1. Introduction

Amorphous aluminium hydroxide precipitates and their recrystallisation products may be characterised by their rate of dissolution by sodium hydroxide solutions (1, 2, 3). This work extends previous studies on the kinetics of dissolution of recrystallised aluminium tri-hydroxide precipitates. Aluminium mono-hydroxide gels were recrystallised under controlled conditions to give Boehmite powders of different particle size and their dissolution by well-stirred sodium hydroxide solutions was studied at 35 °C to 65 °C. Reaction mechanisms were discussed.

2. Experimental

2.1 Materials

2.1.1 Boehmite P5/30 m powder

2.5 percent benzene solution of aluminium isopropoxide (supplied by Honeywell and Stein Ltd.) was hydrolysed by shaking with 200 cm³ hot distilled water at 80 °C. The amorphous aluminium hydroxide gel was then aged in hot water for 30 min (4). This recrystallised material was then centrifuged free of solution, washed three times with distilled water, dried by resuspension in anhydrous acetone and then outgassed at room temperature for 24 hr with a mercury vapour pump.

Boehmite P5/2 and P5/8 powders

Two other batches of amorphous aluminium hydroxide gel were prepared as above and recrystallised for 2 and 8 hr in hot distilled water. The precipitates were then washed and dried in the same manner.

The chemical and physical properties of these powders were investigated by the techniques described in our previous paper (3) and were as follows:

- particle shape; fibres (cylinders) – ℓ₀/μ₀ = 4–6 (Cf. ref 4); particle length (ℓ₀): P5/30 m 0.07 μm, P5/2 0.10 μm, P5/8 0.10 μm;
- chemical and thermogravimetric analysis; 0.995 A₁₀₀H;
- X-ray diffraction; > 0.95 Boehmite;
- i.r. spectrophotometry; > 0.98 Boehmite.

2.1.2 Sodium hydroxide solutions (concentrations C = 1 to 8 M) were prepared from A.R. material in double-distilled CO₂-free water.

2.2 Reaction kinetics

Boehmite powder (0.6 g) was completely redispersed in large excess (100 cm³) aqueous sodium hydroxide solution in a ‘Quickfit’ flask. The reaction flask was shaken at 240 vibrations per min in a Dubnoff Shaker – Water Bath thermostatted to ±1 °C. 1 cm³ reaction solution was withdrawn after different times and analysed for aluminate anion by the modified Waenninen’s method (3). The aluminate concentrations (Wₐₜ) were determined.

3. Results

3.1 Physical and chemical changes

Boehmite powders (cylindrical fibres of initial length ℓ₀ = 0.06 to 0.10 μm) were prepared by controlled hydrolysis of aluminium
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isopropoxide and recrystallisation of the aluminium hydroxide precipitates in hot water (80 °C). These powders were dispersed in sodium hydroxide solutions ($C = 1–8 M$) and their dissolution was studied at 35 ° to 65 °C. The suspension concentration was 0.6 g per 100 cm$^3$ and the hydroxyl ion was in large excess; this eliminated any variation in reaction rate with hydroxyl ion concentration during a run and simplified the kinetic studies (3).

The Boehmite powders first adsorbed ra-

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**Fig. 1A.** Dissolution of Boehmite $P5/2$ by sodium hydroxide solutions at 50 °C. Variation of $(x_{t}^{1/3} - 1)$ with time.

**Fig. 1B.** Dissolution of Boehmite $P5/2$ by sodium hydroxide solution ($C = 2 M$) at different temperatures. Variation of $(x_{t}^{1/3} - 1)$ with time.