Extracting Critical Metals from Mine Waste Using Molten Alkali Salts

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The mining industry globally has produced large quantities of tailings, often containing valuable resources. With the progression of technology, these previously untapped resources are becoming increasingly desired, and due to a difference in form, extraction techniques need to be adjusted for these secondary sources. This is particularly relevant to rare earth elements (REE). Uranium mine tailings have been found to contain potentially economically viable concentrations of REE, such as tailings from the Mary Kathleen and Olympic Dam mines. However, investigations into REE-tailings extraction methods have yielded mixed results, and are not currently sufficient economically for large scale application. Another issue in REE extraction from tailings is the availability of processing infrastructure, as creating new facilities would be extremely costly—any feasible methods should consider the use of existing equipment. We are therefore devising a novel extraction method to separate REE from fine-milled tailings, and do so using readily available equipment. We use high temperature roasting of tailings with alkali salts to induce flux melting and recrystallisation of REE into predictable and consistent mineral phases. Preliminary results indicate methods have been successful, with REE mineral grains increasing in size relative to starting tailings.