

This Week's Digest
June 10, 2022

Alireza Valian

Critical Material and Recovery Technologies Center
University of Kentucky

Page 1/8

Contents

News 2

- Texas Mineral Resources Joint Venture Partner Secures First Domestic Rare Earth Metal and Magnet Manufacturing Facility 2
- NioCorp reworks Elk Creek flowsheet to cut capex, opex, GHG emissions..... 2
- Search Minerals Announces Positive Preliminary Economic Assessment for the Deep Fox and Foxtrot Rare Earth Element Project With \$2.23 Billion NPV 2
- American Resources completes first phase of commissioning its rare earth and battery materials facility in Indiana 2
- Idaho Strategic Receives Final Approval of its Diamond Creek Rare Earth Element Drill Program..... 3
- ACME Lithium kicks off drilling at Nevada brine project 3
- Stellantis secures lithium supply from California for EV batteries 3
- Biden keeps funds flowing to build US electric vehicle supply chain 3

Select Articles..... 3

- Highly functional bio-based micro- and nano-structured materials for neodymium recovery..... 3
- Utilization of sludge-based alginate beads for the application of rare earth elements (REEs) recovery from wastewater: A waste to resource approach 4
- Applicability of new sustainable and efficient alginate-based composites for critical raw materials recovery: General composites fabrication optimization and adsorption performance evaluation 4
- Developing Materials for Rare-Earth–Element Chelation: Synthesis, Solution Thermodynamics, and Applications..... 4
- Recent advances in the global rare-earth supply chain..... 4

Funding Opportunities 4

- DE-FOA-0002678: BIPARTISAN INFRASTRUCTURE LAW (BIL) BATTERY MATERIALS PROCESSING AND BATTERY MANUFACTURING 4
- DE-FOA-0002680: BIPARTISAN INFRASTRUCTURE LAW (BIL) ELECTRIC DRIVE VEHICLE BATTERY RECYCLING AND SECOND LIFE APPLICATIONS 6

News

[Texas Mineral Resources Joint Venture Partner Secures First Domestic Rare Earth Metal and Magnet Manufacturing Facility](#)

Texas Mineral Resources Corp. is pleased to report that its joint venture partner USA Rare Earth Inc. today announced its procurement and development of the first fully integrated U.S.-based rare earth metal and sintered neo-magnet manufacturing facility, located in Stillwater, Oklahoma. USA Rare Earth plans to invest more than \$100 million in developing the manufacturing facility and will utilize its owned facilities and technology to convert rare earth oxides into metals, magnets, and other specialty materials.

Same news, different perspectives:

[Stitt announces \\$100M project to bring rare earth metal and manufacturing facility to Oklahoma](#)

[Governor Stitt welcomes green energy company 'USA Rare Earth' into Stillwater](#)

[City of Stillwater approves \\$7 million incentive for USA Rare Earth manufacturing facility](#)

[NioCorp reworks Elk Creek flowsheet to cut capex, opex, GHG emissions](#)

NioCorp (TSX: NB) is testing a reworked mineral processing flowsheet for its Elk Creek rare earth elements (REE) project 105 km southeast of Lincoln, Nebraska. The tests point toward possible lower capital and operating costs as well as fewer greenhouse gas (GHG) emissions. The tests include using a carbonation process that can be used to recycle key reagents used to remove calcium and magnesium carbonates from the ore before the recovery of niobium, scandium, titanium, and REEs. The process may also allow NioCorp to sell commercial-grade calcium and magnesium products.

[Search Minerals Announces Positive Preliminary Economic Assessment for the Deep Fox and Foxtrot Rare Earth Element Project With \\$2.23 Billion NPV](#)

- The project net present value (NPV) of \$2.23B
- The pre-tax internal rate of return (IRR) is 55.3%, and the after-tax IRR is 41.5%
- The pre-tax capital payback is 1.5 years and after-tax capital payback is 1.8 years from start of production.
- Initial capital costs: \$422M (includes \$61M contingency)
- Life of Mine: 26 years. Annual mining production: 720,000t (at 2000tpd)
- Net value: \$756/t (net of process recoveries and payability terms)
- Operating cost: \$345/t (including third party separation charges)

[American Resources completes first phase of commissioning its rare earth and battery materials facility in Indiana](#)

American Resources Corporation said it has successfully completed the first phase of commissioning of its rare earths facility in Indiana, paving the way for initial production. The company's American Rare Earth division wrapped up the commissioning of its critical and rare earth element isolation and

purification facility, enabling it to prepare its chromatography columns for production, according to a release. The commissioning phase of the processing facility was focused on ensuring that the flow rates, pressurization and valves operated as intended, American Resources told shareholders.

