CCXXXIX.—Bismuth Dihydride.

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HAVING prepared solid hydrides of arsenic (Chem. News, 1924, 129, 31) and antimony (this vol., p. 1069), we turned our attention to the analogous solid bismuth dihydride. The method of preparation was similar to one employed in the case of antimony dihydride. A solution of bismuth chloride in hydrochloric acid was added gradually to a mixture of zinc (free from iron, carbon, and arsenic) and fairly strong hydrochloric acid which was rapidly evolving hydrogen. At each addition of bismuth chloride the evolution of gas slackened and could even be made to stop altogether until the bismuth chloride was converted into a flocculent, grey precipitate : $2BiCl_3+8H=Bi_2H_2+6HCl$. When all the zinc (which was used in excess) had dissolved, the liquid was rapidly filtered in an atmosphere of hydrogen, and the precipitate washed many times, first with hot strong hydrochloric acid, then with hot dilute acid, and finally with water until the wash water was neutral. The residue was drained and dried, first in hydrogen and finally in a vacuum desiccator over concentrated sulphuric acid.

On heating in a vacuum, bismuth dihydride gave off hydrogen and left metallic bismuth—quite different from the amorphous dihydride. 0.9184 G. gave 44 c.c. H₂, measured at *N.T.P.*, and 0.9144 g. Bi : H, 0.45; Bi, 99.57. 1.4606 G. lost 0.0088 g. H₂ : Bi, 99.39; H, 0.60. On combustion 0.4849 g. gave 0.0235 g. H₂O : H, 0.54 (Bi₂H₂ requires Bi, 99.52; H, 0.48%).

The volume of hydrogen produced was determined as follows: The apparatus, with a quicklime tower in series, was twice filled with nitrogen (previously passed over red-hot copper) and exhausted as completely as possible. The pressure (p) was noted, and the dihydride heated until there was no further pressure change. The final pressure (P) was noted, the apparatus re-exhausted until the pressure was p, and nitrogen, measured at atmospheric pressure, added until the pressure P was restored.

Bismuth dihydride, heated in a tube in absence of air, gave a mirror of bismuth just beyond the heated zone. It thus appeared that the dihydride might decompose into bismuth and bismuthine : $3Bi_2H_2=2BiH_3+4Bi$. (On heating, cuprous hydride decomposes into copper and cupric hydride [Barlett and Merrill, Amer. Chem. J., 1896, 17, 185], and arsenic dihydride into arsenic and arsine [Moser and Brukl, Monatsh., 1924, 45, 25]). To test this supposition, bismuth dihydride was heated in a stream of purified hydrogen. The issuing gas produced in silver nitrate solution a grey precipitate soluble in nitric acid. This was presumably silver bismuthide, as its nitric acid solution, after removal of silver as chloride, gave with hydrogen sulphide a dark brown precipitate, the solution of which in warm dilute nitric acid deposited bismuth hydroxide on addition of ammonia.

Bismuth dihydride prepared as described above was free from zinc, carbon, and iron, but contained a trace of chlorine (less than 0.02%, estimated by Volhard's method).

Fused potassium nitrate reacted very vigorously with the dihydride (as with antimony dihydride), but only slowly oxidised finely divided bismuth.

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