Ag – Te (Silver – Tellurium)

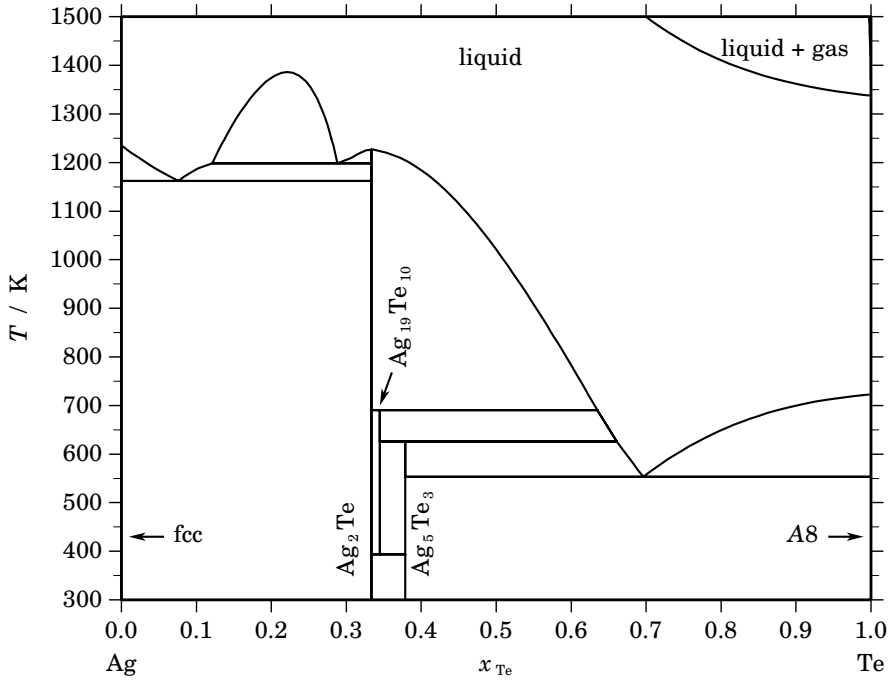

Fig. 1. Calculated phase diagram for the system Ag-Te.

The data for the Ag-Te system were critically assessed by Korb [2004Kor]. The condensed phases of the Ag-Te system are the liquid, with a miscibility gap and the solid phases fcc and hcp and three compounds, Ag_2Te, $Ag_{1.9}Te$, and Ag_5Te_3 [1991Kar]. The experimental investigations of the near-stoichiometric compounds Ag_2Te and Ag_5Te_3 were reported by [1964Hon]. With the exception of the miscibility gap, the phase boundaries for the liquid field were established from cooling curves [1910Pel, 1916Chi]. The presence of a miscibility gap was established by [1940Kra, 1966Kra]. The mutual solid solubilities of the elements in each other are negligible [1939Koe]. The calculated phase diagram agrees well with available experimental data. All three intermetallic compounds are known to have polymorphic modifications but they are not modelled in the assessment.

Table I. Phases, structures and models.

Phase	Struktur-bericht	Prototype	Pearson symbol	Space group	SGTE name	Model
liquid					LIQUID	$(Ag,Te)_1$
fcc	$A1$	Cu	$cF4$	$Fm\overline{3}m$	FCC_A1	$(Ag,Te)_1$
αAg_2Te	···	αAg_2Te	$mP12$	$P21/c$	AG2TE	Ag_2Te_1
βAg_2Te	···	···	$cF12$	···	AG2TE	Ag_2Te_1
γAg_2Te	···	···	$cI*$	···	AG2TE	Ag_2Te_1
$\alpha Ag_{19}Te_{10}$	···	···	···	···	AG19TE10	$Ag_{19}Te_{10}$
$\beta Ag_{19}Te_{10}$	···	···	···	···	AG19TE10	$Ag_{19}Te_{10}$
αAg_5Te_3	···	···	$hP55$	$P6/mmm$	AG5TE3	$Ag_{41}Te_{25}$
βAg_5Te_3	···	···	···	···	AG5TE3	$Ag_{41}Te_{25}$
$A8$	$A8$	γSe	$hP3$	$P3_121$	HEXAGONAL_A8	Te_1

Table II. Invariant reactions.

Reaction	Type	T / K	Compositions / x_{Te}			$\Delta_{\mathrm{r}}H$ / (J/mol)
liquid $\rightleftharpoons$ liquid′ + liquid″	critical	1386.1	0.221	0.221	0.221	0
liquid″ $\rightleftharpoons$ Ag_2Te	congruent	1226.7	0.333	0.333		−18105
liquid″ $\rightleftharpoons$ liquid′ + Ag_2Te	monotectic	1198.8	0.288	0.121	0.333	−14876
liquid′ $\rightleftharpoons$ fcc + Ag_2Te	eutectic	1162.1	0.076	0.000	0.333	−14022
Ag_2Te + liquid″ $\rightleftharpoons$ $Ag_{19}Te_{10}$	peritectic	690.3	0.333	0.635	0.345	−938
$Ag_{19}Te_{10}$ + liquid″ $\rightleftharpoons$ Ag_5Te_3	peritectic	626.0	0.345	0.661	0.379	−1728
liquid″ $\rightleftharpoons$ Ag_5Te_3 + $A8$	eutectic	553.1	0.696	0.379	1.000	−11555
$Ag_{19}Te_{10}$ $\rightleftharpoons$ Ag_2Te + Ag_5Te_3	eutectoid	393.9	0.345	0.333	0.379	−1899

Table IIIa. Integral quantities for the liquid phase at 1281 K.

