

Waste mining: Challenges and opportunities for rare earth element recovery from waste ash

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Rare earth elements (REEs) are critical for the sustainable development of clean energy and high technology. The dependence on international supplies and lack of diverse supplies of REEs have prompted the US to explore new sources and develop environmentally friendly technologies for REE extraction, processing, and manufacturing. Recovery of REEs from waste streams such as coal fly ash (CFA) is a promising resource recovery and waste valorization option that might bring about significant economic and environmental benefits. However, many challenges need to be addressed in order to develop cost effective and environmentally friendly techniques for REE recovery. This talk will discuss the systematic characterization of REE speciation and other trace metals in CFA. By employing complementary techniques across molecular to bulk scales, a range of REE-bearing phases are identified, including REE oxides, REE phosphates, apatite, zircon, and REE-bearing glass phase. REEs can occur as discrete particles, as particles encapsulated in glass phase, or distribute throughout the glass phase. Based on the fundamental understandings of the distribution, speciation, and extractability of REEs and other trace metals in CFA, an integrated system for REE recovery and waste reduction of CFA is developed and evaluated.