A NOVEL PROCESS TO RECOVER SULFUR, LIME AND RARE EARTHS FROM GYPSUM

David van Vuuren, University of Pretoria
Dawie.vanvuuren@up.ac.za
Johannes Maree, Tshwane University of Technology

Key Words: Gypsum, sulfur, lime, carbo-thermal reduction.

A novel process is described to recover elemental sulfur, high-grade calcium carbonate and a concentrate of rare earths. The process entails carbo-thermal reduction of gypsum to form calcium sulfide using ordinary bituminous coal as both energy and carbon source, followed by extraction of calcium sulfide as an aqueous solution of calcium bisulfide. Calcium bisulfide is then converted to hydrogen sulfide that can be converted to elemental sulfur using any one of a number of existing commercial processes and high-purity (>99%) calcium carbonate.

The overall mass and energy balances as well as indicative economic parameters shows that it should be economically viable to replace about 95% of sulfur purchased by a typical merchant-grade phosphoric acid producer with recycled sulfur and to produce high-quality calcium carbonate byproduct that should be suitable for use in many applications such as agricultural lime, lime for cement manufacturing and even in higher-value precipitated calcium carbonate filler markets. Rare-earths in the residue is concentrated to about seven times the concentration in waste phosphogypsum, making the viability to recover it much more lucrative.

Radioactive elements are concentrated as well and report to the same stream as the rare earth elements.