There has been prepared in this Laboratory by the action of fluorine on silver foil at 300°, a black material which differs in every respect from ordinary silver fluoride, and which all evidence indicates to be the difluoride, AgF_2. The compound is not very stable, decomposing quickly in moist air, if heated, and becoming covered with a coating of yellow AgF. Decomposition occurs similarly, but more slowly, at room temperature and even efforts to remove all water vapor will not prevent completely this slow change. The material is a powerful oxidizing agent. Qualitatively it will react with dilute acids to liberate ozone, and with aqueous solutions in general to liberate ozone or oxygen. It releases iodine from iodides, converts ferrous salts to ferric salts, chromium salts to chromates, manganese dioxide to permanganates in both acid and basic media and oxidizes alcohol to acetaldehyde.

Analyses of the material indicate that it is a mixture of fluorides of monovalent and bivalent silver, while the iodine liberated from a very cold, concentrated potassium iodide solution shows that at least three-fourths of the silver is in the higher valence state.

By the action of cold concentrated potassium hydroxide on the above fluorides, there is produced a stable material that can be washed free of alkali and dried. Determinations of its silver content and its oxidizing ability support the assumption that it is a mixture of $Ag^{II}O$ and $Ag^{I}OH$, with 70 to 80% of the silver as Ag^{II}. However, the oxidizing ability might be explained by presence of the peroxide Ag-O-O-Ag.

There is some evidence that an active complex can be formed from the bivalent silver fluoride by molten KHF_2.

Further work will be undertaken on all three phases of this problem.

In addition, Hettich [private communication] in this Laboratory, has obtained some evidence that silver in higher valence form can be obtained by electrolysis.

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SOME PROPERTIES OF PURE H^2H^2O

Sir:

We have recently pointed out [Lewis and Macdonald, *J. Phys. Chem.*, **1**, 341 (1933)] that our process of concentrating the isotope of hydrogen could easily be continued to the point of eliminating practically all of the H^1. Before trying this experiment we had hoped to accumulate a considerable amount of heavy water, but the demand for this material has been so great that we have been obliged to proceed with the amount obtained in one series of electrolyses, which yielded 0.3 cc. of water in which, by our calculations, over 99% of the hydrogen should be H^2. The specific gravity, however, proved to be 1.1059 as against 1.111 calculated for pure H^2H^2O, assuming the same molecular volume as for ordinary water. To test this assumption the water was electrolyzed further until only 0.12 cc. remained. The density was found to be 1.1053. With such small volumes accurate determinations of densities are difficult and we may conclude that we have electrolyzed to constant density and take 1.1056 as a provisional value for the specific gravity of pure H^2H^2O at 25°. Our calculations show that in our final sample no more than 0.01% of the hydrogen can be H^1.

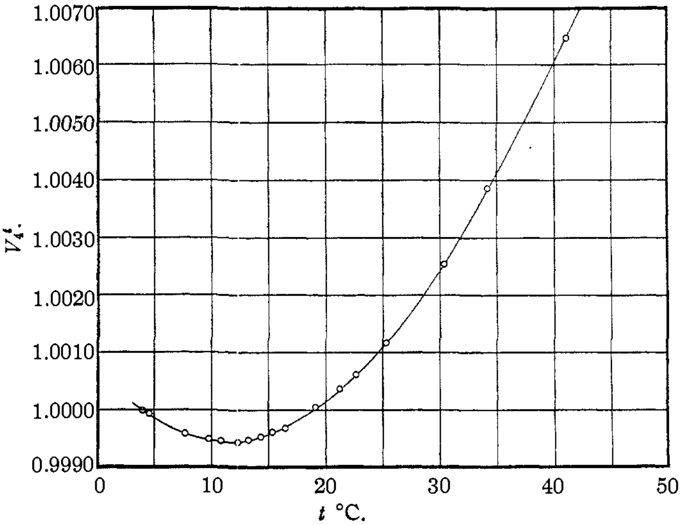

Fig. 1.

With this small amount of pure H^2H^2O we have been able to make the following measurements. The freezing point is +3.8°, the normal boiling point 101.42°. The vapor pressure was compared with that of ordinary water in a differential tensimeter with the results given in Table I, where

TABLE I

t	20	30	40	50	60	70	80	90	100	110
$p_1 - p_2$	2.3	3.9	6.1	9.1	13.1	18.0	23.9	30.7	38.4	47.0
p_2/p_1	0.87	0.88	0.89	0.90	0.913	0.923	0.933	0.942	0.949	0.956

p_1 is the vapor pressure of common water (mm. Hg), p_2 that of H^2H^2O, and t is the centigrade temperature, the measurements being accurate to about 0.1 mm.

When log p_2/p_1 is plotted against $1/T$ a straight line is obtained as far as 90°, and the heat of vaporization proves to be greater than that of ordinary water by 259 calories per mole, this value being accurate to 3 or 4 units.

In a tiny but accurate dilatometer the change of volume with temperature was studied. The volume divided by the volume at 4° is given at several even temperatures in Table II, while the individual measurements (corrected for the expansion of Pyrex glass according to Buffington and Latimer [THIS JOURNAL, **48**, 2305 (1926)]) are shown in the figure. Like common water there is a temperature of maximum density which for H^2H^2O is about 11.6°.

TABLE II

t	5	10	15	20	25	30	35	40
V_4^t	0.99987	0.99948	0.99958	1.00016	1.00111	1.00243	1.00415	1.00605

In the various respects in which water is said to be an abnormal liquid H^2H^2O seems to be more abnormal, but the differences between the two become smaller with rising temperature.

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NEW BOOKS

Qualitative Chemical Analysis. Certain Principles and Methods Used in Identifying Inorganic Substances together with a Systematic Survey of the Chemistry of these Materials. Based upon the Text by A. B. Prescott and O. C. Johnson. By ROY K. MCALPINE AND BYRON A. SOULE, University of Michigan. D. Van Nostrand Company, Inc., 250 Fourth Ave., New York, 1933. xii + 696 pp. 15.5 × 23.5 cm. Price, $4.50.

"The remarkable vitality of the older book," to quote the authors, is well illustrated by the ruinous condition of the copy accessible to the classes of the undersigned. In the present revision, the sections dealing with properties, reactions and detection of elements and compounds have been modernized, and amplified so as to include practically all the atomic types as well as many of the less common anions. Inert gases, only, are omitted. Systematic and detailed directions are now given for separation and detection of twenty-three common cations and about the same number of anions. Although it would not at first be clear how to extend this scheme so as to analyze any imaginable mixture, the student could at once detect the rarer cations or anions occurring alone or in the presence of a very few others. Thereafter his resourcefulness would increase with his grasp of the data supplied. To this extent the discipline of the older book, which often left the analyst to invent his own procedure, is preserved.

A hundred and forty pages now recount principles and theories underlying qualitative analysis. Recent interpretations are duly mentioned, but the classical point of view predominates. This section is clear and helpful. More emphasis might well be laid, in so extended a discussion, upon dispersion and coagulation.