x_{Te}	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)]
0.000	0	0	0.000	0	0.000	0.000
0.100	−7490	−446	5.499	−4028	2.796	0.000
0.200	−13829	−1950	9.274	−8500	5.113	0.000
0.300	−20108	−5544	11.370	−13602	6.291	0.026
0.400	−23244	−8352	11.625	−16076	6.029	0.029
0.500	−23374	−9254	11.023	−15991	5.259	0.002
0.600	−21475	−9042	9.705	−14307	4.110	0.000
0.700	−17976	−7816	7.931	−11469	2.852	0.000
0.800	−13192	−5784	5.782	−7862	1.622	0.000
0.900	−7290	−3132	3.246	−3827	0.543	0.000
1.000	0	0	0.000	0	0.000	0.000

Reference states: Ag(liquid), Te(liquid)

Table IIIb. Partial quantities for Ag in the liquid phase at 1281 K.

x_{Ag}	ΔG_{Ag} [J/mol]	ΔH_{Ag} [J/mol]	ΔS_{Ag} [J/(mol·K)]	$G_{\mathrm{Ag}}^{\mathrm{E}}$ [J/mol]	$S_{\mathrm{Ag}}^{\mathrm{E}}$ [J/(mol·K)]	a_{Ag}	γ_{Ag}
1.000	0	0	0.000	0	0.000	1.000	1.000
0.900	−949	419	1.068	173	0.192	0.915	1.016
0.800	−1273	2661	3.071	1103	1.216	0.887	1.109
0.700	−2479	9885	9.652	1320	6.686	0.792	1.132
0.600	−18047	−2821	11.886	−12606	7.638	0.184	0.306
0.500	−28182	−7479	16.162	−20799	10.398	0.071	0.142
0.400	−38051	−13561	19.118	−28292	11.499	0.028	0.070
0.300	−47257	−19459	21.701	−34434	11.690	0.012	0.039
0.200	−56038	−24735	24.437	−38896	11.055	0.005	0.026
0.100	−65420	−29343	28.163	−40896	9.018	0.002	0.022
0.000	$-\infty$	−33340	∞	26577	−46.774	0.000	12.125

Reference state: Ag(liquid)

Table IIIc. Partial quantities for Te in the liquid phase at 1281 K.

x_{Te}	ΔG_{Te} [J/mol]	ΔH_{Te} [J/mol]	ΔS_{Te} [J/(mol·K)]	$G^{\mathrm{E}}_{\mathrm{Te}}$ [J/mol]	$S^{\mathrm{E}}_{\mathrm{Te}}$ [J/(mol·K)]	a_{Te}	γ_{Te}
0.000	$-\infty$	−994	∞	−38904	29.594	0.000	0.026
0.100	−66362	−8231	45.379	−41837	26.234	0.002	0.020
0.200	−64053	−20390	34.085	−46911	20.703	0.002	0.012
0.300	−61242	−41543	15.377	−48418	5.367	0.003	0.011
0.400	−31039	−16649	11.234	−21280	3.615	0.054	0.136
0.500	−18566	−11029	5.884	−11183	0.120	0.175	0.350
0.600	−10424	−6030	3.430	−4983	−0.817	0.376	0.626
0.700	−5426	−2826	2.030	−1627	−0.936	0.601	0.858
0.800	−2480	−1047	1.119	−103	−0.737	0.792	0.990
0.900	−831	−220	0.477	291	−0.399	0.925	1.028
1.000	0	0	0.000	0	0.000	1.000	1.000

Reference state: Te(liquid)

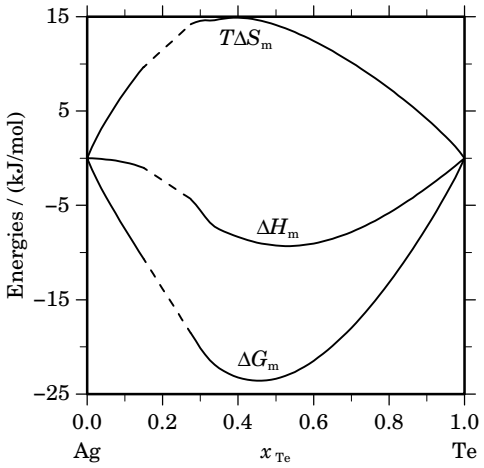

Fig. 2. Integral quantities of the liquid phase at T=1281 K.

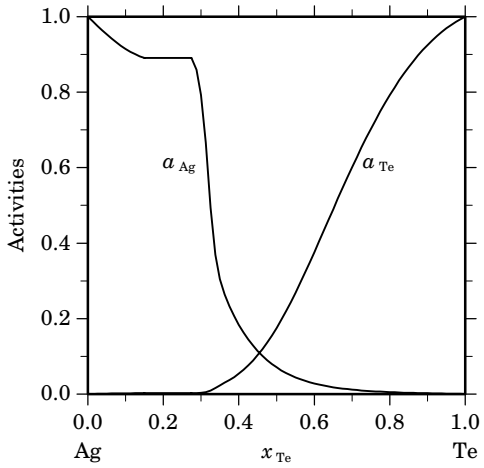

Fig. 3. Activities in the liquid phase at T=1281 K.

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

Compound	x_{Te}	$\Delta_{\mathrm{f}}G^{\circ}$ / (J/mol)	$\Delta_{\mathrm{f}}H^{\circ}$ / (J/mol)	$\Delta_{\mathrm{f}}S^{\circ}$ / (J/(mol·K))	$\Delta_{\mathrm{f}}C^{\circ}_{P}$ / (J/(mol·K))
Ag_2Te_1	0.333	−14104	−12117	6.662	2.830
$Ag_{19}Te_{10}$	0.345	−13542	−9839	12.418	0.000
Ag_5Te_3	0.379	−13942	−12236	5.721	3.630

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