Project Selections for FOA 2619: BIL - Advanced Processing of Rare Earth Elements and Critical Minerals for Industrial and Manufacturing Applications (Round 1)

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TOPIC AREA 1 — Advanced Process Development for Production of Rare Earth Metals and Co-Production of Critical Minerals and Materials from Coal-Based Resources

Development of a Strategic Materials Production System for Rare Earth Metals, Graphite and Other Critical Materials from Bituminous Coal – **University of Kentucky Research Foundation** (Lexington, Kentucky) plans to conduct pilot testing to obtain aqueous solutions rich in mixed rare earth elements and critical minerals and materials (manganese, cobalt, and nickel) and a lithium-containing raffinate. The project will introduce mixed rare earth element solution into a circuit consisting of advanced solvent extraction, oxalic acid precipitation and roasting to obtain high-grade rare earth oxides of individual rare earth elements. The rare earth oxides will then be converted to rare earth metals through ionic liquids low temperature technology and plasma technology. The aqueous solutions containing lithium, manganese, cobalt, and nickel will be processed in a separate circuit to obtain high purity chemical compounds of these metals.

DOE Funding: $5,000,000
Non-DOE Funding: $1,369,593
Total Value: $6,369,593

Separation of Rare Earth Oxides and Reduction to Metal Products – **West Virginia University Research Corporation** (Morgantown, West Virginia) intends to incentivize acid mine drainage treatment while recovering materials critical to the nation's defense and advanced manufacturing industries. The objective of this project is to produce individually separated high purity rare earth element and critical mineral oxides and to further process the rare earth element oxides into rare earth metals. The feedstock will be obtained from a 500 gallon per minute acid mine drainage treatment plant coupled with a rare earth element and critical minerals and materials recovery facility that will produce 21 tons of rare earth elements and critical minerals and materials per year. The project's strategy will help to eliminate investment risk and delays encountered in conventional mining such as exploration, permitting, and infrastructure development that may require years and have high cost.

DOE Funding: $5,000,000
Non-DOE Funding: $1,267,785

Total Value: $6,267,785

The Alliance for Critical Mineral Extraction and Production from Coal-Based Resources for Vitality Enhancement in Domestic Supply Chains – **Pennsylvania State University** (University Park, Pennsylvania) plans to establish a 100% domestic supply chain for rare earth elements and critical minerals and materials. The project will produce a concentrate of mixed rare earth oxides and critical minerals and materials at greater than 90% purity from an acid mine drainage treatment plant. From the concentrate, greater than 99.9% pure rare earth elements will be separated and reduced to metals using a low temperature metallothermic process. This project will also produce high-grade lithium carbonate, nickel, cobalt, manganese, and titanium. Lastly, technoeconomic and lifecycle analyses will be performed.

DOE Funding: $4,999,801
Non-DOE Funding: $1,268,565
Total Value: $6,268,366

TOPIC AREA 2 — Production of Critical Minerals and Materials Excluding Materials Containing Rare Earth Elements from Coal-Based Resources

Production of Germanium and Gallium Concentrates for Industrial Processes – **Microbeam Technologies Incorporated** (Grand Forks, North Dakota) intends to demonstrate on a bench-scale system the ability to extract and produce high purity gallium and germanium from a lignite-derived, mixed rare earth element concentrate obtained from selected gallium and germanium rich lignite carbon ore. The specific objectives will involve the following: 1) design and construct a bench-scale system, 2) perform shakedown and parametric testing of the system using a mixed rare earth oxides/salts concentrate from a pilot-scale facility as input, 3) produce high-purity gallium and germanium metals from the mixed rare earth element concentrate for product testing, and 4) perform a technical and economic analysis of the commercialization potential of the process.

DOE Funding: $2,499,978
Non-DOE Funding: $635,000
Total Value: $3,134,978

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