PAPER NO: 1

EXTRACTION CHARACTERISTICS OF ALUMINA FROM GUJARAT BAUXITES (*)

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A significant growth of the Indian Aluminium industry has taken place in the last decade. Aluminium with its outstanding properties and the fact that it is a successful substitute for many non-ferrous base metals, in which India is comparatively deficient coupled with India's abundant reserves of high grade bauxites has drawn the attention of the Government in recent years of the importance of this industry. The aluminium industry in India has grown from 8,300 tonnes of aluminium in 1958 to 96,500 tonnes of aluminium in 1967 with an expected production of 1,19,000 tonnes by the end of this year. A target of 3,00,000 tonnes of installed capacity of aluminium has been visualised by the end of 1970-71 and 4,50,000 tonnes by 1975-76.

The paper outlines the reserves, chemical and mineralogical make-up of Indian bauxites in general and Gujarat in particular. An outline of the Bayer's process is given and a brief description of the American and European practices is given with a mention of the Sweetening process. The paper describes in detail the geology of Gujarat bauxites and the results of the extraction of alumina from eight bauxite samples with caustic soda.

The eight samples of bauxites investigated were mostly from Jamnagar, Kutch and Kaira districts. The samples analysed 54 to 64 % Al_2O_3, 1 to 5 % SiO_2, 1.8 to 6.1 % Fe_2O_3, 2.24 to 4.3 TiO_2, 0.32 to 2.2 % CaO and 27.25 to 32.65 % L.O.I. It was observed that most of the samples investigated were cliachitic in nature with varying amounts of gibbsite and bohemite and minor amounts of diaspore and kaolinite. Only one particular sample from Jamnagar was found to contain a high proportion of diaspore (9 %) whilst all other samples contained 1 - 2 % Al_2O_3 as diaspore. All the samples contained mostly cliachite with gibbsite present in the cavities and on the grain boundaries of cliachite. The samples were massive, earthy, less oolitic and varied from greyish white to reddish brown in colour

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The samples were tested for the extraction of alumina by caustic soda digestion at atmospheric pressure and it was observed that more than 90 % of alumina could be dissolved from most of the samples on leaching 25 grams of sample with caustic soda solution containing 200 gms. NaOH/litre, with molar ratio of Na_2O : Al_2O_3 as 2:1 for 30 to 60 minutes under boiling conditions. The optimum size for most of the samples was found to be -10 mesh excepting for some of the samples where grinding to -100 mesh was found essential.

The study of the effect of caustic concentration on alumina extraction for different samples has indicated that most of the samples behave in a similar fashion and the optimum concentration of 200 gms. NaOH/litre is needed in the digesting liquor for maximum recovery of Al_2O_3 from the samples.

The study of the rate of extraction of alumina from the different bauxite samples indicated that more than two-thirds of alumina gets dissolved in the first few minutes and thereafter the dissolution is gradual. The optimum period of digestion for maximum extraction of Al_2O_3 has been found to vary from 30 to 60 minutes for most of the samples.

The study of the effect of molar ratio of Na_2O to Al_2O_3 indicated that the Al_2O_3 extraction follows an identical pattern for most of the samples.

Since most of the bauxite samples are capable of alumina extraction at a coarser size with fairly dilute caustic soda solution at atmospheric pressure, the establishment of an aluminium industry in Gujarat has been suggested keeping in view of the requirement of other raw materials for the aluminium industry.
