METALLIC

THE REFINERY

The Refinery establishes domestic processing pathways and expertise for the refining of critical materials, which are essential to U.S. economic and national security.

WHY IS REFINING CRITICAL MATERIALS IMPORTANT?

- Refining is the production of purified metals and materials to a form that they can be used to create an alloy or product.
- A steady supply of domestic critical materials (e.g., rare earth elements, graphite, battery materials, and others) reduces dependence on overseas refining, decreasing supply risks and enabling onshore end-use product manufacturing.
- Validated materials must be produced at sufficient scales for integration into end-use products prior to adoption.



The Refinery provides advanced processing technologies needed to accelerate technology development and scaling.

WHAT ROLE AND SERVICES DOES THE METALLIC REFINERY PROVIDE?

The METALLIC Refinery is focused on refining critical materials produced from new feedstocks to support high-purity material supply chains. Activities are grouped in four categories:

Pyrometallurgical
Provide a bridge from lab-scale demonstrations to commercial adoption via advanced thermal processing

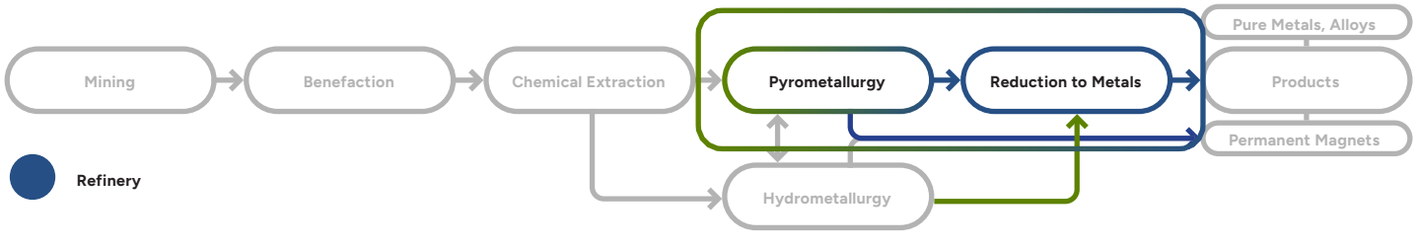
Electrochemical
De-risk expensive pilot/commercial-scale process development by providing mid-scale processing via techniques such as advanced molten salt electrolysis to accelerate process development

Advanced Reduction Technologies
Validate emerging reduction technologies (e.g., microwaves and lasers) to facilitate commercial adoption and fuel future advances

Metals Purification
Move beyond low-throughput, high-cost approaches for high-purity material refining to pave the way for future supply chains

A NATIONAL RESOURCE FOR REFINING

- Working with stakeholders to validate new materials and technologies
- De-risking commercial adoption of new processing pathways and feedstock
- Workforce training and development to rebuild and retain domestic expertise
- Rapid demonstration of mid-scale refining of critical materials



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PYROMETALLURGICAL

Capabilities
Plasma cold hearth, electron beam, cold wall induction and strip casting, vacuum arc/electro-slag remelting, carbonization and graphitization furnaces

Processing Scale
1–20 kilograms (kg)

Outcomes
Mid-scale refining of rare earth metal making and magnet alloy synthesis, graphite manufacturing, and refractory metals

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ELECTROCHEMICAL

Capabilities
Molten salt electrolysis – 150 Ampere (A) and 3000 A refining cells

Processing Scale
Currently 1 kg/day to be upgraded to 100 kg/day by 2029

Outcomes
Commercially relevant scales for reduction technologies for rare earth metal, graphite, and battery materials

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ADVANCED REDUCTION TECHNOLOGIES

Capabilities
Microwave furnaces, laser isotope separation (tunable combo laser & custom spectrometer)

Processing Scale
Continuous processing >5 kg/hour, fine grounds to large ores (~10 centimeters in diameter)

Outcomes
De-risking commercial adoption of new and emerging lab- and pilot-scale technologies

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METALS PURIFICATION

Capabilities
Distillation, zone refining, laser-based processing

Processing Scale
0.1–10 kg

Outcomes
Mid-scale capabilities to produce ultra-high purity critical materials, essential to key energy technologies

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