CLXVII.—*A New Scaly Variety of Aluminium Hydroxide.*

By PANCHANAN NEOGI and ANIL KRISHNA MITRA.

ALTHOUGH several varieties of aluminium hydroxide have been described, there is no definite evidence that any of them are crystalline. The gelatinous precipitate obtained by adding ammonia to solutions of aluminium salts was stated by Ramsay (J., 1877, **32**, 395) to be $Al_2O_3,5H_2O$ if air-dried, or Al_2O_3,H_2O if dried at 300° but Allen (*Chem. News*, 1900, **82**, 75) found that the amorphous hydrate had the composition $Al_2O_3,3H_2O$ and was converted into $Al_2O_3,2H_2O$ if heated at 100° or dried over sulphuric acid. Tommasi (*Chem. Zentr.*, 1905, ii, 605) described what he called a δ-modification ($Al_2O_3,3H_2O$), obtained by keeping the ordinary hydroxide under water for several months; this was amorphous and dissolved in acids and alkalis with difficulty. A so-called β-modification (also $Al_2O_3,3H_2O$) has been described by Noyes and Whitney (*Z. physikal. Chem.*, 1894, **15**, 694) and others as being deposited from soluble aluminates; this was regarded as identical with the crystalline mineral gibbsite (Ditte, *Compt. rend.*, 1893, **116**, 183) until Russ (*Z. anorg. Chem.*, 1904, **41**, 216) showed that it was not crystalline.

Whilst reducing various nitrates by means of the aluminium–mercury couple, we met with glistening scales which were shown by careful qualitative tests to be pure aluminium hydroxide. These are stable and have the composition $Al_2O_3,4H_2O$ and $d^{31°}$ 1·5490. Under the microscope, they show reflexions from innumerable planes, but no doubly-refracting crystals and no resemblance to gibbsite; in view of the flaky appearance, however, it is probable that the substance consists of isometric crystals. As recrystallisation was impossible, no crystals have been obtained large enough to permit of crystallographic classification.

By the action of the aluminium–mercury couple in water alone, aluminium hydroxide is obtained in a gelatinous condition mixed with black particles (Reichard, *Pharm. Z.*, 1907, **40**, 569), so that it is not justifiable to assign a definite composition to it (compare Cossa, *Z. Chem.*, 1879, **13**, 443).

Certain other nitrates and nitrites, such as those of the alkali metals, give a scaly aluminium hydroxide under the same conditions, but it is often accompanied by a much larger quantity of the gelatinous variety, and barium (and, to a less extent, strontium) nitrate gives the best product.

Besides the nitrates, aqueous solutions of the alkali bromates and iodates were similarly reduced, and the aluminium hydroxide

obtained again consisted of a mixture of the gelatinous and scaly varieties, but was usually contaminated with halides.

EXPERIMENTAL.

The freshly-prepared aluminium–mercury couple was added to a concentrated solution of barium nitrate, which covered it to a depth of one or two inches. The reaction commenced at once with the evolution of heat, and the flask was then closed with a soda-lime tube to exclude carbon dioxide and immersed in ice-water. Bright scales of aluminium hydroxide were deposited on the couple, and after a few minutes the supernatant liquid together with the hydroxide was transferred to a large conical flask, which was closed with a cork in order to prevent access of atmospheric carbon dioxide. The couple could be used again with fresh solution and the supernatant liquid in the large flask could be decanted and used again. A quantity of the scales was thus obtained in a few hours; they were repeatedly washed by decantation with large volumes of water until free from barium and any gelatinous variety accompanying it, filtered off, and washed with alcohol and finally with ether. They dried rapidly, retained their lustre in a desiccator, and showed no tendency to absorb water during preparation for analysis, as is the case with the ordinary amorphous variety.

The scales were dissolved in hydrochloric acid and tested for mercury with negative results. (Hasty or negligent washing without repeated decantation leaves traces of barium and mercury.) They were also found to be free from nitrate, nitrite, nitrogen, and peroxidic oxygen.

Ignition of the substance, dried for several days, in a platinum crucible showed a loss of 41·0, 41·2% (Calc. for $Al_2O_3,4H_2O$: 41·4%). Strong ignition in a current of dried air yielded 41·6, 41·0% to calcium chloride tubes, the last molecule of water being removed only with difficulty. Aluminium was estimated after solution in hydrochloric acid (Al_2O_3, found : 59·05, 58·85. Calc. : 58·6%). Loss at 100°, 11·1 (Calc. for $1H_2O$: 9·6%). After the substance had been kept for 3 weeks in a desiccator, its composition, $Al_2O_3,4H_2O$, was unchanged.

The scales were soluble in mineral acids, but insoluble in methylamine, in which the ordinary precipitated hydroxide is soluble (Renz, *Ber.*, 1903, **36**, 2751).

We offer our thanks to Professor S. L. Biswas of the Geological Department of this College for kind assistance in the microscopic examination.

PRESIDENCY COLLEGE, CALCUTTA. [*Received, August 30th*, 1926.]