

## Inorganic Chemistry.

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**Amidosulphonic Acid.** By E. BERGLUND (*Bull. Soc. Chim.* [2], xxix, 422—426).—The author has succeeded in preparing this acid by decomposing (1) the basic barium salt, or (2) the barium and mercury salt of imidosulphonic acid with dilute sulphuric acid, and boiling the product with baryta-water. The reactions are thus represented :—

1.  $\text{N}_2\text{Ba}_3(\text{SO}_3)_4 + \text{H}_2\text{SO}_4 = \text{BaSO}_4 + 2[\text{Ba}(\text{SO}_3)_2\text{NH}];$   
 $\text{Ba}(\text{SO}_3)_2\text{NH} + \text{H}_2\text{O} = \text{NH}_2\text{SO}_3\text{H} + \text{BaSO}_4.$
2.  $\text{N}_2\text{HgBa}_2(\text{SO}_3)_4 + 2\text{H}_2\text{SO}_4 = 2\text{BaSO}_4 + \text{N}_2\text{HgH}_4(\text{SO}_3)_4;$   
 $\text{N}_2\text{HgH}_4(\text{SO}_3)_4 + 2\text{H}_2\text{O} = 2\text{NH}_2\text{SO}_3\text{H} + \text{H}_2\text{SO}_4 + \text{HgSO}_4.$

Pure amidosulphonic acid is best obtained by decomposing the silver salt with hydrogen sulphide, and evaporating the solution over sulphuric acid. It forms large transparent crystals, which are anhydrous and permanent in the air, and may be heated to  $190^\circ$  without undergoing decomposition. It dissolves easily in water and with difficulty in alcohol. The aqueous solution may be heated to the boiling point without alteration, but the acid is converted into acid ammonium sulphate on prolonged boiling. This reaction takes place more rapidly in presence of hydrochloric acid, and is determined at once by addition of potassium chlorate or nitrous acid, even in the cold. The aqueous solution dissolves iron and zinc, evolving hydrogen, and forming the corresponding amidosulphonates. It gives no precipitates with barium hydrate, but when heated with hydrochloric acid and barium chloride, it gradually deposits barium sulphate; whilst with potassium chlorate and hydrochloric acid in presence of barium chloride, it gives at once a precipitate of barium sulphate on being heated. These reactions are characteristic of the acid.

The salts of amidosulphonic acid are all soluble in water, but insoluble in alcohol, and generally crystallise well. Their solutions may be heated to ebullition, without alteration. The salts containing water of crystallisation undergo decomposition at  $100^\circ$ , yielding sulphates; the anhydrous salts are stable at higher temperatures. The salts of the alkalis give off ammonia at  $160$ – $170^\circ$ , being converted into salts of imidosulphonic acid. The following have been analysed:—

*Potassium salt*,  $\text{NH}_2\text{SO}_3\text{K}$ .—Obtained by double decomposition of the barium salt and potassium sulphate. Rhombic tables.

*Sodium salt*,  $\text{NH}_2\text{SO}_3\text{Na}$ .—Very soluble needles.

*Lithium salt*,  $\text{NH}_2\text{SO}_3\text{Li}$ .—Long, deliquescent needles.

*Ammonium salt*,  $\text{NH}_2\text{SO}_3\text{NH}_4$ .—Large, deliquescent tables, melting without decomposition at  $125^\circ$ .

*Thallium salt*,  $\text{NH}_2\text{SO}_3\text{Tl}$ .—Long, brilliant prisms.

*Silver salt*,  $\text{NH}_2\text{SO}_3\text{Ag}$ .—Long, hard prisms, dissolving in 15 parts of water at  $19^\circ$ , and blackening in the light.

*Barium salt*  $(\text{NH}_2\text{SO}_3)_2\text{Ba}$ .—Fine, long prisms, soluble in three parts of water at the ordinary temperature.