[Idaho Strategic Receives Final Approval of its Diamond Creek Rare Earth Element Drill Program](#)

Idaho Strategic Resources, Inc. is pleased to announce that it has received final approval for its Diamond Creek Rare Earth Element (REE) drill program scheduled to begin later this month. The Company's Diamond Creek Rare Earth Element property was initially discovered in the 1950's by the U.S. Government during extensive country-wide exploration efforts aimed at locating nuclear power related raw materials.

[ACME Lithium kicks off drilling at Nevada brine project](#)

ACME Lithium has begun drilling at its Clayton Valley Nevada brine project, located to the northwest of Albemarle's Silver Peak mine, the only lithium brine operation in production in North America. The company said it had contracted Harris Drilling Exploration and Associates to provide drilling services and related activities.

[Stellantis secures lithium supply from California for EV batteries](#)

Stellantis has secured lithium essential for its electric vehicle production in North America from a project in California, as carmakers worldwide scramble to secure supply of the battery metal key to the electric vehicle revolution. Controlled Thermal Resources (CTR) will supply the owner of Jeep and Peugeot with up to 25,000 metric tons per year of lithium hydroxide over the ten-year term of the agreement, Stellantis said on Thursday. CTR, which operates in California's the Salton Sea, is also developing a geothermal lithium brine project to meet General Motors' lithium needs.

[Biden keeps funds flowing to build US electric vehicle supply chain](#)

The latest sum of support was tucked into the Ukraine aid bill that Biden signed into law late last month — another \$500 million to expand funds available under the Defense Production Act to obtain critical battery minerals like nickel, cobalt, lithium and graphite. The Ukraine bill also lifted the cap on the size of grants and expanded eligible projects to include the UK and Australia, as well as the US and Canada.

Select Articles

[Highly functional bio-based micro- and nano-structured materials for neodymium recovery](#)

As a proof-of-concept for the applications of these materials, we show that carboxylated cotton microproducts remove ~ 92.5 mg of neodymium ions per gram from a dilute Nd solution in less than 5 min and recover approximately 64 % of it via pH adjustment.

[Utilization of sludge-based alginate beads for the application of rare earth elements \(REEs\) recovery from wastewater: A waste to resource approach](#)

The results from this work showed that the prepared sludge-based alginate beads can be used for REEs recovery from diluted waste streams and the tested sludge treatment options were also found effective in converting the waste to resource i.e., sludge to adsorbent for REEs recovery.

[Applicability of new sustainable and efficient alginate-based composites for critical raw materials recovery: General composites fabrication optimization and adsorption performance evaluation](#)

This study demonstrates a viable approach to the increasing possibility of the critical materials recovery through biosorption. The environmentally friendly biosorbents were prepared modifying calcium alginate with biochar and clinoptilolite.

[Developing Materials for Rare-Earth–Element Chelation: Synthesis, Solution Thermodynamics, and Applications](#)

This dissertation reports recent progress in the design, synthesis, and application of polymers for the chelation of various REEs. In addition to synthesizing a series of metal-chelating polymers, we elucidated the thermodynamics of binding using isothermal titration calorimetry (ITC) to gain insight into the specific relationship between polymer structure and metal binding.

[Recent advances in the global rare-earth supply chain](#)

This issue of MRS Bulletin delves into the materials science aspects of the REE supply chain, including fundamental REE mineralogy, REE separation and extraction, REE mining economics, the environmental impacts of REE mining and processing, and circular economy potential for REEs. This issue of MRS Bulletin is meant to inform the materials science community of some of the constraints on REE production from the mining of ore deposits, through processing technologies, and then finally, the possibility of recycling.

