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Thermodynamic stability of Sm_2TeO_6

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Abstract

The vapour pressure of Sm_2TeO_6 was measured using a thermal analyser with a horizontal arm. This TG based transpiration technique, was validated by measuring the vapour pressure of pure TeO_2(s). The temperature dependence of the latter was measured to be $\log p\,(\mathrm{Pa}) = \{14.2 - 13321/T\,(\mathrm{K})\}\ (\pm 0.03)$ in the range 884–987 K. These data yielded a ΔH°_{298} value of $269.7 \pm 0.6\,\mathrm{kJ\,mol^{-1}}$ for the enthalpy of sublimation (third-law method) of TeO_2 which compared well with the data reported in the literature. The temperature dependence of the vapour pressure of TeO_2 over the mixture $Sm_2TeO_6(s) + Sm_2O_3(s)$ generated by the incongruent vapourisation reaction,

$$Sm_2TeO_6(s) \rightarrow Sm_2O_3(s) + TeO_2(g) + 1/2O_2(g)$$

could be expressed as

$$\log p\,(\mathrm{Pa}) = \{18.56 - 25469/T\,(\mathrm{K})\} \pm 0.06\,(1374 - 1533\,\mathrm{K})$$

The standard Gibbs energy of formation of Sm_2TeO_6(s) was derived from the above vapour pressure data in conjunction with auxiliary data for the other coexisting phases. The temperature dependence of the Gibbs energy of formation of Sm_2TeO_6 over the temperature range 1374–1533 K could be represented as

$$\Delta G^\circ_\mathrm{f}(Sm_2TeO_6)(\mathrm{kJ\,mol^{-1}}) = \{-2399.3 + 0.5714\,T\,(\mathrm{K})\} \pm 5.8$$

The Gibbs energy of formation of Sm_2TeO_6(s) is being reported for the first time.

Keywords: Samarium tellurate (Sm_2TeO_6); TeO_2; Transpiration technique; Gibbs energy of formation; Vapour pressure; TG

1. Introduction

Tellurium is one of the fission products formed in mixed oxide fuel used in fast breeder reactors (FBRs). It influences the chemistry of the fuel and causes corrosion of the cladding [1,2]. The thermodynamic data on the compounds comprising tellurium and other fission product elements are useful in understanding the fuel-clad chemical interaction in FBR fuel pins. An experimental programme is currently being pursued in our laboratory with an objective to generate thermodynamic data on multicomponent oxide systems involving tellurium and a fission product element. As a part of this study the systematics in the ternary systems with different lanthanide elements are being investigated. This paper presents the results obtained with the system Sm–Te–O. This ternary system comprises three compounds Sm_2TeO_6, $Sm_2Te_4O_{11}$ and $Sm_2Te_6O_{15}$. The thermodynamic stability and vapour pressures of these compounds are yet to be established unambiguously. We measured the vapour pressure of TeO_2(g) over a mixture containing Sm_2TeO_6 and Sm_2O_3 and derived the standard Gibbs energy of formation of Sm_2TeO_6 from the vapour pressure data.

The vapour pressure of pure TeO_2 has been determined in the past by many investigators [3–14]. The measurement of the vapour pressure of pure TeO_2 would be most appropriate for validating the apparatus and procedure, in the context of the lanthanide bearing ternary systems Ln–Te–O. In view of the above, we re-determined the vapour pressure of pure TeO_2 [15].

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2. Experimental

2.1. Materials

Reagent grade TeO_2 of purity better than 99.9% was procured from Aldrich Chemicals, USA and Sm_2O_3 of purity better than 99.99% was supplied by Indian Rare Earths Ltd., India. High purity O_2 ($H_2O < 2$ ppm) and He (O_2 and $H_2O < 2$ ppm) were obtained from M/s. Indian Oxygen Limited, Chennai, India.

