Critical Materials Institute

AN ENERGY INNOVATION HUB

What is the problem?

Actual or threatened shortages of essential raw materials create risks for U.S. manufacturing and energy security. Developing industries, like the clean energy sector, are particularly vulnerable.

Critical materials (*a*) provide essential and specialized properties to advanced products or systems, (*b*) have no easy substitutes, and (*c*) are subject to supply risk.

Rare earth elements emerged as critical materials in 2010, with their essential roles in high-efficiency motors, generators and advanced lighting, lack of supply diversity, and growing demand. Rare earth metals and alloys are not produced in the United States despite the availability of geologic resources, because the processes required to separate individual rare earths from one another and then convert them to metals and alloys are inefficient, costly, polluting, and potentially damaging to worker health and safety.

Other critical materials have emerged in recent years. Beginning in July 2019, CMI will focus on rare earth materials, battery materials (lithium, cobalt, manganese, graphite), indium, and gallium.

In every case, the solution is innovation throughout the supply chain.

What is CMI's mission?

To assure supply chains of materials critical to clean energy technologies – enabling innovation in U.S. manufacturing and enhancing U.S. energy security.

How will CMI help supply chains of critical materials?

By *developing*, *demonstrating*, and *deploying* technology (*a*) to diversify and expand the availability of these materials throughout their supply chains, (*b*) to reduce wastes by increasing the efficiency of manufacturing and recycling, and (*c*) to reduce demand by identifying substitutes for critical materials. In all three areas, the needs of U.S. manufacturing drive CMI's research agenda. From the outset, every project targets one or more key challenges in U.S. supply chains. Projects targeting industrial uptake have a partner and commercialization plan.

What has CMI accomplished so far?

In six years of work, CMI has published more than 285 refereed publications in leading scientific journals. Cumulatively, CMI has issued 120 invention disclosures, eight technologies have been licensed, and three open-source software packages are available. CMI has received 10 U.S. patents, five Federal Laboratory Consortium awards and four R&D 100 Awards. Some CMI inventions are already in commercial use.

What will CMI do next?

The Institute's industrial collaborators are working to incorporate its accomplishments in their products and processes, across all three of the areas described above – source diversification, materials substitution, and improved stewardship of existing resources.

In its second five years, CMI is applying the valuable lessons learned so far to address a wider range of materials and technologies. It will:

- Engage a wider range of industrial partners.
- Address emerging critical materials through world-leading early-stage applied research.
- Provide the leaders, technical experts and skilled professionals needed by U.S. industry to assure its supply chains.
- Become a self-sustaining entity by the end of its tenth year of federal support.

Who are the partners in CMI?

Led by the Ames Laboratory, in Iowa, CMI consists of 290 scientists, engineers and support staff at four national laboratories of the U.S. Department of Energy, six universities, and 13 industrial partners. The leadership team comes from six of these institutions, and they manage CMI's geographically dispersed labs as if they were a single organization.

To learn more about CMI, go to: https://cmi.ameslab.gov