*Strontium salt*  $(\text{NH}_2\text{SO}_3)_2\text{Sr} + 4\text{H}_2\text{O}$ .—Large, well-formed prisms, more soluble than the barium salt.

*Calcium salt*  $(\text{NH}_2\text{SO}_3)_2\text{Ca} + 4\text{H}_2\text{O}$ .—Thin laminae, very soluble.

*Lead salt*  $(\text{NH}_2\text{SO}_3)_2\text{Pb} + \text{H}_2\text{O}$ .—The most soluble of the amidosulphonates. Small needles, not deliquescent.

*Nickel salt*  $(\text{NH}_2\text{SO}_3)_2\text{Ni} + 3\text{H}_2\text{O}$ .—Clusters of emerald-green needles, very soluble.

*Cobalt salt*  $(\text{NH}_2\text{SO}_3)_2\text{Co} + 3\text{H}_2\text{O}$ .—Stellate groups of red needles.

*Manganese salt*  $(\text{NH}_2\text{SO}_3)_2\text{Mn} + 3\text{H}_2\text{O}$ .—Crystalline, rose-red mass; very soluble.

*Zinc salt*  $(\text{NH}_2\text{SO}_3)_2\text{Zn} + 4\text{H}_2\text{O}$ .—Radiated crystalline mass.

*Cadmium salt*  $(\text{NH}_2\text{SO}_3)_2\text{Cd} + 5\text{H}_2\text{O}$ .—Very soluble microscopic tables.

*Copper salt*  $(\text{NH}_2\text{SO}_3)_2\text{Cu} + 2\text{H}_2\text{O}$ .—Blue needles and long tables, less soluble than the preceding salts.

The magnesium, aluminium, and uranium salts are very soluble. The ferric salt is resolved on evaporation into basic salt and free acid. J. R.

**The Flame Reaction of Boric Acid as a Lecture Experiment.** By H. GILM (*Deut. Chem. Ges. Ber.*, xi, 712—713).—A regularly tinted and beautiful green boric acid flame is best obtained by passing the vapour of boric ether through a kind of Bunsen burner, made by enclosing a small, narrow, glass tube in a vertical one, so that the gas may mix with air previous to ignition at the upper end of the tube. The same result is obtained by allowing the vapour of the ether to pass through an ordinary Bunsen burner, the tube of which is heated to avoid condensation. For qualitative analysis it is most convenient to use a small flask, provided with a cork, through which passes a short, drawn out glass jet, a wider tube being placed over the latter, and the gas ignited at the top. After the addition of hydrochloric acid, very small quantities of boric acid may be detected by this means. T. C.

**Crystallisation of Silica in the Dry Way.** By P. HAUTEFEUILLE (*Compt. rend.*, lxxxvi, 1133).—G. vom Rath in 1868 discovered in trachyte a new form of crystallised silica, which he called tridymite, and Rose subsequently found that when amorphous silica was kept for some time in fused microcosmic salt, it was converted into tridymite. The author in this paper shows that an alkaline tungstate may be advantageously substituted for microcosmic salt.

When amorphous silica is kept for some hours in tungstate of soda, at the melting point of silver, it is converted into tridymite, but if the temperature rises above  $100^\circ\text{C}$ ., the silica is attacked by the alkaline tungstate, forming a silicate, which, when the temperature falls again, is reconverted into tridymite. C. W. W.

**Behaviour of Phosphorus with various Metallic Solutions.** By R. BÖTTGER (*Chem. Centr.*, 1878, 208).—Pure phosphorus precipitates gold, copper, and palladium from solutions of the salts of these metals; silver is thrown down as phosphide, whilst platinum, uranium, nickel, iron, zinc, cadmium, and cobalt are not precipitated by phosphorus. M. M. P. M.

