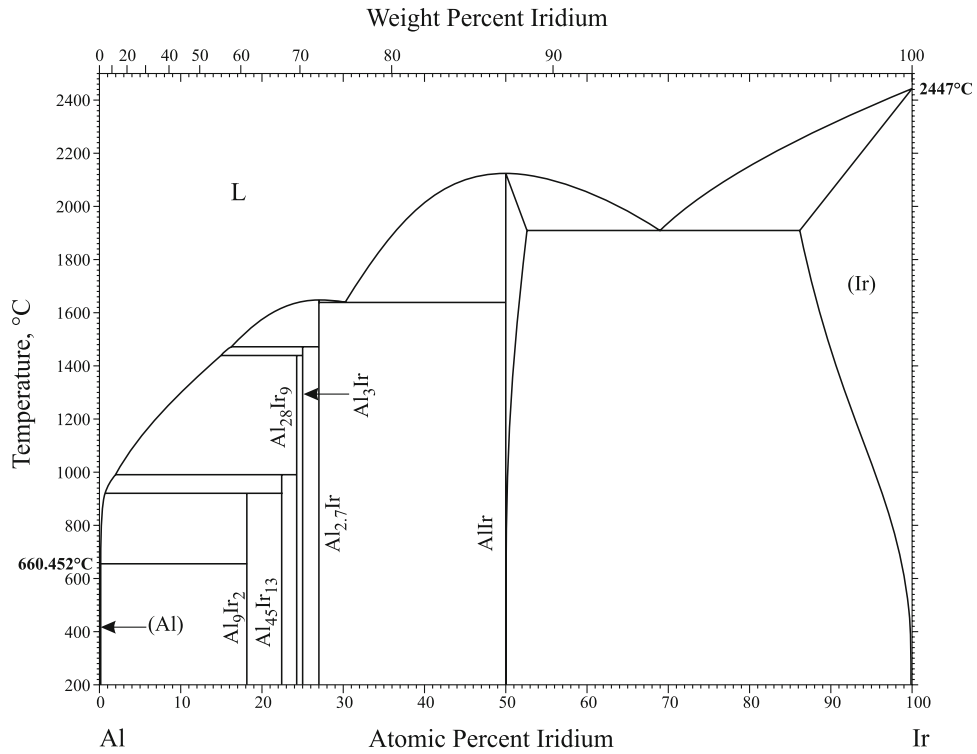

Fig. 1 Al-Ir phase diagram

Earlier, [2006Jia] proposed an Al-Ir phase diagram for the entire composition range based on thermodynamic modeling. The stable compounds assumed in the model were slightly different from those confirmed later by [2008Pav].

The phase equilibria in the Ir-rich side of the phase diagram was investigated by [2008Zha] by means of scanning electron microscopy, energy-dispersive spectroscopy, and electron probe microanalysis.

Figure 1 shows the Al-Ir phase diagram taken from [2008Abe] except that $Al_{13}Ir_4$ is removed from the diagram because of the reasons described above. The diagram of [2008Abe] was calculated based on experimental data outlined above and their preliminary evaluation [2007Abe].

The liquidus of AlIr in [2000Oka] showed unlikely asymmetry. This problem was solved in the diagrams of [2006Jia] and [2008Abe].

Table 1 shows Al-Ir crystal structure data.

References

1989Axl: K.M. Axler, E.M. Foltyn, D.E. Peterson, and W.B. Hutchinson, Phase Investigations of the Al-Ir System, *J. Less-Common Met.*, 1989, **156**, p 213-219

1998Hil: P.J. Hill, L.A. Cornish, and M.J. Witcomb, Constitution and Hardness of the Al-Ir System, *J. Alloys Compds.*, 1998, **280**, p 240-250

2000Oka: H. Okamoto, Al-Ir (Aluminum-Iridium), *J. Phase Equilib.*, 2000, **21**, p 409

2005Bos: M. Boström, R. Niewa, Y. Prots, and U. Grin, Synthesis, Phase Relationship and Crystal Structure of the New Binary Compound $Ir_{13}Al_{45}$, *Solid State Chem.*, 2005, **178**, p 339-345

2006Jia: C. Jiang and B. Gleeson, A Combined First-principles/CALPHAD Modeling of the Al-Ir System, *Acta Mater.*, 2006, **54**(15), p 4104-4110

2006Kat: S. Katrych, V. Gramlich, and W. Steurer, Trigonal Ir_9Al_{28}, a New Structure Type and Approximant to Decagonal Quasicrystals, *J. Alloys Compds.*, 2006, **407**, p 132-140

2007Abe: T. Abe, M. Ode, H. Murakami, C.S. Oh, C. Kocer, Y. Yamabe-Mitarai, and H. Onodera, A Thermodynamic Description of the Al-Ir System, *Mater. Sci. Forum*, 2007, **539-543**, p 2389-2394

2008Abe: T. Abe, C. Kocer, M. Ode, H. Murakami, Y. Yamabe-Mitarai, K. Hashimoto, and H. Onodera, Thermodynamic Re-Assessment of the Al-Ir System, *Calphad*, 2008, **32**(4), p 686-692

2008Ode: M. Ode, T. Abe, H. Murakami, Y. Yamabe-Mitarai, T. Hara, K. Nagashio, C. Kocer, and H. Onodera, An Investigation of the Phase Diagram of the Al-Ir Binary System, *Intermetallics*, 2008, **16**, p 1171-1178

2008Pav: D. Pavlyuchkov, B. Grushko, and T.Ya. Velikanova, A Contribution to the Al-Ir Phase Diagram, *Intermetallics*, 2008, **16**, p 801-806

2008Zha: C. Zhang, J. Zhu, Y. Yang, F. Zhang, and Y.A. Ahang, Experimental Investigation and Thermodynamic Reassessment of the Ir-rich Zone in the Al-Ir System, *Scr. Mater.*, 2008, **59**, p 403-406