chloric acid gas over granulated tin contained in stoneware bottles and evaporates the concentrated solution produced in tin basins over granulated tin. The basin itself is not attacked. The crystals contain one H2O according to Berzelius, while Marignac finds two ; probably both are right The crystals are very soluble in cold water, and if the salt is really pure a small proportion of water forms a clear solution ; but on adding much water most of the salt is decomposed, with the formation of a precipitate of oxy-chloride— 2SnCl2 + 3H2O = 2HCl + Sn2OCl2.2H2O.

According to Michel and Kraft, one litre of cold saturated solution of tin crystals weighs 1827 grammes and contains 1333 grammes of SnCl2∙ The same oxy-chloride is produced when the moist crystals, or their solution, are exposed to the air ; by the action of the atmo­spheric oxygen

O+ 3SnCl2=Sn2Cl2O + SnCl4.

Hence all tin crystals as kept in the laboratory give with water a turbid solution, which contains stannic in addition to stannous chloride. The complete conversion of stannous into stannic chloride may be effected by a great many reagents,—for instance, by chlorine (bromine, iodine) readily ; by mercuric chloride, HgCl2, in the heat, with precipitation of calomel, HgCl, or metallic mercury ; by ferric chloride in the heat, with formation of ferrous salt, FeCl2 ; by ar- senious chloride in strongly hydrochloric solutions, with precipita­tion of chocolate-brown metallic arsenic. All these reactions are available as tests for stannosum or the respective agents. In opposi­tion to stannous chloride, even sulphurous acid (solution) behaves as an oxidizing agent. If the two reagents are mixed, a precipitate of yellow stannic sulphide is produced. By first intention

SO3H2 + 3SnIICl2=3SnIVCl2O + H2S.

The stannic oxy-chloride readily exchanges its O for Cl2 at the ex­pense of the hydrochloric acid, which is always present, and the H2S decomposes one-half of a molecule of SnCl4 with formation of SnS2. A strip of metallic zinc when placed in a solution of stan­nous chloride precipitates the tin in crystals and takes its place in the solution. Stannous chloride is largely used in the laboratory as a reducing agent, in dyeing as a mordant.

Stannous Oxide.—This as a hydrate is obtained from a solution of stannous chloride by addition of carbonate of soda ; it forms a white precipitate, which can be washed with air-free water and dried at 80oC. without much change by oxidation. If the hydrate is heated in carbonic acid, the black anhydride SnO remains (Otto). Precipi­tated stannous hydrate dissolves readily in caustic potash ley ; if the solution is evaporated quickly, it suffers decomposition, with formation of metal and stannate,

2SnO + K2O = SnO2K2O + Sn.

If it is evaporated slowly, anhydrous stannous oxide crystallizes out at a certain stage (Otto). Dry stannous oxide, if touched with a glowing body, catches fire and burns into binoxide, SnO2. Stan­nous oxalate when heated by itself in a tube leaves stannous oxide (Liebig).

Stannic chloride, SnCl4, is obtained by passing dry chlorine over granulated tin contained in a retort ; the tetrachloride distils over as a heavy liquid, from which the excess of chlorine is easily re­moved by shaking with a small quantity of tin filings and re-dis­tilling. It is a colourless fuming liquid of specific gravity 2⋅269 at 0o (Pierre) and 2⋅234 at 15oC. (Gerlach), is fluid at - 29oC., and boils at 115°⋅4 C. under 753⋅1 mm. pressure (Pierre). The chloride unites energetically with water into crystalline hydrates (ex. SnCl4,3H2O), easily soluble in water. It combines readily with alkaline and other chlorides into double salts: thus SnCl4+2KCl=SnCl6K2, analogous to the chloro-platinate ; another example is the salt SnCl6(NH4)2, known industrially as “pink salt,” because it is used as a mordant to produce a pink colour. The plain chloride solution is similarly used. It is usually prepared by dissolving the metal in aqua regia.

