C – Os (Carbon – Osmium)

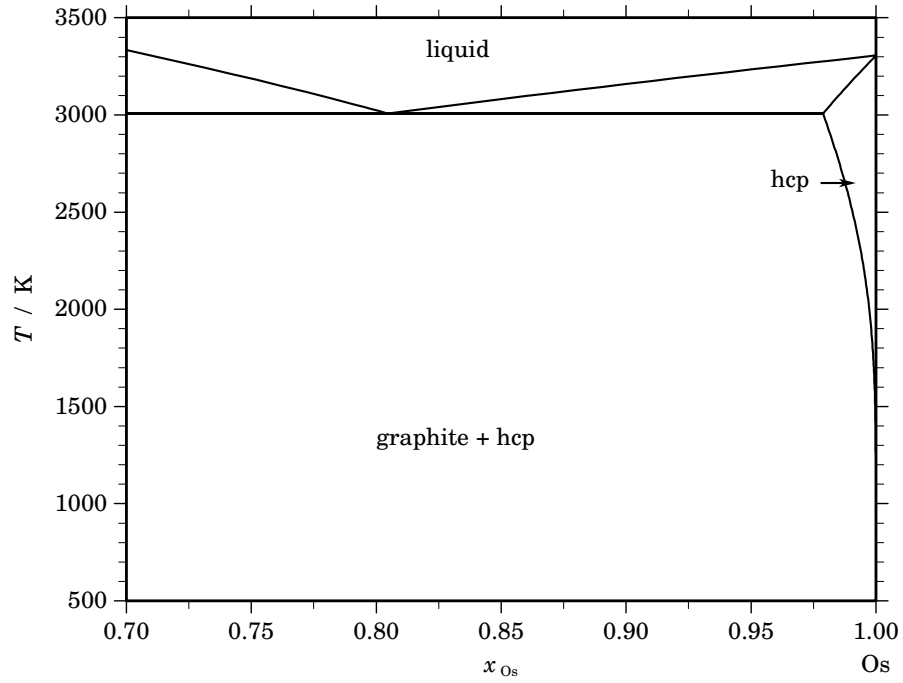

Fig. 1. Calculated phase diagram for the system C-Os.

The C-Os phase diagram is eutectic and includes the liquid phase, the hcp phase based on Os and graphite [1990Mas]. Experimental data on the C-Os system are limited and as the basis for the optimisation the phase diagram data given in [1976Mof] are used. OsC does not exist, according to [1964Rau]. The thermodynamic assessment of the C-Os system was carried out by Korb and Jantzen [2004Kor]. The experimentally determined invariant equilibria [1960Nad] agree satisfactorily with the calculations.

Table I. Phases, structures and models.

Phase	Struktur-bericht	Prototype	Pearson symbol	Space group	SGTE name	Model
liquid					LIQUID	$(C,Os)_1$
graphite	$A9$	C(graphite)	$hP4$	$P6_3/mmc$	GRAPHITE	C_1
hcp	$A3$	Mg	$hP2$	$P6_3/mmc$	HCP_A3	$Os_2(C,\square)_1$

Table II. Invariant reactions.

Reaction	Type	T / K	Compositions / x_{Os}			$\Delta_r H$ / (J/mol)
liquid $\rightleftharpoons$ graphite + hcp	eutectic	3007.5	0.805	0.000	0.979	−63629

Table IIIa. Integral quantities for the liquid phase at 3350 K.

x_{Os}	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)]
0.694	−7299	35054	12.643	9844	7.525	0.000
0.700	−7355	34413	12.468	9660	7.389	0.000
0.800	−7574	22866	9.087	6364	4.926	0.000
0.900	−5911	11395	5.166	3144	2.463	0.000
1.000	0	0	0.000	0	0.000	0.000

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

Table IIIb. Partial quantities for C in the liquid phase at 3350 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}
0.306	0	115537	34.489	33026	24.630	1.000	3.273
0.300	−538	115507	34.640	32997	24.630	0.981	3.270
0.200	−12402	114937	38.012	32427	24.630	0.641	3.203
0.100	−32354	114291	43.775	31781	24.630	0.313	3.130
0.000	$-\infty$	113569	∞	31059	24.630	0.000	3.050

Reference state: C(graphite)

Table IIIc. Partial quantities for Os in the liquid phase at 3350 K.

x_{Os}	ΔG_{Os} [J/mol]	ΔH_{Os} [J/mol]	ΔS_{Os} [J/(mol·K)]	$G_{\mathrm{Os}}^{\mathrm{E}}$ [J/mol]	$S_{\mathrm{Os}}^{\mathrm{E}}$ [J/(mol·K)]	a_{Os}	γ_{Os}
0.694	−10510	−355	3.032	−355	0.000	0.686	0.987
0.700	−10277	−342	2.966	−342	0.000	0.691	0.988
0.800	−6367	−152	1.855	−152	0.000	0.796	0.995
0.900	−2973	−38	0.876	−38	0.000	0.899	0.999
1.000	0	0	0.000	0	0.000	1.000	1.000

Reference state: Os(liquid)

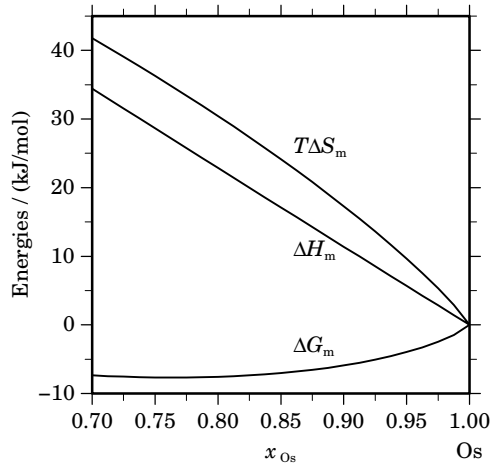

Fig. 2. Integral quantities of the liquid phase at T=3350 K.

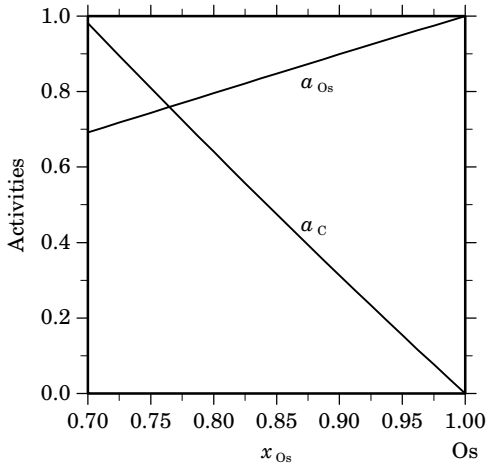

Fig. 3. Activities in the liquid phase at T=3350 K.

References

[1960Nad] M.R. Nadler, C.P. Kempter: J. Phys. Chem. **64** (1960) 1468–1471.
[1964Rau] E. Raub, G. Falkenberg: Z. Metallkd. **55** (1964) 186–189.
[1976Mof] W.G. Moffatt, (ed.): "Handbook of Binary Phase Diagrams", General Electric Co., Schenectady, NY (1976).
[90Mas] T.B. Massalski (ed.), Binary Alloy Phase Diagrams, ASM International (1990).
[2004Kor] J. Korb, T. Jantzen, unpublished assessment, GTT-Technologies, 2004.