**Vapour-density of Ammonium Sulphide.** By G. SALET (*Compt. rend.*, lxxxvi, 1080).—No contraction takes place when sulphuretted hydrogen and ammonia gas are mixed together, at a temperature of  $80^\circ$ ; this shows that the statement that a molecule of ammonium sulphide in the state of vapour occupies the same volume as an alcoholic sulphide is incorrect. The apparatus employed is fully described. W. C. W.

**Composition of Ancient Glass and Crystal.** By E. PELIGOT (*Ann. Chim. Phys.* [5], xiii, 271—283).—It is generally stated that the glass manufactured by the ancients was prepared from the same materials as are used at the present time. Such is not, however, the author's opinion; common glass and lead crystal had formerly a composition very different from that of more recent date. Three ingredients are now employed in the manufacture of glass, namely, silica, soda, and lime. Bohemian glass has potash substituted for the soda. But with antique glass only two substances were employed, sand and an alkaline flux. Many old recipes are given, but no mention is made of lime; this substance, however, is generally present, and was probably introduced accidentally with the flux or the sand. Analyses of various selected specimens of ancient glass, chiefly from Autun, of about the 11th century, gave:—Silica, 66·0—70·9; lime, 5·8—7·9; alumina, oxides of iron, and manganese, 2·8—5·7; soda and potash, 16·7—24·7. The presence of soda together with potash, indicates that the ash of seaweed was used as a flux. Lime has only recently been employed in the manufacture of glass. Window glass analysed by Dumas 35 years ago contained only 3·8 per cent. of lime. Water and chemical reagents have considerable action upon ancient glass. A well made glass at the present time contains 12—15 per cent. of lime; the alkalis are contained in almost equivalent proportions. These data furnish a ready method for distinguishing modern from ancient glass.

**Lead Crystal.**—Very old specimens of glass are found to contain lead, but the author does not regard them as real crystal. This material is of modern manufacture, introduced by the English, under the name of "flint-glass."

R. C. W.

**The Equivalent of Gallium.** By LECOQ DE BOISBAUDRAN (*Compt. rend.*, lxxxvii, 941—943).—The equivalent was determined—1. By igniting gallium-ammonium alum. 2. By igniting the nitrate obtained from a known weight of metal.

The alum was prepared from metallic gallium, and was freed by repeated crystallisation from the traces of copper and zinc which this element is apt to contain. 3·1044 grams gave on ignition 0·5885 of oxide, the composition of the latter corresponding with that of the sulphate originally present; from these numbers the equivalent 70·032 is deduced.

The metal used in the preparation of the nitrate did not show in the spectroscope any lines foreign to gallium. 4481 gram yielded after conversion into nitrate and ignition, 0·6024 gram of oxide, which gives the number 69·698 for the equivalent.

The mean of these two experiments, 69·865, may be taken as a fair approximation to the truth, considering the small quantity of material at the disposal of the operator.

The author points out the coincidence which exists between the experimental equivalent and the numbers which he has calculated from theoretical data for a body intermediate between aluminium and indium. The maximum theoretical equivalent would be 69·97; the minimum, 69·66; and the mean, 69·82; the latter, as will be seen, scarcely differs from that actually obtained; it is, however, a little

higher than that adopted by Mendelejeff, for the element which in his classification should correspond with gallium. J. W.

**Compounds of Didymium and Lanthanum.** By F. FRERICHS and F. SMITH (*Liebig's Annalen*, xcxi, 331—366).—The authors have prepared and analysed a large number of salts of didymium and lanthanum, which they regard as triatomic metals, in accordance with the specific heats determined by Bunsen and Hillebrand (*Pogg. Ann.*, clviii, 71). They obtained from cerite a mixture of the oxides of the metals, from which by further treatment pure didymium and lanthanum salts were isolated. No process for the complete separation of the two elements has yet been discovered. The methods adopted by the authors are given in detail.

**DIDYMIUM COMPOUNDS** ( $Di = 144$ ).—*Chloroplatinate*,  
 $2DiCl_3 \cdot 3PtCl_4 \cdot 24H_2O$ .

Obtained by mixing concentrated solutions of didymium chloride and platinic chloride. Very fine orange-coloured tables.

