C – Ir (Carbon – Iridium)

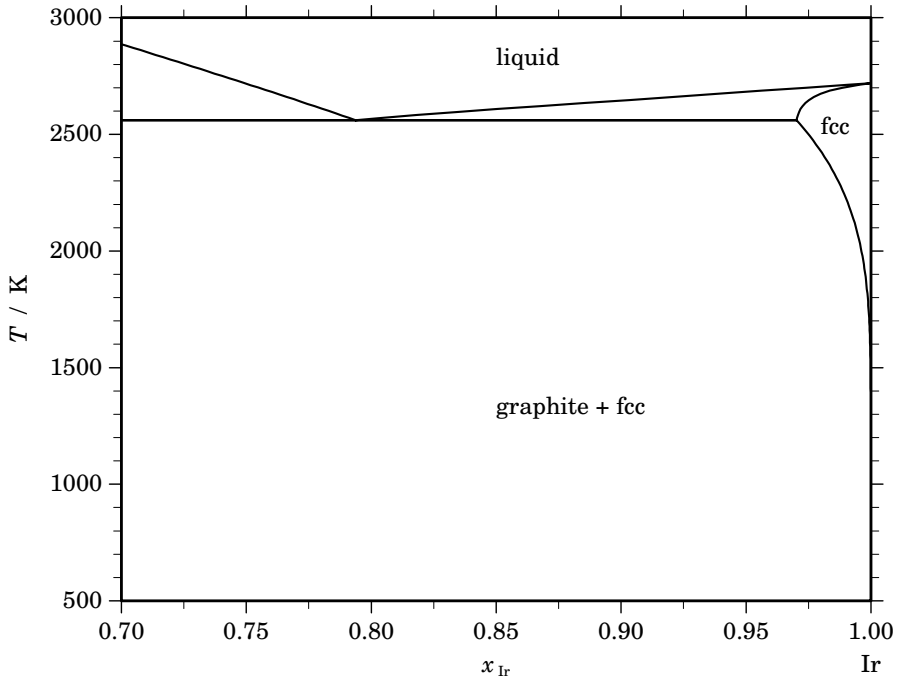

Fig. 1. Calculated phase diagram for the system C-Ir.

The C-Ir phase diagram displays the liquid phase, the fcc phase based on Ir with quite small solubility of C and the graphite phase. Burylev [1967Bur, 1969Bur] estimated the solubility of C in liquid Ir assuming systematic changes with atomic number in the interaction between the elements. Vol and Kagan [1976Vol] constructed the Ir-C phase diagram based on the above information [1990Mas]. The C-Ir system has been critically assessed by Korb [2004Kor]. The eutectic was experimentally determined by Nadler and Kempter [1960Nad], and later confirmed by the experimental investigations carried out by Dinsdale [2004Din]. The calculated eutectic temperature agrees well the experimental value [2004Din].

Table I. Phases, structures and models.

Phase	Struktur-bericht	Prototype	Pearson symbol	Space group	SGTE name	Model
liquid					LIQUID	$(C,Ir)_1$
graphite	$A9$	C(graphite)	$hP4$	$P6_3/mmc$	GRAPHITE	C_1
fcc	$A1$	Cu	$cF4$	$Fm\overline{3}m$	FCC_A1	$Ir_1(C,\Box)_1$

Table II. Invariant reactions.

Reaction	Type	T / K	Compositions / x_{Ir}			$\Delta_r H$ / (J/mol)
liquid $\rightleftharpoons$ graphite + fcc	eutectic	2561.1	0.794	0.000	0.970	−34244

Table IIIa. Integral quantities for the liquid phase at 2800 K.

x_{Ir}	ΔG_{m} [J/mol]	ΔH_{m} [J/mol]	ΔS_{m} [J/(mol·K)]	$G_{\mathrm{m}}^{\mathrm{E}}$ [J/mol]	$S_{\mathrm{m}}^{\mathrm{E}}$ [J/(mol·K)]	ΔC_P [J/(mol·K)]
0.726	−3135	10139	4.740	10539	−0.143	0.000
0.800	−3257	6890	3.624	8393	−0.537	0.000
0.900	−2764	3270	2.155	4804	−0.548	0.000
1.000	0	0	0.000	0	0.000	0.000

