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MATERIALS MANUFACTURING INNOVATION CENTER
Argonne National Laboratory

ARGONNE'S MERF

Materials Engineering Research Facility for Accelerating U.S. CMM Competitiveness

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U.S. DEPARTMENT of ENERGY

Argonne National Laboratory is a U.S. Department of Energy laboratory managed by UChicago Argonne, LLC.

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ARGONNE'S CRITICAL MATERIALS CAPABILITIES

From discovery to validated process and material

Resource and Extraction

- Resource mapping and characterization
- Feedstock beneficiation and physical separations
- Crushing, milling, flotation, gravity and density separation
- Sensor-based sorting
- Mechanical and size-based separations

Separation and Refining

- Hydrometallurgy and pyrometallurgy
- Solvent extraction, ion exchange, membrane and electrochemical separations
- Bioprocessing
- Electrowinning and electrorefining
- Molten salt electrolysis
- Metals refining

Materials Development

- Novel materials synthesis and processing
- Reactors for material development
- Advanced characterization
- Flow sheet design and rapid prototyping
- Rare earths, metals, Li ion batteries
- Validation of new materials and processes

Production and Scale-Up

- Bench to pilot-scale testing
- Advanced scale-up manufacturing and process modeling
- Roll-to-roll processing
- Cell analysis, modeling and prototyping (CAMP)

Recycling and Circularity

- Direct recycling
- Multi-material recycling
- Mechanical, hydrometallurgical, and pyrometallurgical recovery pathways
- TEA, LCA, supply chain and economic analysis

Supported by: HPC-powered AI/ML, Digital Twins, Autonomous Labs, Analysis, Radioactive & Hazardous Material Handling, Secure Facilities, Characterization, Partnerships, Workforce

MATERIALS ENGINEERING RESEARCH FACILITY (MERF)

Technology center for scaling up new materials and processes

- Develop **cost-effective** processes for synthesizing and scaling materials
- Evaluate **emerging process technologies** for domestic CMM production
- Validate CMM **commercial process technologies** with industrial scale testbeds, including **METALLIC** and **ReCell**
- **Integrate AI/ML and digital twins** for predictive monitoring and optimization to support commercialization

Supports Centers 1-4

- 25% of new equipment on-line and available for use now
- Remaining equipment coming on-line FY27

Existing capabilities: beneficiation, bioprocessing, extraction, separations, refining, advanced manufacturing, and recycling

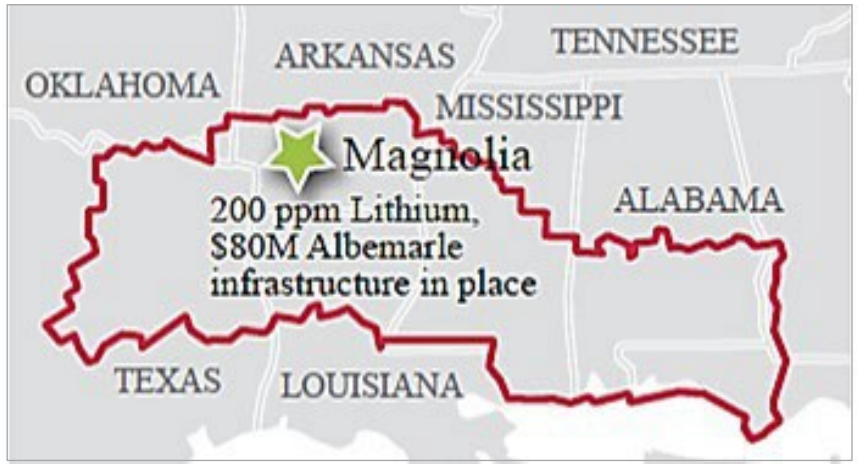
Argonne-led DOE Center advancing adoption of **CMM recycling technology**

Basic to applied research

Works closely with industry to **translate and scale technologies**

Hosts Industry Day events to convene stakeholders across relevant sectors (September 21-22)

PROJECT EXAMPLE: LITHIUM RECOVERY



Argonne's experimental lithium recovery systems

ALBEMARLE'S CHALLENGE

Cost-effectively recover lithium from the natural Smackover brine reservoir (outlined in red), at a planned facility in Magnolia, Arkansas, to increase domestic supplies of this critical material

ARGONNE'S SOLUTION: A WORK IN PROGRESS

Designed an electrodialysis process with advanced membranes to recover lithium with minimal impact from impurities

Continuing to validate product performance and process economics, including lower production costs and elimination of landfilled waste

15+ Years of Scaling Materials and Processes

Track record of supporting DOE priorities on CMM supply chains

- **Over 400 publications** and **100 patents**
- **10** R&D 100 awards
- Partnered with over **100 companies**
- **Over 3,300** visitors

24m, 3M, A123 Systems, ABTC American Battery Technology Company, ACT-ion, ADA Technologies, Inc., ADVANO, Albemarle, Aloterra, Ameridia, Applied Spectra A Laser Solutions Company, Arkema, BASF We create chemistry, Bren-Tronics, Inc., Blue Current, Boulderionics, Cabot, CAMX Power, Caporus Technologies, Cardinal Glass Industries, Catapult High Value Manufacturing, CEAR, Celadyne, Chemours, Ciba Solutions, Clarios, CoorsTek, Conovate, cyclopure, DellaTech, Donaldson Filtration Solutions, EastPenn International, electroninks, Enerdel, Energizer, Entek, Flexcon, FOM Technologies, Franklin Energy, Ge Solartech, GM, GOLeafe, Hanwha Momentum, Hazen, HighT-Tech, Hunt Energy Enterprises, IK4 Cidetec Research Alliance, ITN Energy Systems, Iris light technologies, Jinetics, Koura, Kraton, Laminar, Li Industries, Light & Charge Solutions, Mitsubishi Chemical America, Nano Research, Navitas Systems, Novacentrix, Numix Materials, Orbis Braid, PPG, Princeton NuEnergy, Qorvo, QuantumScape, SafeLi, saft a company of Total, Sigma-Aldrich, Sion, SiNode Systems, Sharp, solid energy, Solvay, Solar Window Technologies, Inc., SQM, Strem Chemicals, Inc., SVX, Talon, TIAX, Toyota, volexion, Wildcat Discovery Technologies, WMG Innovative Solutions

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