*Chloro-aurate*,  $2DiCl_3 \cdot 3AuCl_3 \cdot 21H_2O$ .—Brilliant yellow tables, very hygroscopic and deliquescent.

*Oxychloride*,  $DiOCl$ .—Obtained by heating didymium oxide in chlorine. Resolved by boiling with water into hydrate and chloride.

*Didymium and Zinc Bromide*,  $2DiBr_3 \cdot 3ZnBr_2 \cdot 36H_2O$ .—Reddish-brown needles, very hygroscopic, taking up water even from calcium chloride.

*Didymium and Nickel Bromide*,  $2DiBr_3 \cdot 3NiBr_2 \cdot 18H_2O$ .—Small brownish crystals, which rapidly absorb water from the air.

*Didymium and Zinc Iodide*,  $2DiI_3 \cdot 3ZnI_2 \cdot 24H_2O$ .—Small yellowish needles, very hygroscopic.

*Fluoride*,  $2DiF_3 \cdot (HF)_3$ .—Thrown down as a gelatinous precipitate on adding hydrofluoric acid to a solution of didymium sulphate. Over the water-bath it dries up to a transparent rose-coloured mass.

$DiO_9$ .—An oxide having this composition was obtained as a chestnut-brown powder by decomposing the nitrate at a gentle heat, and then heating the residual oxide to low redness in a current of oxygen. It dissolves in nitric acid, giving off oxygen.

*Sulphide*,  $Di_2S_3$ .—A yellow or brownish substance, obtained by heating the oxide in vapour of carbon bisulphide. It dissolves easily in acids, giving off hydrogen sulphide.

*Nitrate*,  $DiO_3(NO_2)_3 \cdot 6H_2O$ .—Large violet crystals having this composition are obtained by dissolving the oxide in nitric acid and evaporating the solution over sulphuric acid. The salt absorbs water from the air, becomes anhydrous at  $200^\circ$ , and melts without decomposition at  $300^\circ$ . It dissolves easily in alcohol. Forms crystalline compounds with other nitrates.

*Didymium and Zinc Nitrate*,  $2DiO_3(NO_2)_3 \cdot 3ZnO_2(NO_2)_2 \cdot 69H_2O$ .—Deliquesces extremely rapidly in the air.

*Didymium and Nickel Nitrate*,  $2DiO_3(NO_2)_3 \cdot 3NiO_2(NO_2)_2 \cdot 36H_2O$ .—Large bright-green tables, hygroscopic and very easily soluble in water.

*Didymium and Cobalt Nitrate*,  $2DiO_3(NO_2)_3 \cdot 3CoO_2(NO_2)_2 \cdot 48H_2O$ .—Dark-red crystals, obtained with great difficulty. Very soluble.

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*Hypochlorite*,  $\text{Di}(\text{OCl})_3$ .—Obtained by passing chlorine into water in which didymium hydrate is suspended. Thin nearly colourless tables, dissolving sparingly in water, but easily in strong acids.

*Basic Sulphate*  $[\text{Di}_2(\text{OH})_3]_2(\text{SO}_4)_3$ .—Ammonia added to the neutral sulphate throws down a gelatinous precipitate which dries up to a mass having this composition. The salt is insoluble in water, but easily soluble in acids.

*Neutral Sulphate*,  $\text{Di}_2(\text{SO}_4)_3$ .—This salt crystallises from strongly acid solutions in rose-red crystals containing  $6\text{H}_2\text{O}$ , and from neutral saturated solutions on slow evaporation in crystals containing  $9\text{H}_2\text{O}$ . The latter give off two-thirds of their water at  $200^\circ$ .

*Selenate*,  $\text{Di}_2(\text{SeO}_4)_3 \cdot 6\text{H}_2\text{O}$ .—Fine rose-red prisms, very easily soluble in water, obtained by evaporating a solution of the oxide in selenic acid.

