C – Pt (Carbon – Platinum)

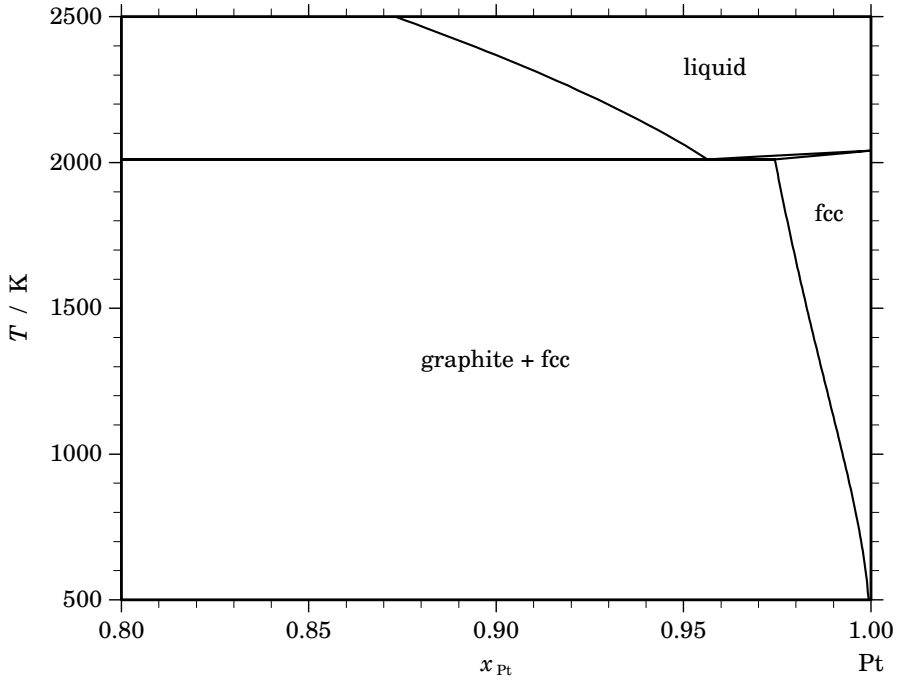

Fig. 1. Calculated phase diagram for the system C-Pt.

The C-Pt phase diagram has been studied by [1960Har, 1966Rhe, 1968Shi] using various experimental techniques. The system consists of the liquid, the fcc phase with very small solubility of C in Pt and the graphite phase with practically no solubility for Pt. No compounds were found to form at 65 kbar and 2973 K [1960Har]. The solid solubility of C in Pt was determined by [1968Sil] in the range from 1149 to 1518 K. According to [1996Mas] the solubility of C in Pt is less than 3 at.% C. This behaviour can be reproduced well by the calculations. Earlier investigations of the eutectic reaction at about 1978 K in the C-Pt system were carried out by Rhee [1966Rhe]. Later measurements done by Bhatt and Venkataramani [1987Bha], Park and Yamada [1999Par], and Dinsdale [2004Din] do not confirm previous experimental work. These investigations are however in good accord with each other and report the eutectic reaction between 2010 and 2011 K. The thermodynamic assessment of the C-Pt system was carried out by Korb and Jantzen [2004Kor]. The calculated eutectic temperature agrees very well with the experimental values [1987Bha, 2000Par, 2004Din].

Table I. Phases, structures and models.

Phase	Struktur-bericht	Prototype	Pearson symbol	Space group	SGTE name	Model
liquid					LIQUID	$(C,Pt)_1$
graphite	$A9$	C(graphite)	$hP4$	$P6_3/mmc$	GRAPHITE	C_1
fcc	$A1$	Cu	$cF4$	$Fm\overline{3}m$	FCC_A1	$Pt_1(C,\Box)_1$

Table II. Invariant reactions.

Reaction	Type	T / K	Compositions / x_{Pt}			$\Delta_r H$ / (J/mol)
liquid $\rightleftharpoons$ graphite + fcc	eutectic	2011.0	0.956	0.000	0.974	−25116

Table IIIa. Integral quantities for the liquid phase at 2100 K.

x_{Pt}	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)]
0.945	−986	5603	3.138	2745	1.361	0.000
0.950	−987	5066	2.882	2480	1.232	0.000
0.975	−812	2522	1.588	1229	0.616	0.000
1.000	0	0	0.000	0	0.000	0.000

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

Table IIIb. Partial quantities for C in the liquid phase at 2100 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}
0.055	0	102285	48.707	50562	24.630	1.000	18.098
0.050	−1913	102117	49.538	50394	24.630	0.896	17.924
0.025	−14829	101303	55.301	49580	24.630	0.428	17.109
0.000	$-\infty$	100469	∞	48746	24.630	0.000	16.310

Reference state: C(graphite)

Table IIIc. Partial quantities for Pt in the liquid phase at 2100 K.

x_{Pt}	ΔG_{Pt} [J/mol]	ΔH_{Pt} [J/mol]	ΔS_{Pt} [J/(mol·K)]	$G_{\mathrm{Pt}}^{\mathrm{E}}$ [J/mol]	$S_{\mathrm{Pt}}^{\mathrm{E}}$ [J/(mol·K)]	a_{Pt}	γ_{Pt}
0.945	−1044	−52	0.473	−52	0.000	0.942	0.997
0.950	−938	−42	0.426	−42	0.000	0.948	0.998
0.975	−453	−11	0.211	−11	0.000	0.974	0.999
1.000	0	0	0.000	0	0.000	1.000	1.000

Reference state: Pt(liquid)

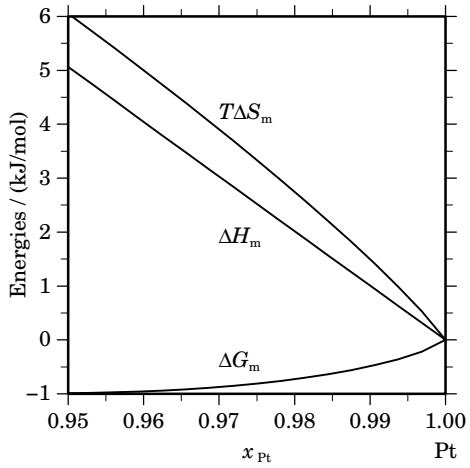

Fig. 2. Integral quantities of the liquid phase at T=2100 K.

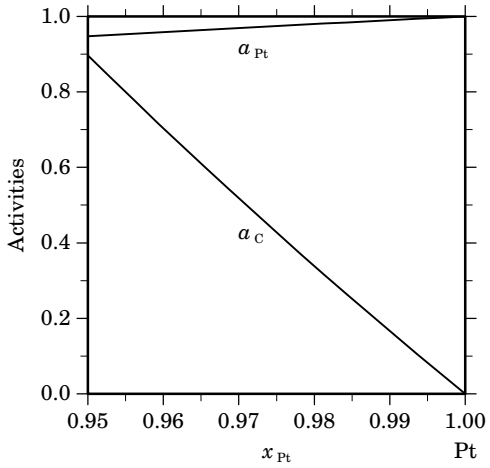

Fig. 3. Activities in the liquid phase at T=2100 K.

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