

ALIEN PROPERTY CUSTODIAN

EXTRACTION OF VANADIUM AND PHOSPHORUS FROM RESIDUES OF THE PREPARATION OF ALUMINA ACCORDING TO THE ALKALINE METHOD

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It is known that the alkaline method used in the manufacture of alumina consists of treating bauxite or other aluminous ore with soda. In these conditions aluminium passes into solution in the form of sodium aluminate; but at the same time small amounts of phosphoric anhydride and of vanadium oxide contained in the ore pass into solution in the form of sodium phosphate respectively vanadate; these compounds remain in the mother-liquors during the hydrolysis originating the precipitation of alumina and then their greater part deposits, together with the excess of sodium carbonate present during the concentration of the mother-liquor, in the form of salts containing up to 10-12% of V_2O_5 .

Various methods have been proposed relating to the extraction of vanadium oxide from these mixed salts. According to one method, the salts are neutralized by means of sulphuric acid to a pH-value of approximately 3 and V_2O_5 is separated from the solution by hydrolysis; but this requires a large quantity of sulphuric acid and consequently a considerable amount of oxidising agent to hydrolyse the strongly acid solution. According to another method, the saturated solutions are treated with ammonium chloride in order to precipitate vanadium in form of ammonium vanadate; but this case shows the disadvantage of requiring a large amount of ammonium chloride, quite disproportionate to the small share of V_2O_5 contained in the mixed salts solution, which is very diluted in view of the little solubility of the salts.

I have now found that it is possible, by treating the mixed salts solutions with a limited quantity of acid until the pH-value is very slightly alkaline, to separate by cooling most part of phosphorus as disodium phosphate and a V_2O_5 concentrated mother-liquor is then obtained from which vanadium may be entirely precipitated with ammonium chloride in little excess with respect to the stoichiometric quantity.

On this basis a practical and economic method has been elaborated which does not present the inconvenients of the methods hitherto known.

The mixed crystals, previously washed in order to separate most part of sodium carbonate, are softly dissolved by means of the liquors resulting from preceding washings and in such a rate to obtain a more or less viscous paste; this is gradually heated and an acid is added until a pH-value of about 8 is reached; the limpid solution thus obtained, eventually filtered from the insoluble substances (e. g. alumina), is slowly crystallised until separation of disodium phosphate occurs. The salt is centrifuged, filtered and washed with cold water; while the washing-liquors are used for the dissolving of mixed salts of the subsequent steps, the mother-liquor containing the whole sodium vanadate, is treated with ammonium chloride, while the pH-value is conveniently regulated, or else it is subjected to hydrolysis; in the first case ammonium metavanadate precipitates, from which anhydrous V_2O_5 is obtained by simple roasting; in the second case humid V_2O_5 is directly obtained.

Example.—Mixed salts containing 4% of V_2O_5 and 12% of P_2O_5 are used. These crystals are softly dissolved by means of liquors resulting from preceding washings, in order to obtain a paste containing 60 g/l of V_2O_5 ; this is gradually heated, by adding sulphuric acid, until a pH-value of 8 is reached; the solution is filtered from the impurities, maintaining the temperature above 35° C in order to avoid crystallisation of sodium phosphate; the limpid solution is crystallised by cooling down to 10° C; disodium phosphate is then entirely separated. The mother-liquor containing 50 g/l of V_2O_5 is treated with ammonium chloride, while the pH-value is maintained at 7, since metavanadate is soluble in alkaline or acid solutions, even when diluted.

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