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Note

Study on the heat capacity of metal metatellurates of some d-elements within groups I and II of the periodic system and lead metatellurate

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There are few literature data concerning these metatellurates. So far, some metatellurates of the s-elements in Group II of the Periodic System, with the exception of beryllium metatellurate, have been prepared by hydrothermal technology and their crystallographic characteristics have also been determined [1]. By thorough examination of metal salt–$Na_2H_4TeO_6$–H_2O systems, a number of metatellurates have been prepared by us under various synthetic conditions; both the structure and thermal decomposition of these compounds have also been described. The aim of the present paper is to give some information on the specific heats of the metatellurates prepared.

EXPERIMENTAL

Metatellurates of bivalent elements were prepared by separation of the constitutional water from metal hydrogenorthotellurates of type MeH_4TeO_6. Silver metatellurate was prepared by the same procedure from $Ag_2H_4TeO_6$. Identification of metatellurates was conducted by chemical and X-ray phase analysis.

Chemical analysis of Cu^{2+}, Zn^{2+}, Cd^{2+} and Pb^{2+} was carried out by direct or back complexometric titration with Xylenol Orange or Eriochrome Black T indicators, respectively, using methods described previously [2]. The Follkhard method was employed for determination of silver [3]. Tellurium was analysed using both volumetric and gravimetric methods [4]. The results of the chemical analyses are shown in Table 1. The corresponding theoretically calculated values are also presented for comparison.

The X-ray phase and X-ray analysis of the metatellurates were both determined using a DRON-2 apparatus with a Cu anode and Kα emission.

TABLE 1

Results from theory and chemical analysis

Compound	Theoretical composition (%)		Results obtained by chemical analysis (%)	
	Metal oxide	Tellurous oxide	Metal oxide	Tellurous oxide
$CuTeO_4$	31.17	68.83	30.97, 31.20, 31.12	68.87, 68.84, 68.82
Ag_2TeO_4	56.89	43.11	56.79, 56.91, 56.98	43.20, 43.09, 43.10
$ZnTeO_4$	31.67	68.33	31.69, 31.59, 31.60	68.38, 68.39, 68.30
$CdTeO_4$	42.23	57.77	42.30, 42.21, 42.27	57.80, 57.73, 57.79
$PbTeO_4$	55.97	44.03	56.01, 55.93, 55.99	44.10, 43.98, 44.10

TABLE 2

Coefficients for the temperature dependence of the heat capacity in the equation $C_p = a + bT + cT^2 + dT^3$ (temp. range 390–550 K)

Compound	a	b	c	d
$CuTeO_4$	−10243.7574	64.0874	−0.1316	8.9113×10^{-5}
Ag_2TeO_4	235.3404	−1.1764	2.3000×10^{-3}	-1.4748×10^{-6}
$ZnTeO_4$	523.3606	−2.9392	5.8793×10^{-3}	-3.9574×10^{-6}
$CdTeO_4$	−183.5641	1.3787	-2.9141×10^{-3}	2.0341×10^{-6}
$PbTeO_4$	−504.9318	3.9596	-7.9824×10^{-3}	5.8604×10^{-6}

The crystallographic parameters of the elementary cells of both cadmium and lead metatellurates were calculated: $CdTeO_4$ was found to crystallise in an orthorhombic pattern with elementary cell parameters $a = 5.004$ Å, $b = 12.526$ Å, $c = 4.990$ Å and $\rho = 6.435$ g cm^{-3}; lead metatellurate $PbTeO_4$ crystallises in the monoclinic pattern with $a = 5.494$ Å, $b = 4.948$ Å, $c = 6.020$ Å and $\rho = 8.284$ g cm^{-3}.

The heat capacities of the metatellurates studied were determined, employing a method described previously [5], by heating the samples at a rate of 1°C min^{-1} within the temperature range 390–550 K Al_2O_3 was used as a reference sample. The results obtained were subjected to computer processing (IBM PC-TX with Brother recorder). The corresponding coefficients were calculated of the equation $C_p = a + bT + cT^2 + T^3$, where C_p is the specific heat and T the temperature (see Table 2). The results from the measurements and the corresponding coefficients are presented in Table 2.

REFERENCES

1 I.W. Sleinght, C.M. Foris and M.S. Licis, Inorgan. Chem., 11 (1972) 1158.
2 G. Chvarzenbach and G. Fliachka, Kompleksometritcheskoe titrovanie, Chimia, Moscow, 1970.

3 W.F. Hillebrand, G.E. Lundell, H.A. Bright and D.I. Hofman, Applied Inorganic Analysis, Wiley, New York, Champman and Hall, London, 1953.
4 S.Iu. Fainberg and N.A. Filipova, Analiz rud zvetnich metalov, Metalurgizdat, Moscow, 1963.
5 J.L. McNaughton and C.T. Mortimer, Differential Scanning Calorimetry, Perkin–Elmer Corporation, Norwalk, Connecticut (reprinted from IRS, Phys. Chem., 10, Ser. 2, 1975).