



## **RECOVERY OF RARE EARTH ELEMENTS FROM PHOSPHOGYPSUM (REE-PG)**

The uses of rare earth elements (REE) in technologies that contribute to environmental, energy efficiency and health solutions have created an increasing demand. China is responsible for 86% of REE production and, due to an uncertainty in supply, they are included in the European Commission's list of 20 critical raw materials.

Phosphogypsum (PG) waste is generated in large quantities (100-280 Mt a year) in the wet phosphoric acid process. Light and middle REE are concentrated into PG. In total 21 Mt of REE has been locked into PG over the past decades. PG is therefore a potential secondary source for sustainable REE production. South Africa has been one of the largest phosphoric acid producers in the world. Finland, with its apatite and carbonatite deposits, is one of the few countries within the EU where REE are found.

Extensive testwork programs on REE recovery from PG at GTK and VTT in Finland and at MINTEK in South Africa have shown that the PG is highly variable, both in terms of physical properties and REE recovery, which prevents the industry from successfully treating the PG dumps. The REE-PG project extends REE processing beyond state-of-the-art by means of detailed investigation of the fundamental phenomena in the beneficiation, extraction and separation of REE. Understanding the cause of varying responses of PG samples to a certain process will lead to identification of a new methodology to unlock REE accumulated in waste. Biological pretreatment and sulphate reducing bacteria (SRB) precipitation are investigated to provide an efficient, affordable and environmentally friendly concentration of REE in PG. An optimized Resin-in-Leach (RIL) process will provide a viable methodology for REE recovery from low grade sources. Finally, utilizing novel ion exchange materials, aqueous feed and/or eluent modification and novel process configurations will enhance the RIL recovery process, improve REE separation and improve the economics of the process in general.

In this project, GTK specializes in mineralogical research and methods for concentrating REE-bearing minerals. VTT's contribution will be in novel passive biochemical approach based on SRB for minerals' concentration. MINTEK brings expertise on leaching and downstream processing as well as economic evaluations. LUT focuses on the chemistry and engineering aspects of the ion exchange purification of REE, as well as development and application of novel separation materials.

## Researchers

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