CASE STUDIES

Automated Sortation of High-Value Metallic Scrap (Fine Particles)
Every year, millions of tons of nonferrous metals are discarded and not reused. Recent developments in spectroscopic technology have opened the door for high-speed automated metal sortation and recovery, especially for high-value precious metals. At CR³ we've developed a viable method to feed scrap particles of high-value materials onto a conveyer belt with improved sensing and ejection that reduces waste and reuses non-renewable material resources.

Novel Recycling Process Development for Li-ion Batteries
The rechargeable lithium-ion (Li-ion) battery market is currently a $12 billion industry and still growing. Yet these batteries are not widely recycled due to unfavorable economics, a lack of government regulation, and complex battery chemistries. At CR³ we've developed a process that recycles the cathode powder, the most valuable part of the Li-ion battery. This work is reducing landfills, and helping industry to be more competitive, while preserving our natural resources.

Recovery of Vanadium Oxide from Oil Fly Ash
This study focused on the characterization of a power plant fly ash and the recovery of vanadium oxide. Oil fly contains about 85% of unburned carbon and 2.2% of vanadium by weight. Carbon removal, salt-roasting, and water leaching were applied at different temperatures and concentrations. During the salt-roasting process, sodium carbonate is used as a sodium salt to convert vanadium oxides to water-soluble sodium metavanadate (NaVO3). The salt-roasted sample is leached with water at the elevated temperature, and the percentage of vanadium extraction is about 92% with 98% purity. The economic analysis shows that the cost of indium oxide production is under 70% of the market price.

Hydrometallurgical Process to Recover Magnetite from Red Mud
Red mud is a complex mineralogical mixture of primarily iron, aluminum, and titanium oxides in addition to some high-value rare-earth elements. Over 3 billion tons of red mud have been accumulated and stored in red mud ponds. The developed proprietary process can use red mud slurries directly from the Bayer circuit. First, the slurries enter a hydrometallurgical leaching process to selectively extract iron, aluminum, and titanium. Then, a solid-liquid precipitation mechanism is used to selectively precipitate iron. Finally, the precipitated residue is converted into magnetite nanoparticles. Magnetite nanoparticles are extensively used in magnetically assisted drug delivery agents, pigments, fertilizers, and magnetic drives. The process offers a way to extract aluminum, titanium, and rare-earth.

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CR³ is an NSF Industry/University Cooperative Research Center

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CR³ DELIVERS RESULTS

The Center for Resource Recovery and Recycling (CR³) is the premier cooperative research center dedicated to a sustainable future.At CR³ you and your organization will advance technologies that recover, recycle, and reuse materials throughout the manufacturing process. These advancements help industry reduce energy costs and increase profitability while protecting our natural resources.

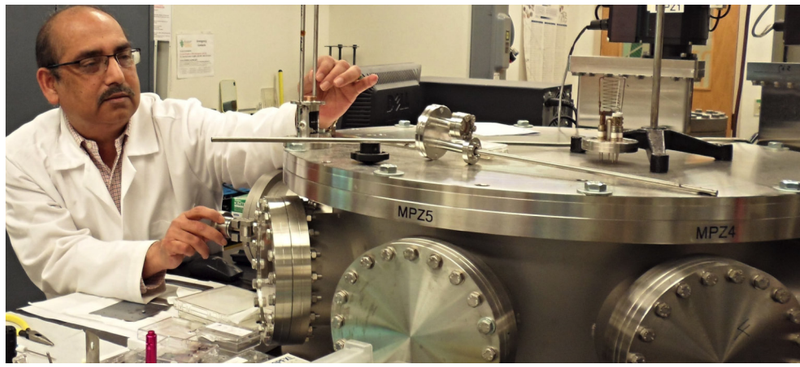
Members benefit from ...

- leading-edge research in automated sortation, battery recycling, fine metal recovery, alloy recycling, and resource efficiency.
- networking globally with the best minds in the industry.
- technical expertise and troubleshooting.
- a membership fee that is used for research expenses; there is no institutional overhead.

THE BENEFITS OF MEMBERSHIP

AS A MEMBER OF CR³, YOUR COMPANY ...

- submits and votes annually on research projects.
- networks with global industry leaders.
- has royalty-free IP rights to pre -competitive research.
- may opt to sponsor company-proprietary research that remains exclusive.
- has access to findings from large -scale projects funded by the U.S. government or foundation grants.
- can recruit top students from various engineering disciplines.
- has access to all (past and current) CR³ technical reports and process data.
- has access to characterization facilities at all member institutions.
- can consult with CR³ faculty to get timely solutions to factory floor problems without additional cost.
- can sponsor student projects (senior theses) and industrial internships.
- can work with sister centers and institutes at WPI, CSM, KU Leuven, and U of Tokyo, broadening your understanding in related fields from leading experts.



What Members Say

"Gopher Resource is proud to collaborate with world-class universities and industry leaders focused on recycling and sustainability. Membership in CR³ provides Gopher Resource with tailored research projects, technical expertise and industry knowledge sharing that complements our internal research and development practice."

—Joseph Grogan, Gopher Resource

"The Center offers opportunities to work collaboratively with a diverse group of people from industry and academia to improve and innovate processes, materials, and/or devices to address industrial or societal needs. Those needs are developed into projects mainly related to conserving resources through reduction, reuse, and recycling of by-products from manufacturing and society. Members can benefit both directly and indirectly from R&D they help guide to satisfy their own or societal needs in economically favorable and more sustainable ways. Along the way, members network and grow their own knowledge while getting to know talented graduate students and postdocs that might make great additions to their staffs."

—Mark Bauer, General Motors Company