TECHBRIEF

NOVEL METHOD CONCENTRATES RARE EARTH ELEMENTS WITHIN COAL BYPRODUCTS TO FACILITATE EXTRACTION

OPPORTUNITY:

This patented technology establishes a novel method for concentrating rare earth elements (REEs) within coal byproducts to facilitate extraction processes. The technology is available for licensing and/or further collaborative research from the U.S. Department of Energy's National Energy Technology Laboratory.

CHALLENGE:

REEs are essential components of modern technological devices, such as cell phones and computer hard drives, that support a broad range of vital industries. China provides the bulk of the world's supply, largely due to environmental and economic challenges associated with extraction. Coal resources used in energy, iron, and steelmaking operations contain quantities of REEs sufficient to meet U.S. needs for years to come, but not as enriched solids. Cost-effective technology that facilitates the recovery of REEs in their most useful form offers the potential to simultaneously boost America's economy, national security, and independence.

OVERVIEW:

NETL researchers have developed a novel method that concentrates REEs from coal byproducts, such as ash and slag, to facilitate extraction, expanding the possibilities for a domestic supply of REEs. A high concentration of REEs is achieved by partitioning the elements into a single solid compound through temperature/time manipulations without acid leaching. Using this method, REEs of less than 0.05% – or 500 parts per million – could be concentrated to 59%.

The process begins by fluxing a coal byproduct with predetermined additives in air and heating it at elevated temperatures until molten. Then, the melt is slowly cooled at a controlled rate. The controlled cooling forces the REE-bearing phase to precipitate as solid from the melt. During this stage, essentially all REEs are concentrated in this solid and separated from the melt. Cooling can be controlled to co-precipitate other minerals at large quantities along with the REE-bearing phase, if desired; byproduct credits would expand economic benefits.

ADVANTAGES:

- Results in high concentration of REEs.
- Uses existing waste material from coal-based operations.
- Does not require controlled atmosphere.
- Low-cost simple temperature manipulations.
- Eliminates need for toxic acids.
- Reduces health and environmental risks as compared to current leaching processes.

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APPLICATIONS:

- Extraction of REEs from coal byproducts.
- Extraction of REEs from urban waste.
- Extraction of REEs from other materials that contain REEs.

PATENT STATUS:

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