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(54) Method for the Precipitation of Aluminium-chloride from Solutions which Contain Ions of Aluminium and Magnesium

(57) The invention provides a method of producing aluminium-chloride with a low magnesium content from hydrochloric acid solutions which contain ions of aluminium and magnesium and from which the aluminium chloride is precipitated by hydrochloric acid gas, where the precipitation is carried out continuously in cascade so that the major part of the aluminium will be precipitated from solutions in which the ratio between aluminium and magnesium calculated as g Al^{+3}/g Mg^{+2} is above 0.5. The aluminium-chloride produced may be transformed to aluminium oxide by calcination.

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SPECIFICATION

Method for the Precipitation of Aluminium-chloride from Solutions which contain Ions of Aluminium and Magnesium

This invention relates to the production of aluminium-chloride particularly for subsequent decomposition to aluminiumoxide for the eventual production of aluminium metal.

Aluminiumoxide which is to be used for production of metallic aluminium should be as pure as possible as several elements would otherwise contaminate the aluminium metal produced or cause difficulties during the production. Magnesium is one such unwanted element.

When aluminiumoxide is produced from aluminiumchloride by decomposition of the chloride, it has been shown that any magnesium in the aluminiumchloride will be largely retained in the aluminiumoxide produced. In order to be able to produce from aluminiumchloride an aluminiumoxide which is low in magnesium it is necessary to be able to produce a chloride which is low in magnesium. By production of aluminiumchloride from mineral raw material the latter has to be treated with hydrochloric acid whereby the aluminium content will be dissolved, and the undissolved remnants of the mineral can be removed for instance by filtration.

Aluminiumchloride may be recovered from the aluminium-containing solution by addition of sufficient amounts of hydrochloric acid gas which reduces the solubility of the aluminiumchloride so that it is precipitated as $AlCl_3 6H_2O$. In order to obtain an elevated yield by this precipitation the remnants of aluminium in the solution have to be as low as possible. It has then proved that magnesium in the solution contaminates the precipitated aluminiumchloride.

It has now been found that it is possible to produce aluminiumchloride ($AlCl_3 6H_2O$) with a low magnesium content from hydrochloric acid solutions which contain aluminium and magnesium ions by precipitation with hydrochloric acid gas, the precipitation being carried out continuously in cascade so that the major part of the aluminium will be precipitated from solutions in which the ratio aluminium/magnesium calculated as g Al^{+3}/g Mg^{+2} is above 0,5. The produced aluminiumchloride is transformed to aluminium-oxide by calcination.

In order to promote a fuller understanding of the above and other aspects of the invention, an exemplary embodiment will be described.

Example

Anorthosite from Sogn (50% SiO_2, 30,5% Al_2O, 14,5% CaO, 0,5% MgO) was leached with hydrochloric acid which resulted in a solution containing 40 g Al^{+3}/l and 0,7 g Mg^{+2}/l. Hydrochloric acid gas was then supplied to the solution and aluminiumchloride was precipitated which contained 0,2% MgO in relation to its content of Al_2O_3. The chloride was dissolved in water and the solution was conducted continuously to a crystalliser to which hydrochloric acid gas was simultaneously supplied so that the aluminium concentration was kept constant at 25 g Al^{+3}/l. The solution from this crystallizer was conducted further to another crystalliser in which the aluminium concentration was maintained at 5 g Al/l by supply of hydrochloric acid gas. The precipitated crystals from these two crystallisers were collected and separated from the mother lye, washed with 36% hydrochloric acid in water and calcined to aluminiumoxide. The contents of MgO in this oxide was 0,03%.

The solution from the second crystalliser was conducted to a third crystalliser and remaining aluminium content was precipitated by supply of additional amounts of hydrochloric acid gas. In this way the aluminium content was reduced to 0,2 g Al^{+3}/l. This resulted in an aluminiumchloride which was strongly contaminated by magnesium (0,6% MgO in Al_2O_3). This chloride was returned to solution and renewed precipitation.

It is thus possible to provide a process which is continuous and also gives an acceptably pure product by carrying out the precipitation continuously in cascade so that when the solution passes through the cascade system, only a part of the aluminium content is precipitated in each cascade step. In this way the precipitation of the major part of the aluminium content of the solution takes place at a relatively high aluminium concentration and gives a product which is contaminated by magnesium to an acceptably small extent.

Claims

1. A method for producing an aluminiumchloride with a low magnesium content from hydrochloric acid solutions containing ions of aluminium and magnesium by precipitation of the aluminiumchloride with hydrochloric acid gas, in which the precipitation is carried out continuously in cascade so that the major part of the aluminium will be precipitated from solutions in which the ratio between aluminium and magnesium calculated as g Al^{+3}/g Mg^{+2} is above 0,5.

2. A method as claimed in Claim 1, in which the aluminiumchloride is transformed to aluminiumoxide by calcination.

3. A method for the production of aluminiumchloride substantially as herein described with respect to the Example.

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