*Selenite*,  $\text{Di}_2(\text{SeO}_3)_3 \cdot 6\text{H}_2\text{O}$ .—Obtained as a gelatinous precipitate on adding alcohol to a mixture of concentrated solution of didymium nitrate with selenious acid.

*Phosphate*,  $\text{DiPO}_4 \cdot \text{H}_2\text{O}$ .—Obtained by boiling solutions of didymium with phosphoric acid, or by adding trisodium phosphate to didymium sulphate. Insoluble in water; soluble in acids.

*Triphosphate*,  $\text{Di}_2(\text{HO}_3\text{PO})_3$ .—Precipitated from the sulphate by disodium phosphate.

*Pyrophosphate*,  $\text{Di}_2(\text{H}_2\text{O}_4\text{P}_2\text{O}_5)_3$ .—Precipitated by neutral sodium pyrophosphate from acid solutions of didymium. Soluble in excess of the precipitant.

*Metaphosphate*,  $\text{DiO}_3(\text{PO}_2)_3$ .—Rose-red powder, precipitated by sodium metaphosphate from didymium sulphate.

*Arsenate*,  $\text{Di}_2(\text{H}_3\text{O}_3\text{AsO})_3$ .—Pale-red precipitate thrown down by disodium arsenate from didymium sulphate. Insoluble in water.

*Phosphite*,  $\text{Di}_2(\text{O}_2\text{PHO})_3$ .—Precipitated from solutions of didymium by disodium phosphite.

*Arsenite*,  $\text{Di}(\text{O}_2\text{AsHO})_3$ .—A white granular powder, insoluble in water, formed by boiling didymium hydrate with aqueous solution of arsenious acid.

*Chromate*,  $\text{Di}_2(\text{O}_2\text{CrO}_2)_3$ .—A yellow granular powder, precipitated by potassium bichromate from didymium sulphate. Dissolves sparingly in water, easily in dilute acids.

*Manganate*,  $\text{Di}_2(\text{O}_2\text{MnO}_2)_3$ .—Formed by heating didymium nitrate with manganese dioxide. Black powder, insoluble in water, soluble with dark-red colour in sulphuric acid.

*Permanganate*,  $\text{Di}(\text{MnO}_4)_3 \cdot 21\text{H}_2\text{O}$ .—Deposited from a mixture of potassium permanganate and didymium sulphate on standing. Reddish-brown crystalline powder, sparingly soluble in water.

*Borate*,  $\text{Di}_2(\text{O}_2\text{B}_2\text{O}_5)_3$ .—Thrown down as a white gelatinous precipitate on adding sodium borate to a solution of didymium sulphate. Insoluble in water.

*Molybdate*,  $\text{DiH}_3\text{O}_6(\text{MoO}_2)_3$ .—Obtained as a pale-red gelatinous precipitate by adding ammonium molybdate to solutions of didymium.

*Tungstate*,  $\text{Di}_2(\text{O}_2\text{WoO}_2)_3$ .—Precipitated by disodium tungstate from didymium sulphate. Gelatinous precipitate, drying up to a rose-red mass, insoluble in water.

**LANTHANUM COMPOUNDS** ( $\text{La} = 139.2$ ).—The following bodies were obtained in the same manner as the corresponding didymium compounds, which in general they closely resemble.

*Chloroplatinate*,  $2\text{LaCl}_3.3\text{PtCl}_4.24\text{H}_2\text{O}$ .

*Chloro-aurate*,  $2\text{LaCl}_3.3\text{AuCl}_3.21\text{H}_2\text{O}$ .

*Oxychloride*,  $\text{LaOCl}$ .—When boiled with water containing didymium oxychloride in suspension, it is gradually converted into lanthanum chloride.

*Lanthanum and Zinc Bromide*,  $2\text{LaBr}_3.3\text{ZnBr}_2.39\text{H}_2\text{O}$  (?).