2.2. Preparation of solid solutions

The ternary oxide Sm_2TeO_6 was prepared by heating an equimolar mixture of Sm_2O_3 and TeO_2. The temperature suitable for preparing the ternary compound was identified by carrying out a trial experiment in which the above mixture was heated at $10\,K\,min^{-1}$ in static air in the thermal analyser (Model Seiko 320, Japan). This experiment revealed an exotherm at 1058 K with an attendant weight gain that continued up to 1223 K. However, no further gain in weight was observed at higher temperatures. The solid mixture was homogenized using an agate mortar and pestle and then compacted into pellets with about 10 mm diameter and 2–3 mm thickness. These pellets were heated at 923 K for 24 h followed by a soak at 1223 K for 48 h. The purity of this ternary oxide Sm_2TeO_6 was ascertained by using X-ray diffraction (XRD) analysis. Thus it could be concluded that the amount of impurities in this compound is less than the detection limits of XRD, viz., 2–5 mass%. The heat treated samples were found to contain Sm_2TeO_6 (JCPDS XRD file No.40-0332), neither Sm_2O_3 nor TeO_2 was present in them.

2.3. Transpiration set-up

A horizontal thermal analyser (Model Seiko 320, Japan) was employed as a transpiration apparatus for the vapour pressure investigations. The horizontal disposition of a narrow tubular furnace chamber and the central location of the horizontal dual arm help minimize the errors due to buoyancy, convection and thermomolecular effects. Both the sample temperature and the differential temperature were measured within ±0.5 K by using a Pt–13% Rh/Pt (Type-R) thermocouple. The accuracy in the temperature measurement was testified by determining the freezing points of pure metals viz., Sn, Pb, Sb, Al, Ag and Au. This calibration was found to conform to the ITS-90 [16] scale. Precise flow calibration of the carrier gases viz., He (for the experiments with pure TeO_2) and O_2 (for the experiments with Sm_2TeO_6) was done using a capillary glass flow meter, which in-turn was calibrated by a soap bubble flow meter. Even though the precision in the flow as measured by the glass capillary flow meter was found to be within 0.5%, the overall precision in the integral volume was of the order of ±1%. Saturation of the carrier gas with the vapour emanating from the sample was ensured by using a finely divided powder of the specimen and by spreading it evenly in a shallow Pt crucible kept in a narrow reaction chamber (furnace tube). Prior to the measurements, blank runs were carried out, in the temperature range 800–1500 K, with empty pans, by maintaining an optimum flow ($3–18\,dm^3\,h^{-1}$) of an appropriate carrier gas (He/O_2). The apparent gain in mass upon heating was found to be about 10–20 μg per 100 K, over the entire range of flow. A similar drift was observed in the isothermal experiments as well. The “mass loss” values obtained in the isothermal experiments were corrected for this drift. A detailed account on the equipment and methodology could be found elsewhere [17–19].

2.4. Vapourisation reaction and intermediates

The heat effects and mass loss steps pertaining to the vapourisation of Sm_2TeO_6 were identified using a simultaneous TG-DTA experiment. In a typical experiment, about 85 mg of Sm_2TeO_6 was taken in a Pt crucible and heated in a flowing stream of pure oxygen (flow rate $8\,dm^3\,h^{-1}$) at a linear heating rate of $0.17\,K\,s^{-1}$. In order to identify the intermediates the TG-DTA experiment was interrupted and the specimen was characterized by using XRD.

3. Results and discussion

The apparent pressure of TeO_2(g) in equilibrium with either pure TeO_2(s) or with a mixture of Sm_2TeO_6(s) and Sm_2O_3(s) was calculated from the mass loss of the sample per unit volume of the carrier gas flown over it, using the relation

$$P^{app} = \frac{WRT_c}{MV_c} \tag{1}$$

W is the mass loss of the sample, V_c is the total volume of the carrier gas (saturated with the vapour species) and T_c is temperature of the carrier gas and M is molecular weight of the vapour species. In an earlier study [18] the temperature of the specimen was used in place of T_c. It is more appropriate to use the latter since the volume measurement is carried out only at T_c Hence, the data presented in ref. [18] should be corrected accordingly.

