

leaching, but only by complete decomposition of the phosphorite mineral.

REFERENCE:

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RESEARCH ON URANIUM FROM PHOSPHORIC ACID IN ISRAEL - PROGRESS AND PROSPECTS

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The economics of uranium recovery from phosphoric acid are very unfavorable at present because of the low prices of uranium and its high production cost.

The liquid-liquid contacting systems used to extract uranium from phosphoric acid are very sensitive to impurities that exist in the acid (mainly organic matter and finely dispersed solids). Moreover, they usually contaminate the barren acid with traces of solvents. Therefore, appropriate cleaning of the phosphoric acid is needed prior to the extraction of uranium as well as afterwards. It was estimated that expenses associated with these pre- and post- treatments of the phosphoric acid constitute a major part of the total investment and operating costs of uranium recovery facilities.

We are engaged in research and development aimed at improving the economics of uranium recovery from phosphates by developing new processes that simplify the required cleaning operations. The following two processes have been investigated.

a) The phosphogypsum route. By maintaining reductive conditions during the acidulation of phosphate rock to produce phosphoric acid, uranium can co-precipitate with solid compounds that form phosphogypsum. The uranium can be easily leached and recovered from the phosphogypsum which is separated from the phosphoric acid in the course of the production process. Thus, direct contact between phosphoric acid and solvent is avoided.

b) Solid extractants. Solid extractants, in contrast to liquid solvents, do not contaminate the barren phosphoric acid. Moreover, it is expected that the correct choice of operating technology can minimize their sensitivity to most of the impurities in the acid.

Several samples of polystyrene-DVB resins impregnated or copolymerized with DEHPA-TOPO were tested. These samples were produced either by the Applied Research Institute, Ben Gurion University of the Negev, or by Bayer AG, Leverkusen, Germany. Other ion-exchange resins have been tested as well. The results, although of a preliminary nature, indicate prospects of solid extractants significantly improving the economics of uranium recovery from phosphoric acid.

#### CAUSTIC TREATMENT OF ZIRCON SAND IN A CONTINUOUS FLUIDIZED BED REACTOR

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The treatment of insoluble zircon sand with sodium hydroxide, according to the reaction  $ZrO_2 \cdot SiO_2 + 4 NaOH \rightarrow Na_2ZrO_3 + Na_2SiO_3$ , is the first step in the recovery of zirconium from this mineral. The reaction gives rise to two products: sodium silicate, which is water soluble, and sodium zirconate, which is acid soluble. The high temperature required and the caustic nature of the reactant cause severe corrosion of the reaction vessel. Another difficulty encountered is the formation of a doughy mass.

We have developed a bench scale fluidized bed reaction which successfully eliminates these problems. The reaction is started by initially filling the bed with a predetermined amount of zircon and fluidizing the bed by passing heated air through a porous distributor plate at the bottom of the reactor. The temperature of the bed is raised to 600°-700°C and sodium hydroxide pellets are fed in from the top. After the amount of hydroxide required to react with the zircon has been added, simultaneous feeding, of zircon sand into the bottom of the reactor and hydroxide at the top, is commenced. A finely-divided powdery product is obtained which overflows into a tube in the upper half of the reactor. The product is removed, washed with water to remove sodium silicate and unreacted sodium hydroxide and the remaining sodium zirconate is then dissolved in mineral acid.

Best results were obtained at 700°C, using a 40% excess of NaOH; 92% of the available zirconium was recovered as soluble zirconium.