*Lanthanum and Nickel Bromide*,  $2\text{LaBr}_3.3\text{NiBr}_2.18\text{H}_2\text{O}$ .

*Lanthanum and Zinc Iodide*,  $2\text{LaI}_3.3\text{ZnI}_2.27\text{H}_2\text{O}$ .

*Fluoride*,  $2\text{LaF}_3.(\text{HF})_3$ .

*Sulphide*,  $\text{La}_2\text{S}_3$ .

*Lanthanum and Zinc Nitrate*,  $2\text{LaO}_3(\text{NO}_2)_3.3\text{ZnO}(\text{NO}_2)_2.69\text{H}_2\text{O}$ .

*Lanthanum and Nickel Nitrate*,  $2\text{LaO}_3(\text{NO}_2)_3.3\text{NiO}(\text{NO}_2)_2.36\text{H}_2\text{O}$ .

*Basic Sulphate*,  $[\text{La}_2(\text{OH})_3]_2(\text{SO}_4)_3$ .

*Neutral Sulphate*,  $\text{La}_2(\text{SO}_4)_3.6\text{H}_2\text{O}$ .

*Selenate*,  $\text{La}_2(\text{SeO}_4)_3.12\text{H}_2\text{O}$ .

*Selenite*,  $\text{La}_2(\text{SeO}_3)_3.9\text{H}_2\text{O}$ .

*Phosphate*,  $\text{LaO}_3\cdot\text{PO}$ .

*Pyrophosphate*,  $\text{La}_2(\text{H}_2\text{O}_4\cdot\text{P}_2\text{O}_3)_3$ .

*Triphosphate*,  $\text{La}_2(\text{HO}_3\cdot\text{PO}_3)_3$ .

*Metaphosphate*,  $\text{LaO}_3\cdot(\text{PO}_2)_3$ .

*Arsenate*,  $\text{La}_2(\text{HO}_3\text{AsO})_3$ .

*Phosphite*,  $\text{La}_2(\text{O}_2\text{PHO})_3$ .

*Arsenite*,  $\text{La}_2(\text{O}_2\text{AsHO})_3$ .

*Chromate*,  $\text{La}_2(\text{O}_2\text{CrO}_2)_3$ .

*Manganate*,  $\text{La}_2(\text{O}_2\text{MnO}_2)_3$ .

*Permanganate*,  $\text{LaO}_3(\text{MnO}_3)_3.21\text{H}_2\text{O}$ .

*Borate*,  $\text{La}_2(\text{O}_2\text{B}_4\text{O}_5)_3$ .

*Molybdate*,  $\text{LaH}_3\text{O}_6(\text{MoO}_2)_3$ .

*Tungstate*,  $\text{La}_2(\text{O}_2\text{WO}_2)_3$ .

*Cyanide*,  $\text{La}(\text{CN})_3$ .—Obtained as a gelatinous precipitate by adding potassium cyanide to a solution of lanthanum sulphate. Forms double salts with other cyanides. J. R.

**Presence of Oxygen in Bessemer Metal.** By S. KERN (*Chem. News*, xxxvii, 48).—The following experiment was made. 1000 grams of the Bessemer metal, taken out of the retort just before the addition of spiegeleisen, was cast in a small cast-iron mould. The casting was divided into two pieces, one of them being hammered strongly in the heated state, whilst the other was allowed to cool. The two specimens were then tested for oxygen by the method formerly described by the author.

The following results were obtained :—

	Expt. 1.	Expt. 2.
Hammered specimen . . . . .	·165	·162
Not hammered ditto . . . . .	·185	·171

The quantity of oxygen in steel naturally depends upon the time the blowing process is continued after the carbon of the metal in the



converter has been consumed. Britton found .76 gram of oxygen in steel. Such metal which may be called burnt steel, is of course not suitable for manufacturing purposes. D. B.