3.1. Vapour pressure of pure solid TeO_2

The vapour pressure of solid TeO_2 was measured using He as the carrier gas. It was presumed that the vapour comprised only the monomeric TeO_2(g) species. The contribution of all other tellurium-bearing species [$(TeO_2)_2$, TeO, $(TeO)_2$, Te_2] to the total pressure was estimated to be less than 5% from the mass spectrometric studies of Muenow et al. [14].

In the isothermal experiment at 925 K, the mass lost per unit volume of the carrier gas (helium) flown over TeO_2 was found to remain constant when the flow was between 8 and $12\,dm^3\,h^{-1}$. This corresponds to the flow regime (Fig. 1) in which the carrier gas is saturated with vapour species. Data obtained in the isothermal experiments carried out in this flow regime, are presented along with the values of the vapour pressures p_{TeO_2} derived from them in Table 1.

$$TeO_2(s) \rightarrow TeO_2(g) \tag{2}$$

A linear least square regression analysis of the experimental data obtained during the congruent vapourisation of TeO_2(s)

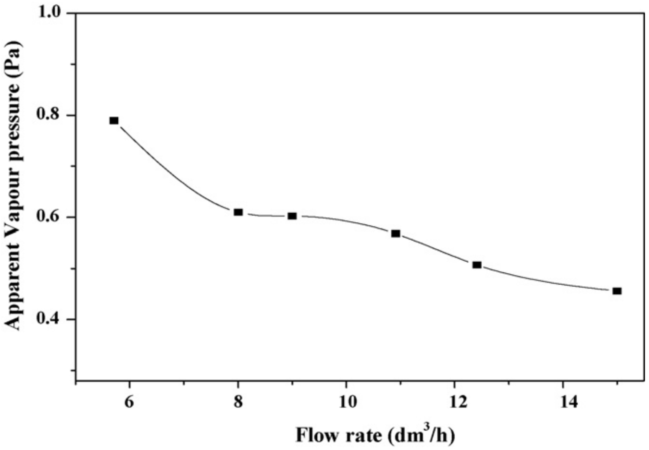

Fig. 1. Apparent vapour pressure versus flow rate of TeO_2 at 925 K.

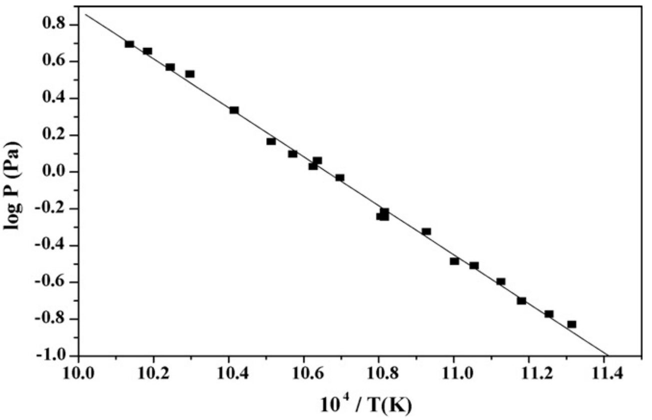

Fig. 2. Temperature dependence of equilibrium vapour pressure of solid TeO_2.

shown in Eq. (2) yielded an expression (3) for the temperature dependence of the vapour pressure. These data are also graphically depicted in Fig. 2.

$$\log p\,(\mathrm{Pa}) = \left\{14.2 - \frac{13321}{T\,(\mathrm{K})}\right\} \pm 0.03\,(884 - 987\,\mathrm{K}) \qquad (3)$$

The enthalpy of sublimation derived from the slope of the temperature dependence of the vapour pressure at the mean temperature of the measurement (936 K) was found to be $255 \pm 0.1\,\mathrm{kJ\,mol^{-1}}$.

