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Crystalline hydrous tin (II) oxide.

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Hydrous tin (II) oxide (tin (II) hydroxide) is normally prepared by the addition of a solution of an alkali or alkali carbonate to the solution of a tin (II) salt under a non-oxidising atmosphere (Ditte, 1882; Bury & Partington, 1922; Britton, 1925; Weiser & Milligan, 1932). The product is a powder with crystallites, which are not large enough to be seen under a microscope.

It was found, however, that a crystalline material with an X-ray diffraction powder pattern identical with that of hydrous tin (II) oxide can be prepared by the hydrolysis of a basic tin (II) nitrate (Donaldson, 1959). The basic nitrate is hydrolysed by storage under oxygen-free distilled water until yellow nuggets of hydrous tin (II) oxide are deposited. The preparation presumably depends upon the fact that the rate of hydrolysis of basic tin (II) nitrate is slow enough to permit orderly crystal formation. The crystalline product contains some tin (IV) material but is sufficiently pure for study by X-ray diffraction.

In a recent publication, Weber (1959) deals with crystalline tin (II) materials containing silica but which do not have the same X-ray diffraction powder data as hydrous tin (II) oxide. These materials cannot, therefore, be crystalline tin (II) hydroxide as suggested by the title of the publication.

From X-ray diffraction single-crystal rotation, oscillation and Weissenberg photographs with Cu $K\alpha$ radiation it was found that the crystals of hydrous tin (II) oxide were triclinic with unit-cell dimensions:

$$a = 11{\cdot}5,\ b = 6{\cdot}03,\ c = 19{\cdot}8\ \text{Å};$$
$$\alpha = 99°,\ \beta = 60°\ 30',\ \gamma = 88°\ 30';$$
$$U = 1175\ \text{Å}^3.$$

The reciprocal cell dimensions are:

$$a^* = 0{\cdot}1005,\ b^* = 0{\cdot}1686,\ c^* = 0{\cdot}0590\ \text{Å}^{-1};$$
$$\alpha^* = 79°\ 30',\ \beta^* = 120°,\ \gamma^* = 96°.$$

Most of the lines in the powder pattern of hydrous tin (II) oxide were found to be due to more than one reflection and thus indexing was impracticable.

Chemical analyses of hydrous tin (II) oxide have given three formulae; 3 SnO . 2 H_2O (Bury & Partington, 1922), 4 SnO . 2 H_2O (Weiser & Milligan, 1932) and more recently 5 SnO . 2 H_2O (Donaldson, 1959). Unit-cell contents based on each of these formulae, together with the observed density of $4{\cdot}71 \pm 0{\cdot}06$ g.cm.$^{-3}$ (by displacement of various liquids) and the cell volume are as follows:

	Cell contents		
Composition	Tin	Oxygen	Hydrogen
3 SnO . 2 H_2O	22·5	37·5	30·0
4 SnO . 2 H_2O	23·2	34·8	23·2
5 SnO . 2 H_2O	23·5	32·9	18·8

Of these the nearest to a possible cell is 5 SnO . 2 H_2O (a cell content of $Sn_{24}O_{14}(OH)_{20}$ is possible from lattice considerations). The composition $Sn_{24}O_{14}(OH)_{20}$, which can also be written 24 SnO . 10 H_2O, could not easily be distinguished from 5 SnO . 2 H_2O by chemical analysis. The density calculated for the idealised formula is 4·82 g.cm.$^{-3}$.

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