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clearly to reveal itself only in the case of those cobalti-salts whose anions contain several *oxygen*-atoms. [1])

It must be proved by future investigations, in how far this influence of the oxygen-containing radicals may be considered as a general and essential one; and if general, of what nature it actually is.

In any case it has now become clear that in the phenomenon discovered by PASTEUR, the optical activity of the molecules at the one side, and the enantiomorphism of the crystalforms, as well as the phenomena connected therewith regarding the pyro- and piezo-electric properties, — do *not* play an equivalent role. More detailed and more extensive investigations in this same direction will perhaps be able to teach us more exactly than now, what share the special configuration of the molecules really possesses for the occurrence of each of these categories of physical phenomena.

Groningen, March 1915.   *Laboratory for Inorganic Chemistry of the University.*

Chemistry. — *"The Allotropy of Bismuth."* II. By Prof. ERNST COHEN.

(Communicated in the meeting of March 27, 1915).

1. In my first paper [2]) on this matter (published in collaboration with Mr. A. L. TH. MOESVELD) we pointed out that bismuth can be transformed into a second allotropic modification at 75° C., and that this metal as it has been known up to the present is a metastable system at ordinary temperatures, in consequence of the marked retardation which accompanies that transformation.

2. However, the results obtained with cadmium, copper, antimony etc. gave rise to the supposition that in this case also the previous thermal history of the metal might have an influence on the transition temperature, which would prove that there exist more than two forms of bismuth.

3. Our dilatometric measurements carried out in order to clear up this point more fully were made in the same way as in the experiments with cadmium [3]).

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[1]) In this connection it may be remarked that such enantiomorphism as the *nitrates* and *perchlorates* possess, could also be stated in the case of the rhombic *dithionates* ($(S_2O_6)''$-ions). However the crystals of this salt contain much water of crystallisation, and effloresce so rapidly, that no exact measurements could be made. It is for that reason, that the salts are not described in paper II.

[2]) Zeitschr. f. physik. Chemie **85**, 419 (1913).

[3]) Proc. **16**, 485 (1913).

4. After having reduced the metal (500 grms. "Wismuth KAHLBAUM") to a fine powder, we studied its behaviour in a dilatometer. The metal had *not* undergone any previous treatment with an electrolyte. At 70° C. there did *not* occur any transformation.

5. After this the bismuth was kept in contact with a solution of potassium chloride (10 per cent) during 12 hours, and put again into a dilatometer. The results are given in Table I. -The values indicated with A represent the duration of the observations (minutes), those indicated with B the level on the millimeter scale.

TABLE I.

70°.0		81°.0		90°.0		96°.0	
A	B	A	B	A	B	A	B
0	382	0	275	0	192	90	207
15	190	45	160	20	187	40	155
32	64	65	120	80	176	210	161
45	0	90	94	—	—	290	164

6. Comparing these measurements with those carried out formerly[1]) with a preparation of different previous thermal history (see table II) it is evident that there exist more than two forms of bismuth.

TABLE II.

Temperature	Duration of the observations in hours	Rise of the level in mm.
99°.7	20	+ 450
93.7	2	+ 16
87.7	13	+ 12
77.7	30	+ 16
75.7	24	+ 10
74.7	14	— 10
15	36	— 95

Whilst we found formerly (Table II) at 81° and 90° an *increase* of volume, we now find a *decrease* (Table I) at these temperatures.

1) Zeitschr. f. physik. Chemie **85**, 419 (1913).

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7. These results are corroborated by the observations made at 96°.0 C. (Table I); there occurs a *change* in the direction of motion of the meniscus at a constant temperature.

8. I hope to report shortly on the limits of stability of the different modifications.

Utrecht, March 1915.   VAN 'T HOFF-Laboratory.

Chemistry. — "*The Metastability of the Metals in consequence of Allotropy and its Significance for Chemistry, Physics, and Technics.*" IV. By Prof. ERNST COHEN and Mr. W. D. HELDERMAN.

(Communicated in the meeting of March 27, 1915).

On the necessity of redetermining the data of Thermochemistry. I.

1. Since our investigations as well as those of our collaborators have proved that the metals are metastable systems in consequence of the fact that different allotropic modifications of these substances may be simultaneously present, we wish to consider here some conclusions which may have an important bearing on thermochemistry.

a. Heats of Reaction.

2. The heat developed when a definite quantity of a metal reacts with any other substance, will be a function of the previous thermal treatment of the metal, as the relative quantities of the a-, β-, γ , ... modifications present in the metal are dependent on that treatment.

For instance, a definite quantity of cadmium (chemically pure) formed from the molten metal and which we shall indicate by the symbol M_1, will develop a different quantity of heat when it combines with any other substance than the same quantity of cadmium (M_2) will do which has been formed at ordinary temperatures by electrolysis of the solution of a cadmium salt.

While M_1 contains unknown quantities of a-, β-, γ-cadmium, M_2 consists of pure γ-cadmium; moreover we know to-day that the heat of transformation (per gram atom) of γ-cadmium $\rightarrow$ a-cadmium is 739 gram calories at 18° C. [1]).

If, for instance, equal quantities of M_1 and M_2 are dissolved at 18° C. in equal quantities of $HCl . 200 H_2O$, the evolution of heat which accompanies this reaction will be in maximo 739 gram calories

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[1]) Proc. **17**, 1050 (1915).