The temperature dependent systematic errors in the measured values of the vapour pressure were examined by using the third-law analysis Eq. (4). The free energy functions (FEF), required for this analysis were derived using the values of S°_{298} and C^0_p of TeO_2 (both solid and gas) obtained from the thermochemical tables compiled by Knacke et al. [20]. The value of the standard enthalpy of sublimation at 298 K was derived using Eq. (4). The values of $\Delta H^\circ_{\mathrm{sub,298\,K}}$ derived from the experimental data are listed in Table 2. Their temperature dependence is depicted in Fig. 3. The mean of these values was found to be $(269.7 \pm 0.6)\,\mathrm{kJ\,mol^{-1}}$.

$$\Delta H^\circ_{\mathrm{sub,298\,K}} = \Delta G^\circ_{\mathrm{vap}} - T\ \ \Delta\mathrm{FEF} \qquad (4)$$

It is evident from Fig. 3 that the values of $\Delta H^\circ_{\mathrm{sub,298\,K}}$ are randomly distributed about the mean. This indicates that the present measurements are devoid of any significant temperature dependent systematic errors.

Mills [3] and Cordfunke and Konings [4] have extensively reviewed the thermochemical data on TeO_2 which include calorimetric measurements, vapour pressure values and EMF data. The vapour pressure of TeO_2 was a subject of study from 1941 till recent years. Various experimental techniques such as Knudsen cell mass loss method [5–8], mass spectrometry [9–11,14] and transpiration [12,13] have been used to measure the vapour pressures. In order to validate the experimental technique used in the present study and to testify the accuracy of the vapour pressure data it would be instructive to compare all the measured values of vapour pressures with that obtained in this

Table 1
Vapour pressure of TeO_2(s)

Experiment number	T (K)	Mass loss ((g)	V_c (dm^3)	T_c (K)	Pressure (mPa)
1	884	120	12.414	295	148.7
2	889	120	10.909	295	169.2
3	895	140	10.909	297	198.7
4	899	180	10.909	295	253.8
5	905	220	10.909	295	310.2
6	909	232	10.909	295	327.1
7	915	334	10.909	297	474.1
8	925	315	8	297	609.9
9	925	350	9	297	602.3
10	925	400	10.909	297	567.9
11	926	404	10.909	297	573.6
12	935	660	10.909	295	929.5
13	940	820	10.909	295	1154.8
14	941	760	10.909	295	1071.8
15	946	890	10.909	295	1255.1
16	951	1040	10.909	295	1464.6
17	960	1260	9	297	2168.4
18	971	1980	9	297	3407.4
19	976	2160	9	297	3717.2
20	982	2640	9	297	4543.2
21	987	2880	9	297	4956.2

Initial weight of the sample: 85 mg, T (K): temperature corresponding to each experimental measurement, V_c (dm^3): volume of the helium carrier gas, T_c (K): temperature of the helium carrier gas.

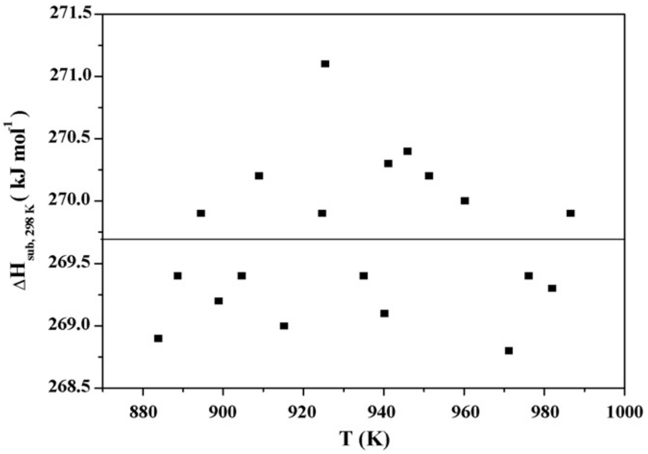

Fig. 3. Third-law plot of enthalpy of sublimation of TeO_2; the horizontal line is the mean value of $\Delta H^\circ_{\mathrm{sub,298\,K}}$.