**Some Reactions of Silver Chloride and Bromide.** By M. C. LEA (*Am. J. Sci.* [3], xv, 189—191).—The author's former results, as also those of von Bibra, are confirmed: it is now established that the substance produced by the action of light on silver chloride is of a much more permanent character than that formed in the case of the other silver haloids, inasmuch as nitric acid decomposes the bodies so produced from silver bromide and iodide (with formation of silver, and ordinary silver bromide and iodide), but is without action on the substance formed from silver chloride.

The author finds that after five days' action of strong sunshine on moist silver chloride, exposed in a thin layer and frequently stirred up, about one per cent. of the chloride is acted upon. The darkened chloride is not acted on by nitric acid sp. gr. 1.28 in the cold, so that it does not contain reduced silver, but as it is quickly whitened by *aqua regia*, it is probable that the darkening is due to the formation of a subchloride or oxychloride. By digesting the darkened chloride (precipitated in presence of hydrochloric acid) with nitric acid of sp. gr. 1.28, for 18 hours on the sand-bath, a perceptible amount of silver was dissolved.

Darkened silver bromide was readily acted on by the same nitric acid; after heating for some hours, complete decomposition of the darkened bromide had taken place. M. M. P. M.

**The Action of Sulphuric Acid on Platinum.** By A. SCHEURER KESTNER (*Compt. rend.*, lxxxvi, 1082).—In an attempt to manufacture fuming sulphuric acid by heating acid sodium sulphate in an earthen retort, the inside of which was lined with platinum, 100 grams of platinum were dissolved in the production of 100 kilos. of acid, which is at the rate of 1 kilo. per ton. The metal was found to be in the residue of sodium sulphate, in a state in which it was soluble in water. In the ordinary concentrating apparatus the amount of platinum dissolved varies from 1 to 8 grams per ton of acid, containing 94 to 99 per cent. of monohydrated acid. But by employing vessels which expose a comparatively small amount of surface to the action of the acid, the amount of platinum dissolved is reduced to 0.1—0.15 gram per ton for ordinary acid, and to 1—1.5 grams per ton for very strong acid (98—99 per cent.). W. C. W.

**A New Compound of Palladium.** By H. ST. CLAIRE DEVILLE and H. DEBRAY (*Compt. rend.*, lxxxvii, 926—928).—In order to recover the palladium from some mother-liquors of dipalladamine chloride ( $\text{PdCl}_4 \cdot 4\text{NH}_3$ ), they were treated with *aqua regia* in presence of excess of sal ammoniac. Instead of the well-known red double chloride, a very deep-red almost black precipitate was obtained, which closely resembled in appearance and solubility the double chloride of iridium and ammonium.

An examination of the precipitate, and of the conditions under



which it was formed, showed that it contained only palladium, and that it could be easily obtained by treating with *aqua regia* the yellow palladamine chloride,  $\text{PdCl}_2 \cdot 2\text{NH}_3$ . Analysis assigned to it the formula  $\text{Pd}_2\text{Cl}_6 \cdot 4\text{NH}_3$ , thereby showing it to be an ammonia derivative of an hitherto unknown chloride of palladium, the so-called *sesquichloride*.

The following equation doubtless represents its mode of formation,  $2(\text{PdCl}_2 \cdot 2\text{NH}_3) + \text{Cl}_2 = \text{Pd}_2\text{Cl}_6 \cdot 4\text{NH}_3$ .

The new salt is easily destroyed by heat, breaking up into hydrochloric acid, sal-ammoniac, nitrogen, and metallic palladium. It is also decomposed by boiling water, with energetic evolution of nitrogen, the palladium being reduced to protochloride, of which a portion remains combined with the undecomposed ammonia.

The formation of this salt is theoretically interesting, inasmuch as it shows that, with the exception of platinum, all the metals of this natural group can, under suitable conditions, furnish an intermediate chloride of the formula  $\text{M}_2\text{Cl}_6$ .

J. W.

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