Reference states: C(graphite), Ir(liquid)

Table IIIb. Partial quantities for C in the liquid phase at 2800 K.

x_{C}	ΔG_{C} [J/mol]	ΔH_{C} [J/mol]	ΔS_{C} [J/(mol·K)]	$G_{\mathrm{C}}^{\mathrm{E}}$ [J/mol]	$S_{\mathrm{C}}^{\mathrm{E}}$ [J/(mol·K)]	a_{C}	γ_{C}
0.274	0	45194	16.141	30127	5.381	1.000	3.648
0.200	−4008	38780	15.281	33461	1.900	0.842	4.209
0.100	−11724	33413	16.120	41882	−3.025	0.604	6.044
0.000	$-\infty$	32865	∞	55649	−8.137	0.000	10.917

Reference state: C(graphite)

Table IIIc. Partial quantities for Ir in the liquid phase at 2800 K.

x_{Ir}	ΔG_{Ir} [J/mol]	ΔH_{Ir} [J/mol]	ΔS_{Ir} [J/(mol·K)]	$G_{\mathrm{Ir}}^{\mathrm{E}}$ [J/mol]	$S_{\mathrm{Ir}}^{\mathrm{E}}$ [J/(mol·K)]	a_{Ir}	γ_{Ir}
0.726	−4318	−3101	0.435	3141	−2.229	0.831	1.144
0.800	−3070	−1083	0.710	2125	−1.146	0.876	1.096
0.900	−1769	−79	0.603	684	−0.273	0.927	1.030
1.000	0	0	0.000	0	0.000	1.000	1.000

Reference state: Ir(liquid)

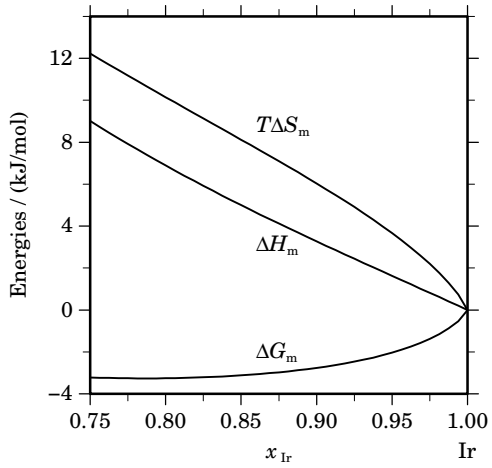

Fig. 2. Integral quantities of the liquid phase at T=2800 K.

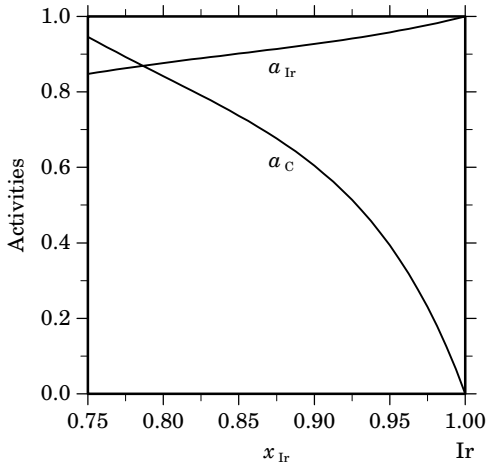

Fig. 3. Activities in the liquid phase at T=2800 K.

References

[1960Nad] M.R. Nadler, C.P. Kempter: J. Phys. Chem. **64** (1960) 1468-1471.
[1967Bur] B.P. Burylev: Izv. V.U.Z. Chern. Metall. **10** (1967) 20-22.
[1969Bur] B.P. Burylev: Izv. V.U.Z. Tsvetn. Metall. **12** (1969) 112–116.
[1976Vol] A.E. Vol, I.K. Kagan in: "Handbook of Binary Metallic Systems", Nauka Publishers, Moscow (1976); TR: National Bureau of Standards, pp. 788–789 (1985).
[1990Mas] T.B. Massalski (Ed.): "Binary Alloy Phase Diagrams", 2nd Ed., ASM Int., Materials Park, OH, 1990.
[2004Din] A.T. Dinsdale, NPL, Teddington, U.K., private communication, 2004.
[2004Kor] J. Korb, unpublished assessment, GTT-Technologies, 2004.