Table 2
Comparison of vapour pressure data of solid TeO_2 with the literature

$\log p\,(\mathrm{Pa}) = A - \frac{B}{T\,(\mathrm{K})}$		T Range (K)	p at 900 K (Pa)	$\Delta H^\circ_{\mathrm{sub}}$(mean T) (kJ mol^{-1}) (K)	$\Delta H^\circ_{\mathrm{sub,298\,K}}$ (Third-law) (kJ mol^{-1})	Method	Ref.
A	B						
13.70	12570	870–930	0.54	240.7 (900)	266.2 ± 0.7	KEML	[5]
13.00	12000	846–1006	0.54	229.8 (926)	261.0 ± 2.0	T	[12]
14.38	13169	730–981	0.55	252.1 (856)	266.0	KEML	[6]
14.54	13292	873–1006	0.59	254.5 (940)	265.3	KEML	[7]
13.78	12650	913–993	0.53	242.2 (953)	266.8	T	[13]
14.66	14666	782–903	0.023	280.8 (843)	289.8	KCMS	[14]
14.65	13432	778–906	0.53	257.2 (842)	266.9	KCMS	[9]
15.87	14529	926–970	0.53	278.2 (948)	264.4	KEML	[8]
14.24	13534	750–950	0.16	259.1 (850)	264.0	KCMS	[10]
15.02	13988	805–905	0.3	267.8 (855)	268.6	KCMS	[11]
14.20	13321	884–987	0.25	255.0 (936)	269.7	T	This work
					264.0 ± 8.4	Review	[3]
					266.2 ± 0.6	Review	[4]

KEML: Knudsen effusion mass loss; T: transpiration; KCMS: Knudsen cell mass spectrometry, $\Delta H^\circ_{\mathrm{sub}}$ (mean T): enthalpy of sublimation at the mean temperature of the present measurements, $\Delta H^\circ_{\mathrm{sub,298\,K}}$: enthalpy of sublimation at 298 K by third-law, p: pressure (p) at 900 K, T range: temperature range.

study. Such a comparison (presented in Table 2) reveals that, by and large, there is a reasonable agreement among the cited values of p (Pa) at 900 K and those obtained in the present study. Since the temperature range over which each of these investigations was carried out differ considerably, a comparison of the enthalpy of sublimation at the mean temperature of these measurements is not useful. However, a meaningful comparison of the vapour pressure data (presented in Table 2) could be made with the help of the "third-law" analyses. Mills [3] and Cordfunke and Konings [4] have reviewed the $\Delta H^\circ_{\mathrm{sub,298\,K}}$ values using the mass spectrometric data of Piacente et al. [9]. The value of $\Delta H^\circ_{\mathrm{sub,298\,K}}$ of TeO_2 (269.7 ± 0.6) kJ mol^{-1} derived from the present study agrees very well with that reported by the other investigators [5–11,13] as well as with those recommended by the reveiwers [3,4] within 4 kJ mol^{-1}. In view of the above it could be concluded that the vapour pressures of TeO_2 obtained in this study are quite reliable. Thus, the present study validates the reliability of this TG based transpiration technique for measuring the vapour pressures.