Funding Opportunities

[DE-FOA-0002678: BIPARTISAN INFRASTRUCTURE LAW \(BIL\) BATTERY MATERIALS PROCESSING AND BATTERY MANUFACTURING](#)

Funding entity: DoE, Office of Manufacturing and Energy Supply Chains (MESCC) and Office of Energy Efficiency and Renewable Energy (EERE)

Areas of Interest: Just like the corresponding Notice of Intent, twelve areas of interest are listed in the FoA, of which numbers 4 and 5 are the ones we can consider. The rest of the item are related to commercial-scale development or expansion projects.

- AOI 4: Demonstrations of Domestic Separation and Production of Battery-grade Materials from Unconventional Domestic Sources: The objective of this

area of interest is to accelerate commercialization of battery-grade lithium-ion battery separation and extraction materials from unconventional domestic sources through **pre-commercial large-scale pilot demonstration** projects.

Requirements:

- Applications must describe the specific battery feedstock to be demonstrated. Coproduction of battery materials with other value-added materials to increase commercial viability of the demonstration project are also of interest.
- Applications that use domestic upstream suppliers are highly encouraged.
- Applications must include analysis that demonstrates the battery feedstock's impact on cost, energy, water usage, and emissions related to the production of battery separation and extraction materials relative to current practices
- Applications must identify the proposed scale, timeline, as well as upstream feedstock and downstream supply markets for their proposed battery precursor material.
- Applications that use unconventional deleterious materials and sources, such as mine tailings, coal ash, and drainage ponds, etc. must describe environmental management and impact.
- Applications must include an economic analysis of the process and battery separation and extraction materials being investigated and materials qualification plans.
- Applications must identify key technical barriers, such as impurities of concern in their proposed plan, and market barriers, such as how to source and produce enough material for qualification into the battery supply chain.

Teaming:

- Applicant teams are encouraged to include participation by universities and FFRDCs (Federally Funded Research and Development Centers) for studies supporting innovation and that drive down costs.
- Applicant teams are encouraged to include upstream suppliers and downstream customers.
- Participation by underrepresented partners and suppliers and labor unions is highly encouraged.
- Applicants are encouraged to include participation by MSI's, including Historically Black Colleges and Universities and Tribal Colleges and Universities.
- AOI 5: Demonstrations of Innovative Separation Processing of Battery Materials Open Topic: The objective of this area of interest is to accelerate commercialization of innovative processes for refining and extracting high concentrations of battery-grade lithium-ion material from diluted feedstock through **pre-commercial large-scale pilot demonstration** projects.

Requirements:

- Applications must identify and describe the process innovation and technical maturity being proposed.
- Applications must include analysis that demonstrates the proposed novel process potential to improve yield and decrease cost, energy, water usage, and emissions related to the production of precursor materials.
- Applications must identify the proposed scale, timeline, and economic projections, as well as upstream feedstock and downstream supply markets for their proposed battery precursor material.
- Applications must include a cost estimate of the material(s) produced and materials qualification plans.
- Applications must include an economic analysis of the process and feedstock being investigated, including the potential commercial value of resultant “non-battery material” byproducts.
- Applications must identify key technical barriers, such as impurities of concern in their proposed plan, and market barriers, such as how to source and produce enough material for qualification into the battery supply chain.
- Applications that use the domestic upstream supply chain are highly encouraged.

Teaming: Same as above

- Award size: \$50 million to \$100 million for demonstration projects
Anticipated number of awards: 1-2 for AOI 4 and 1-2 for AOI 5
- Cost sharing: **The cost share must be at least 50% of the total allowable costs for demonstration and for commercial projects.**
- Duration: Anticipated 24-60 months
- Deadline: Letter of Intent: 5/27/2022 5pm ET
Full Applications: 7/1/2022 5pm ET
- Notes:
- DoE [teaming partner list](#)
 - “Applications that include mining operations (mining and extraction) or mining equipment, excavation, labor, siting, etc. within the project scope” will be rejected.
 - The National Energy Technology Laboratory and the Idaho National Laboratory are ineligible to participate as a prime applicant or as a team member/sub-recipient.
 - An entity may submit more than one Full Application to this FOA.
 - Incorporated consortia are eligible to apply. Unincorporated Consortia must designate one member of the consortium to serve as the prime recipient/consortium representative.
 - An entity may submit more than one Concept Paper and Full Application.

