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PROCESS SELECTION CONSIDERATIONS FOR RECOVERY OF RARE EARTHS FROM MINERAL SANDS CONCENTRATES

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ABSTRACT

Mineral sand deposits contain a concentrated amount of economically important minerals known as “heavy minerals”. The minerals of economic interest typically comprise of zircon (a zirconium source) and rutile, leucoxene and/or ilmenite (titanium sources). These deposits also contain rare earth minerals such as monazite and xenotime. With the increased demand for rare earths, and specifically “magnet rare earths” of praseodymium, neodymium, terbium and dysprosium, there is an increased focus to recover the rare earths from these deposits.

As both monazite and xenotime are only sparingly soluble in acid solutions, a pretreatment (“cracking”) stage is required. There are presently two commercial methods used in industry for the cracking this type of concentrate. The most widely used method, known as sulphuric acid baking, mixes the concentrate with concentrated sulphuric acid followed by thermally heating to produce solid rare earth sulphates. The other method, known as caustic conversion, involves the mixing of the concentrate with a strong sodium hydroxide solution and heating to near boiling point to produce solid rare earth hydroxides. Both methods then can dissolve the soluble rare earths followed by purification prior to separation either on site or at a remote facility via solvent extraction.

This paper discusses the metrics such as cost, recovery, operability, waste management and radionuclide deportment that need to be considered when selecting a process route for these rare earth concentrates.

Keywords: Rare earth recovery, monazite, xenotime, mineral sands, radionuclides