3.2. Non-isothermal TG of Sm_2TeO_6

The simultaneous TG-DTA pertaining to the incongruent vapourisation of Sm_2TeO_6(s) revealed that this compound begins to lose mass from 1373 K in pure O_2. The X-ray diffraction of a specimen from an interrupted TG-DTA experiment confirmed the presence of the compounds Sm_2TeO_6(s) and Sm_2O_3(s). Thus the vapourisation of the ternary compound could be represented by Eq. (5).

$$Sm_2TeO_6(s) \rightarrow Sm_2O_3(s) + TeO_2(g) + \tfrac{1}{2}O_2(g) \qquad (5)$$

3.3. Vapourisation behaviour of Sm_2TeO_6 by the transpiration technique

The dependence of the mass loss on the flow of the carrier gas (pure oxygen) at 1422 K was obtained from the thermogravimetric experiments and is depicted in Fig. 4. This "chair" shaped curve revealed a plateau between the flow values of 7 and 9.5 dm^3 h^{-1}, over which the mass loss was independent of the flow. In this flow regime the carrier gas was saturated with TeO_2 vapour. All the isothermal mass loss measurements were carried out by employing a flow pertaining to this plateau region.

The vapour pressure of TeO_2(g) over samarium tellurate was calculated at different temperatures from the observed mass loss of the sample, m_{total} per unit flow volume of the O_2(g) at a pressure of 1 bar. Both O_2(g) and TeO_2(g) contribute to the total weight loss m_{total}. The loss of weight due to the loss of TeO_2(g) alone was computed from this value using Eq. (6),

$$m_{TeO_2} = m_{\mathrm{total}}\left[\frac{M_{TeO_2}}{M_{TeO_2} + 0.5M_{O_2}}\right] \qquad (6)$$

where M is the molecular weight and m is the mass loss of the respective compounds. The vapour pressures, p_{TeO_2} computed from these experiments are enlisted along with the values of

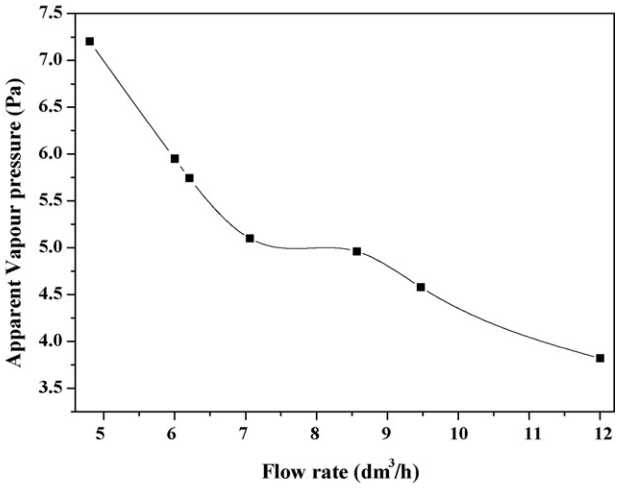

Fig. 4. Apparent vapour pressure versus flow rate of Sm_2TeO_6 at 1422 K.

Table 3
Table 3 Vapour pressure data and calculation of ΔG_f° of Sm_2TeO_6

T (K)	Mass loss (mg)	V_c (dm^3)	$p_{TeO_2}^{(a)}$ (Pa)	$p_{TeO_2}^{0}$ (Pa)	ΔG_f°, $(Sm_2TeO_6)^{(b)}$ (kJ mol^{-1})	ΔG_f°, $(Sm_2TeO_6)^{(c)}$ (kJ mol^{-1})
1374	0.4363	7.059	0.964	7719	−1614.0	−1609.5
1380	0.5817	7.059	1.285	8345	−1610.8	−1606.3
1392	0.8544	8.571	1.554	9884	−1603.9	−1599.4
1403	1.3633	8.571	2.479	11484	−1597.7	−1593.2
1417	2.3086	8.571	4.199	13933	−1589.5	−1585.0
1422	2.7266	8.571	4.957	14795	−1586.9	−1582.5
1422	2.7812	9.474	4.575	14795	−1586.9	−1582.5
1422	2.3086	7.059	5.096	14795	−1586.9	−1582.5
1427	2.9448	8.571	5.354	15808	−1584.1	−1579.6
1438	3.1265	8.571	5.685	18212	−1577.9	−1573.4
1448	5.4533	8.571	9.915	20909	−1571.8	−1567.3
1458	8.0163	8.571	14.575	23687	−1566.2	−1561.7
1478	12.361	7.059	27.290	30323	−1554.9	−1550.4
1514	26.7483	8.571	48.633	46567	−1534.5	−1530.0
1533	41.9357	8.571	76.246	58635	−1523.1	−1518.7

