The Heat Capacity of Crystalline Tellurium from 15 to 300°K. and the Entropy at 298.1°K.

BY CYRIL M. SLANSKY AND LOWELL V. COULTER

The heat capacity of tellurium has been determined by Anderson[1] from 54 to 292°K. At 54° the element has a heat capacity of some 3.8 cal./mole/deg., which would tend to make the entropy extrapolation below 54° very uncertain. In Anderson's work this extrapolation amounts to 3.54 e. u. whereas the total entropy at 298.01°K. found by him was only 12.85 ± 0.5 entropy units. Therefore, the authors have deemed it especially wise to investigate the region around liquid hydrogen temperatures in order to determine how closely the experimental heat capacity checks that from the Debye and Einstein functions of Anderson.

Material.—The tellurium sample used was the identical one that Anderson used and weighed 262.69 g. *in vacuo*. The authors wish to thank Dr. K. K. Kelley of the Bureau of Mines for the use of the sample of tellurium. No correction was made for the estimated 0.2% selenium that was present as impurity.

Heat Capacity Measurements.—The experimental method followed the general procedure described by Latimer and Greensfelder.[2] One colorie was taken as equal to 4.1833 int. joules. The results are summarized in Table I.

Entropy of Tellurium.—The entropy of tellurium at 298.1° was evaluated by graphical integration of the heat capacity data, combined with a Debye specific heat extrapolation between 0 and 12.59°K. The result is given in Table II.

TABLE I

MOLAL HEAT CAPACITY OF TELLURIUM

T, °K.	C_p, cal./mole/deg.	T, °K.	C_p, cal./mole/deg.
14.22	0.536	168.48	5.79
15.40	.642	178.48	5.83
19.35	1.001	188.95	5.86
23.39	1.421	200.44	5.90
26.91	1.738	212.10	5.94
30.21	2.029	218.34	5.93
34.04	2.364	223.71	5.97
38.32	2.742	228.62	5.97
42.41	3.048	239.80	6.06
46.82	3.340	250.12	6.15
51.75	3.652	258.28	6.10
57.71	3.976	259.64	6.07
64.42	4.248	267.09	6.12
104.75	5.226	278.75	6.13
117.25	5.45	289.80	6.16
127.15	5.52	301.27	6.15
137.04	5.59		
147.38	5.65		
157.85	5.76		

TABLE II

MOLAL ENTROPY OF TELLURIUM

Debye extrapolation (0–12.59°K.)	0.14
Graphical from data (12.59–298.1°K.)	11.74 ± 0.10
Entropy at 298.1°K.	11.88 ± 0.10 e. u.

The entropy from 0 to 50.1°K. was found to be 2.51 compared to the corresponding extrapolated value of 3.54 calculated by Anderson.

By comparing the heat capacity curve of selenium crystals as determined by Anderson with our tellurium data and the curve for rhombic sulfur of Eastman and McGavock[3] we find that the extrapolated value (0–50.1°K.) of Anderson is some 0.5 e. u. large, which gives a more probable value of 10.0 e. u. for selenium crystals.

Summary

The molal heat capacity of tellurium has been determined from 15 to 300°K., and the entropy at 298.1°K. found to be 11.88 ± 0.10 entropy units.

BERKELEY, CALIF.   RECEIVED DECEMBER 13, 1938

(1) C. T. Anderson, THIS JOURNAL, **59**, 1036 (1937).

(2) W. M. Latimer and B. S. Greensfelder, *ibid.*, **50**, 2202 (1928).

(3) E. D. Eastman and W. C. McGavock, *ibid.*, **59**, 145 (1937).