

Characterization and recovery of rare earth elements from coal fly 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 critical metal extraction, processing, and manufacturing. Recovery of REEs from coal fly ash (CFA) is a promising resource recovery and waste recycling 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 from CFA. This talk characterizes 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, extractability of REEs and other trace metals in CFA, an integrated system for REE recovery and waste reduction of CFA was successfully developed and evaluated.