Initial weight of the sample: 68 mg, T (K): temperature corresponding to each experimental measurement, V_c (dm^3): volume of the oxygen carrier gas, T_c (K): temperature of the oxygen carrier gas (T_c = 299 K), $p_{TeO_2}^{(a)}$: calculated by using Eq. (1), T_c = 299 K, $p_{TeO_2}^{0}$: extrapolated values from Eq. (15), $\Delta G_f^\circ(Sm_2TeO_6)^{(b)}$: standard Gibbs energy of formation of Sm_2TeO_6 using Eq. (13), $\Delta G_f^\circ(Sm_2TeO_6)^{(c)}$: standard Gibbs energy of formation of Sm_2TeO_6 using Eq. (16).

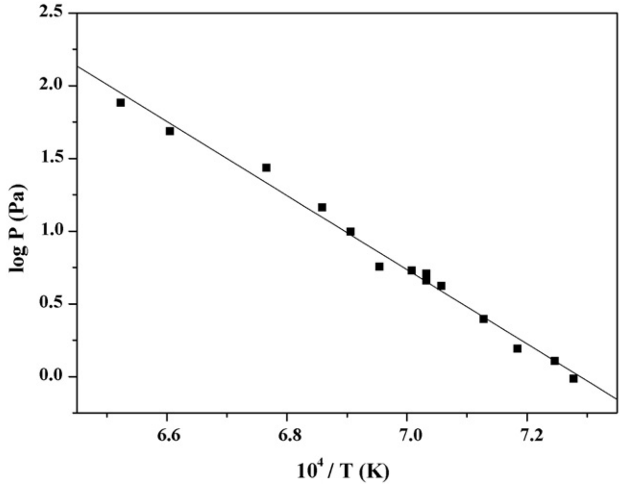

Fig. 5. Temperature dependence of equilibrium vapour pressure of Sm_2TeO_6.

mass loss, temperature and cumulative volume of the carrier gas V_c, in Table 3.

The temperature dependence of the vapour pressure is shown in Fig. 5. The linear least squares regression analysis of these data yielded expression (7).

$$\log p\,(\text{Pa}) = \{18.56 - 25469/T\,(\text{K})\}(\pm 0.06)(1374 - 1533\,\text{K}) \tag{7}$$

The standard Gibbs energy change, $\Delta G_{r(5)}^\circ$ for the reaction (5) could be expressed as

$$\Delta G_r^\circ(5) = -RT \ln K \quad (\text{where } K = \text{equilibrium constant}) \tag{8}$$

$$= -RT \ln \left\{ \frac{a\,Sm_2O_3 x p(TeO_2) x pO_2{}^{1/2}}{a\,Sm_2TeO_6} \right\} \tag{9}$$

where activities of solids ($a_{Sm_2O_3}$ and $a_{Sm_2TeO_6}$) are equal to one and $p_{O_2} = 1$ bar. Hence,

$$\Delta G_r^\circ(5) = -RT \ln p_{(TeO_2)} \tag{10}$$

$$\Delta G_r^\circ(5)\,(\text{kJ mol}^{-1}) = \{487.7 - 0.2595\,T\,(\text{K})\} \pm 0.1 \tag{11}$$