[DE-FOA-0002680: BIPARTISAN INFRASTRUCTURE LAW \(BIL\) ELECTRIC DRIVE VEHICLE BATTERY RECYCLING AND SECOND LIFE APPLICATIONS](#)

- Funding entity: DoE, Office of Manufacturing and Energy Supply Chains (MESC) and Office of Energy Efficiency and Renewable Energy (EERE)

Topic areas:

- Topic Area 1: Advanced Materials Separation, Scale-Up, and Reintegration for Lithium-Ion Battery Recycling for the Battery Supply Chain: The objective of this topic area is to research, develop, and validate economically viable end-of-life advanced Lithium-Ion Battery recycling methods, processes and/or technologies that enable efficient recovery and requalification of valuable materials for return into the supply chain.

Technical approaches include (but are not limited to):

- Processes that use flexible feedstocks from end-of-life batteries, scrap materials from manufacturing, and ore derived feedstocks.
- Processes that substantially decrease energy, water, and greenhouse gas emissions over current recycling practices.
- Processes that increase lithium, cobalt and nickel recovery yield to above 90%.
- Innovative processes to separate anode, electrolyte, and other battery materials for additional processing.
- Direct recycling and upcycling approaches to cathode recycling.
- Intermediate, low capital cost processes to disassemble and render batteries inert for transportation that meet Department of Transportation and United Nations regulations.
- Other processes that increase economic viability and yield of recycling processes to help reach 90% recovery by weight of battery materials from recycling feedstocks.
- Modular designs to lower capital costs for installation and allow for flexibility of capacity to expand with demand.

Requirements

- Applications must include a plan to use the new process, technology, or technique to produce a representative sample of the recovered material for 3rd party national laboratory validation and characterization by the end of the project.
- Applications must describe where their current technology is in the development stages, and how their proposed project will enable market adoption at the end of the project.
- Applications must address potential environmental impacts associated with bringing process, technology, or technique to scale.

Teaming Arrangements

Applicant teams are encouraged to include battery producers for optimization of battery recycling techniques and approaches as well as battery materials manufacturers to ensure materials specifications and quantities are relevant to the front-end component of the supply chain. Letters of commitment and support are encouraged to demonstrate the level of participation by potential customers of the recycled feedstock. Applicants should include plans to partner with downstream battery materials producers to qualify their recycled feedstock as they scale up their approach.

- Topic Area 2: Second-Use Scale-Up Demonstration Projects: The objective of this topic area is to develop and demonstrate economically viable end-of-life

advanced Lithium-Ion Battery methods, processes and/or technologies that enable end-of-life batteries second use applications outside of the automotive industry such as stationary energy storage systems.

Requirements

- Same as above with the following addition:
- Applicants must describe the materials, energy, water, and greenhouse gas savings associated with the reuse of battery components.

Teaming Arrangements

Applicant teams are encouraged to include national laboratories and universities, Minority Serving Institutions, and utility partners capable of assistance with use case performance requirements and economic feasibility projections.

- Award size: Topic Area 1 (anticipated number of awards: 3-6): \$6 million to \$12 million each
Topic Area 2 (anticipated number of awards: 2-4): \$4 million to \$6 million each
- Cost sharing: Topic Area 1: The cost share must be at least 20% of the total allowable costs
Topic Area 2: The cost share must be at least 50% of the total allowable costs
- Duration: 36 months
- Deadline: Concept Papers: 5/31/2022 5pm ET
Full Applications: 7/19/2022 5pm ET
- Notes:
- DoE [teaming partner list](#)
 - FFRDCs are eligible to apply for funding as a subrecipient but are not eligible to apply as a prime recipient.
 - Incorporated consortia are eligible to apply. Unincorporated Consortia must designate one member of the consortium to serve as the prime recipient/consortium representative.