O – Sn (Oxygen – Tin)

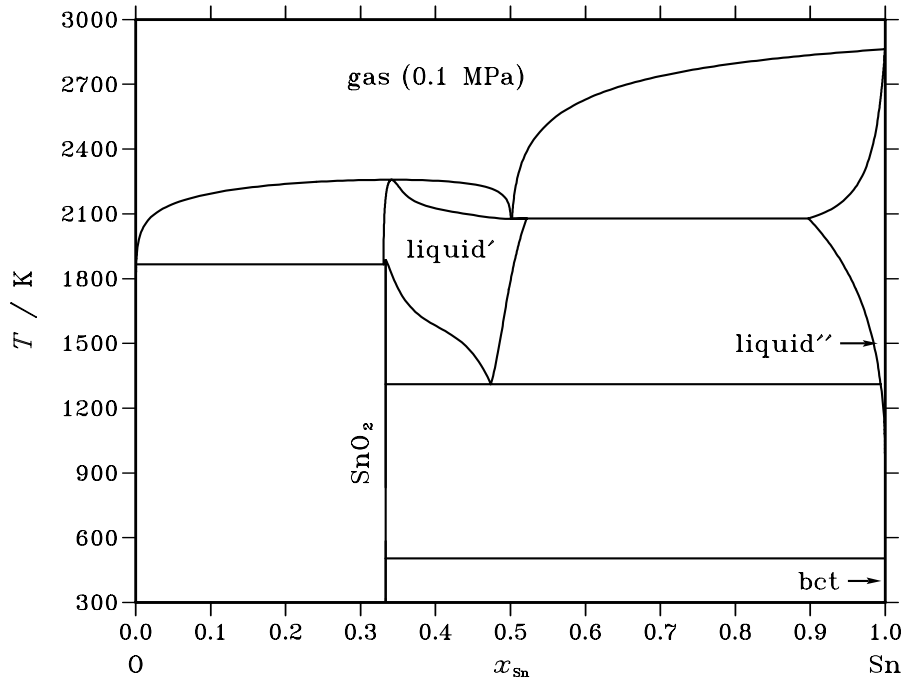

Fig. 1. Calculated phase diagram for the system O-Sn.

An understanding of the properties of the O-Sn system is important for glass manufacturers for control of the float glass process. The phase diagram is characterised by an extensive miscibility gap in the liquid phase for Sn rich compositions and the existence of the compound SnO_2 which is stable up to at least 1880 K. There is some indication that other compounds SnO and Sn_3O_4 could be stable at lower temperatures. The dataset adopted by SGTE is from the critical assessment of data for the system carried out by Ansara and Dupin [97Ans] which is based on the thermodynamic evaluation of SnO_2 in TCRAS and the experimental study of the miscibility gap by Kuxmann and Dobner [80Kux].

Table I. Phases, structures and models.

Phase	Struktur-bericht	Prototype	Pearson symbol	Space group	SGTE name	Model
liquid					IONIC_LIQ	$Sn_p^{2+}(O^{2-},O,SnO_2,\Box)_q$
SnO_2	$C4$	TiO_2	$tP6$	$P4_2/mnm$	SNO2	Sn_1O_2
Sn_3O_4	···	···	$a**$	···	···	Sn_3O_4
SnO	$B10$	PbO	$tP4$	$P4/nmm$	···	Sn_1O_1
bct	$A5$	βSn	$tI4$	$I4_1/amd$	BCT_A5	Sn_1

Table II. Invariant reactions.

Reaction	Type	T / K	Compositions / x_{Sn}			$\Delta_{\mathrm{r}}H$ / (J/mol)
gas $\rightleftharpoons$ liquid′	congruent	2257.7	0.341	0.341		−169104
gas + liquid″ $\rightleftharpoons$ liquid′	gas-peritectic	2079.1	0.502	0.898	0.521	−110096
gas $\rightleftharpoons$ liquid′	congruent	2077.0	0.501	0.501		−117510
liquid′ $\rightleftharpoons$ SnO_2	congruent	1885.9	0.333	0.333		−8500
liquid′ $\rightleftharpoons$ gas + SnO_2	gas-eutectic	1866.7	0.330	0.001	0.333	−7847
liquid′ $\rightleftharpoons$ SnO_2 + liquid″	monotectic	1311.5	0.474	0.333	0.994	−16743
SnO_2 + liquid″ $\rightleftharpoons$ bct	degenerate	505.1	0.333	1.000	1.000	−7029

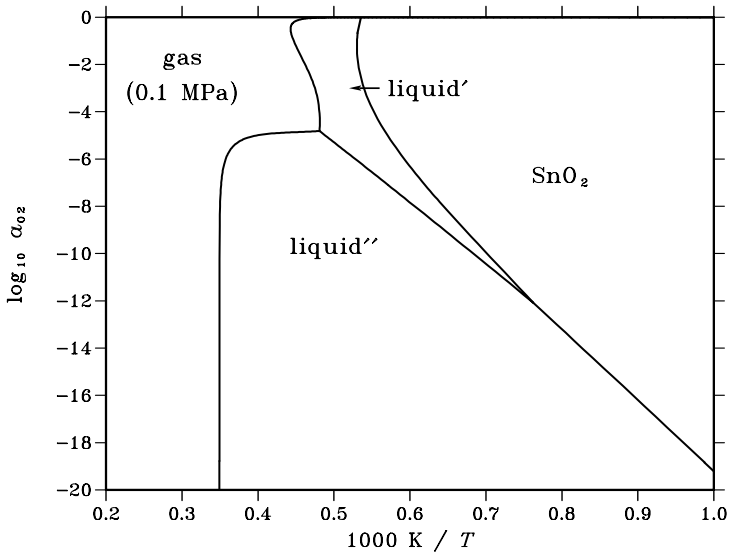

Fig. 2. Calculated temperature-activity phase diagram. Reference state: $\frac{1}{2}O_2$(gas, 0.1 MPa).

Table III. Standard reaction quantities at 298.15 K for the compounds per mole of atoms.

Compound	x_{Sn}	$\Delta_{\mathrm{f}}G^\circ$ / (J/mol)	$\Delta_{\mathrm{f}}H^\circ$ / (J/mol)	$\Delta_{\mathrm{f}}S^\circ$ / (J/(mol·K))	$\Delta_{\mathrm{f}}C_P^\circ$ / (J/(mol·K))
SnO_2	0.333	−171950	−192543	−69.070	−1.032

References

[80Kux] U. Kuxmann, R. Dobner: Metall (Berlin) **34** (1980) 821–827
[97Ans] I. Ansara, N. Dupin: unpublished work, 1997.