The standard Gibbs energy of formation of Sm_2TeO_6 could be expressed in terms of the equilibrium partial pressure of TeO_2(g) and the stabilities of Sm_2TeO_6 and Sm_2O_3 as follows

$$\Delta G_f^\circ(Sm_2TeO_6, s) = \Delta G_f^\circ(Sm_2O_3) + \Delta G_f^\circ(TeO_2, g) + RT \ln p_{(TeO_2)} \tag{12}$$

Combining the expression (11) along with the key data for $\Delta G_f^\circ(Sm_2O_3, s)$ and $\Delta G_f^\circ(TeO_2, g)$ from the literature [20], $\Delta G_f^\circ(Sm_2TeO_6, s)$ was calculated to be

$$\Delta G_f^\circ(Sm_2TeO_6)(\text{kJ mol}^{-1}) = \{-2399.3 + 0.5714\,T\,(\text{K})\} \pm 5.8\ \ (1374 - 1533\,\text{K}) \tag{13}$$

ΔG_f° (Sm_2TeO_6, s) with liquid TeO_2 as the reference state is presented in Eq. (14).

$$\Delta G_f^\circ(Sm_2TeO_6, s) = \Delta G_f^\circ(Sm_2O_3, s) + \Delta G_f^\circ(TeO_2, l) + RT \ln \frac{p_{TeO_2}}{p_{TeO_2}^0} \tag{14}$$

The temperature dependence of vapour pressure of TeO_2(g) ($p_{TeO_2}^0$) over pure liquid TeO_2 was measured in our laboratory using the same TG based transpiration technique and was found to be [15],

$$\log p_{TeO_2}^0\,(\text{Pa}) = 12.38 - 11672/T\,(\text{K})(1006 - 1070\,\text{K}) \tag{15}$$

The standard Gibbs energy of formation of Sm_2TeO_6 was obtained with the help of Eq. (14) using auxiliary data on the

ΔG_f° (TeO_2, l) and ΔG_f° ($Sm_2O_{3,}$ s) from the literature [20]. This is shown in Eq. (16)

$$\Delta G_f^\circ(Sm_2TeO_6)(\mathrm{kJ\,mol^{-1}}) = \{-2394.4 + 0.5711\,T\,(\mathrm{K})\} \pm 5.8(1374 - 1533\,\mathrm{K}) \quad (16)$$

The slope and intercept of the Eqs. (13) and (16) are related to the standard molar enthalpy and entropy of the formation of Sm_2TeO_6(s), respectively (valid over the temperature range 1374–1533 K). The Gibbs energy of formation of Sm_2TeO_6(s) is being reported for the first time. Since no information is available on the heat capacity of this compound, the second law and third-law analyses of the vapour pressure data could not be carried out. Hence it was not possible to evaluate and verify the values of the ΔH_f° Sm_2TeO_6(s) at 298 K. However, the average enthalpy of formation of Sm_2TeO_6 obtained from the present work by using the method of slopes, was found to be $-2396.9 \pm 5.8\,\mathrm{kJ\,mol^{-1}}$ at the mean temperature of the present measurements.

4. Conclusion

The applicability of a TG based transpiration technique for measuring vapour pressures was verified by measuring the vapour pressure of pure TeO_2 over the range 884–987 K yielding a value of $269.7 \pm 0.6\,\mathrm{kJ\,mol^{-1}}$ for the third-law enthalpy of sublimation which compares well with the literature data. The ternary compound, Sm_2TeO_6(s) was prepared by the solid state reaction of an equimolar mixture of $Sm_2O_{3,}$ and TeO_2 and was characterized by X-ray and TG-DTA. The vapour pressure of TeO_2(g) over Sm_2TeO_6(s) was derived from these vapour pressure measurements. The values of ΔG_f° Sm_2TeO_6(s) were derived from these vapour pressure measurements and are being reported for the first time. The average enthalpy of formation of Sm_2TeO_6 obtained from the present work was found to be $-2396.9 \pm 5.8\,\mathrm{kJ\,mol^{-1}}$.

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