

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 conveyor 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. Inductively-coupled plasma atomic emission spectroscopy (ICP-AES), X-ray fluorescence (XRF), thermogravimetric and differential thermal analysis (TG-DTA), were used for the initial characterization. Oil fly ash contains about 85% of unburned carbon and 2.2% of vanadium by weight. For the vanadium recovery processes, several steps including the 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.

Learn more about our research projects at wpi.edu/+cr3.

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CENTER FOR RESOURCE RECOVERY & RECYCLING

CR³ is an NSF Industry/University
Cooperative Research Center



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.

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.
- membership fee is ONLY used for research expenses. There is no institutional overhead.
- 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 thesis) 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

“Being a member of CR³ has proven to leverage pre-competitive research in such a way that companies can use it in their own competitive field. This unique collaboration, combined with its industrially driven research portfolio, stimulates innovation throughout institutions.”

—**Marleen Esprit, Umicore**

“The benefits of membership are significant. We network with existing and potentially new customers and suppliers in the field of metals recovery and recycling. The partner universities provide valuable insight into current research activities, which gives us a broader, technical understanding. We meet young, high potentials for future job opportunities and we can suggest research projects that benefit our organization.”

—**Uwe Habich, Steinert**

“CR³ research projects create cross-fertilization between different metal recycling industries as well as research approaches. This is important to our organization, because we benefit greatly by looking beyond our core activities of aluminum production and application. We also benefit from the academic know-how build-up for bilateral projects and the availability to recruit future talent.”

—**Georg Rombach, Hydro Aluminium Rolled Products**

“CR³ breaks down the wall between academia and industry, offering Tianqi and other members new possibilities to explore in the field of recovery and recycling.”

—**Naizhen Cao, Tianqi Lithium Corporation**