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Note

DETERMINATION OF THE HEATS OF FORMATION OF SOME BASIC METAL TELLURITES AND PYROTELLURITES

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Data concerning the possible basic metal tellurites and pyrotellurites are rather scarce. The T–X projections of the state diagrams of the systems ZnO–TeO_2 [1], PbO–TeO_2 [2] and Bi_2O_3–TeO_2 [3,4] have been drawn.

The alloys of the systems CuO–TeO_2 and CdO–TeO_2 have been studied by means of X-ray analysis [5,6]. The composition of the possible compounds have been determined for these five systems.

No data concerning the thermodynamic characteristics of these compounds are available.

EXPERIMENTAL, RESULTS AND DISCUSSION

In order to determine the heats of formation of the compounds under study, high-purity metal oxides (Merck and Fluka) were used. Tellurous oxide was obtained by oxidation of tellurium, class B-4, with a mixture of HCl and HNO_3 (Merck) and subsequent precipitation with ammonia. The products obtained were then thoroughly washed, dried and heated. According to spectral analysis data, the total content of mixtures in the tellurous oxide used is less than 10^{-4}%. Chemical and X-ray analyses confirm the formation of a pure phase of TeO_2.

The aim of the present study was to determine the heats of formation of ten basic metal tellurites and pyrotellurites. Mechanical mixtures of a metal oxide and tellurous oxide corresponding exactly to the stoichiometry of the compounds under study (Table 1) were previously prepared. Homogeneity of the initial mixtures was checked by chemical and X-ray techniques as described in ref. 7.

To determine the heats of formation, a differential scanning calorimeter DSC-111 (Seteram, France) was used. The samples were sealed in metal capsules which were inactive towards the components of the system, and were heated, the reaction heat of formation of the corresponding compounds being recorded. Then the reaction heats obtained were summed with the

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TABLE 1

Results of the chemical analysis of the mechanical mixtures of a metal oxide and tellurous oxide corresponding to the stoichiometry of the basic metal tellurites and pyrotellurites

Compound	Calculated (%)		Found (%)	
	Metal oxide	Tellurous oxide	Metal oxide	Tellurous oxide
$CuO \cdot CuTeO_3$	49.92	50.08	49.83	50.00
			49.97	50.40
			49.88	50.12
$2PbO \cdot PbTeO_3$	80.75	19.25	80.84	19.29
			80.72	19.32
			80.73	19.24
$4PbO \cdot PbTeO_3$	87.49	12.51	87.43	12.44
			87.53	12.53
			87.47	12.49
$Bi_2O_3 \cdot 2TeO_2$	59.35	40.65	59.41	40.60
			59.34	40.67
			59.33	40.65
$Bi_2O_3 \cdot TeO_2$	74.49	25.51	74.52	25.55
			74.44	25.53
			74.48	25.80
$CuTe_2O_5$	19.95	80.05	19.99	80.10
			19.90	80.13
			19.94	80.08
$Zn_2Te_3O_8$	25.37	74.63	25.33	74.60
			25.41	74.62
			25.35	74.64
$CdTe_2O_5$	28.69	71.31	28.63	71.28
			28.74	71.33
			28.64	71.40
$SnTe_3O_8$	23.94	76.06	23.90	76.16
			23.94	76.10
			23.97	76.08
$Bi_2Te_4O_{11}$	42.19	57.81	42.13	57.83
			42.19	57.80
			42.17	57.80

TABLE 2

Heats of formation (kcal mol^{-1}) of some basic metal tellurites and pyrotellurites

Compound	Literature data		Present data	
	$-\Delta H_f^0$ of metal oxide [8]	$-\Delta H_f^0$ of TeO_2 [9]	$-\Delta H$ of reaction	$-\Delta H_f^0$ of metal tellurite
$CuO \cdot CuTeO_3$	79.00	76.90	2.43 ± 0.07	158.33
$2PbO \cdot PbTeO_3$	156.21	76.90	1.20 ± 0.03	234.31
$4PbO \cdot PbTeO_3$	260.35	76.90	4.18 ± 0.13	341.43
$Bi_2O_3 \cdot 2TeO_2$	138.10	153.80	10.55 ± 0.32	302.43
$Bi_2O_3 \cdot TeO_2$	138.10	176.90	6.31 ± 0.19	221.31
$CuTe_2O_5$	39.50	153.80	5.91 ± 0.18	199.21
$Zn_2Te_3O_8$	167.60	230.70	15.77 ± 0.47	414.07
$CdTe_2O_5$	61.90	153.80	4.14 ± 0.12	219.84
$SnTe_3O_8$	139.80	230.70	7.49 ± 0.22	377.99
$Bi_2Te_4O_{11}$	138.10	307.60	12.33 ± 0.37	458.03

heats of formation of the metal oxide and tellurous oxide obtained from the literature [8]. The results obtained are presented in Table 2.

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