Stannic Oxide, SnO2.—This, if the term is taken to include the hydrates, exists in a variety of forms. (1) Tinstone (see above) is proof against all acids. Its disintegration for analytical purposes can be effected by fusion with caustic alkali in silver, with the formation of soluble stannate, or by fusion with sulphur and car­bonate of soda, with the formation of a soluble thio-stannate, SnS2 + xNa2S. (2) A similar oxide is produced by burning tin in air at high temperatures or exposing any of the hydrates to a strong red heat. Such tin-ash, as it is called, is used for the polishing of optical glasses. (3) Meta-stannic acid (H2OSnO2, generally written H10Sn5O15, to account for the complicated composition of meta- stannates, e.g., the soda salt H8Na2Sn5O15) is the white hydrate produced from the metal by means of nitric acid. It is insoluble in water and in nitric acid and apparently so in hydrochloric acid ; but if heated with this last for some time it passes into a hydro­chlorate, which, after the acid mother liquor has been decanted off, dissolves in water. The solution when subjected to distillation behaves pretty much like a physical solution of the oxide in hydro­chloric acid, while a solution of ortho-stannic acid in hydrochloric acid behaves like a solution of SnCl4 in water, i.e., gives off no hydrochloric acid and no precipitate of hydrated SnO2, (4) Ortho­stannic acid is obtained as a white precipitate on the addition of carbonate of soda or the exact quantity of precipitated carbonate of lime to a solution of the chloride. This hydrate, SnO2H2O, is readily soluble in acids forming stannic salts, and in caustic potash and soda, with the formation of ortho-stannates. Of these stannate of sodium, Na2SnO2, is produced industrially by heating tin with Chili saltpetre and caustic soda, or by fusing very finely powdered tinstone with caustic soda in iron vessels. A solution of the pure salt yields fine prisms of the composition Na2SnO3 + lOH2O, which effloresce in the air. The salt is much used as a mordant in dyeing and calico-printing. Alkaline and other stannates when treated with aqueous hydrofluoric acid are converted into fluo-stannates (e.g., K2SnO3 into K2SnF6), which are closely analogous to, and iso­morphous with, fluo-silicates.

Sulphides.—If tin is heated with sulphur the two unite very readily into stannous sulphide, SnS, a lead-grey mass, which under the circumstances refuses to take up more sulphur. But, if a mixture of tin (or, better, tin amalgam), sulphur, and sal-ammoniac in proper proportions be heated, stannic sulphide, SnS2, is produced in the beautiful form of aurum musivum (mosaic gold),—a solid consisting of golden yellow, metallic lustrous scales. It is used chiefly as a yellow “bronze” for plaster-of-Paris statuettes, &c.

Analysis.—Tin compounds when heated on charcoal with car­bonate of soda in the reducing blowpipe flame yield metal and a scanty ring of white SnO2. The reduction, however, succeeds better with cyanide of potassium as a flux. Stannous salt solutions yield a brown precipitate of SnS with sulphuretted hydrogen, which is insoluble in cold dilute acids and in real sulphide of ammonium, (NH4)2S ; but the yellow, or the colourless reagent on addition of sulphur, dissolves the precipitate as SnS2 salt. The solution on acidification yields a yellow precipitate of this sulphide. Stannic salt, SnCl4, solutions give a yellow precipitate of SnS2 with sulphur­etted hydrogen, which is insoluble in cold dilute acids but readily soluble in sulphide of ammonium, and is re-precipitated therefrom as SnS2 on acidification. Only stannous salts (not stannic) give a precipitate of calomel in mercuric chloride solution. A mixture of stannous and stannic chloride when added to a sufficient quantity of solution of chloride of gold, gives an intensely purple precipitate of gold purple (purple of Cassius),—a compound which, although known for centuries, is to this day little understood chemically. It behaves on the whole like a compound of Sn2O3 with Au2O. The test is very delicate, although the colour is not in all cases a pure purple. (W. D.)

TINAMOU, the name given in Guiana to a certain bird as stated in 1741 by Barrere *(France Equinoxiale,* p. 138), from whom it was taken and used in a more general sense by Buffon *(Hist. Nat. Oiseaux,* iv. p. 502). In 1783 Latham *(Synopsis,* ii. p. 724) adopted it as English, and in 1790 *(Index,* ii. p. 633) Latinized it *Tinamus,* as the name of a new and distinct genus. The “ Tinamou ” of Barrere has been identified with the “Macucagua” described and figured by Marcgrave in 1648, and is the *Tinamus major* of modern authors.@@1

Buffon and his successors saw that the Tinamous, though passing among the European colonists of South America as “ Partridges,” could not be associated with those birds, and Latham’s step, above mentioned, was generally ap­proved. The genus he had founded was usually placed among the *Gallinæ,* and by many writers was held to be allied to the Bustards, which, it must be remembered, were then thought to be “ Struthious.” Indeed the likeness of the Tinamou’s bill to that of the Rhea (vol. xx. p. 506) was remarked in 1811 by Illiger. On the other hand L’ Herminier in 1827 saw features in the Tinamou’s sternum that in his judgment linked the bird to the *Rallidæ.* In 1830 Wagler *(Nat. Syst. Amphibien,* &c., p. 127) placed the Tinamous in the same Order as the Ostrich and its allies ; and, though he did this on very insufficient grounds, his assignment has turned out to be not far from the mark, as in 1862 the great affinity of these groups was shown by Prof. Parker’s researches, which were afterwards printed in the Zoological *Transactions* (v. pp. 205-232, 236-238, pls. xxxix.-xli.), and was further substantiated by him in the *Philosophical Transactions* (1866, pp. 174-178, pl. xv.). Shortly after this Prof. Huxley in his often-quoted paper in the Zoological *Proceedings* (1867, pp. 425, 426)

@@@1 Brisson and after him Linnæus confounded this bird, which they had never seen, with the Trumpeter (q∙v.).