

TOKORO LAB.

Resource Circulation, Separation-Concentration Powder Processing



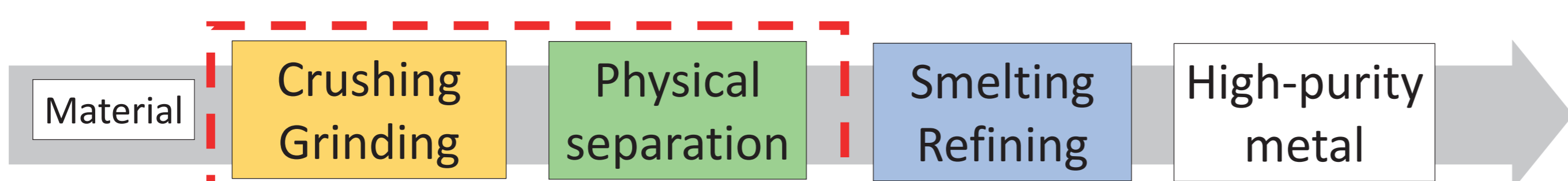
Endowed Research Unit for Non-ferrous Metal Resource Recovery Engineering
(JX Metals Endowed Unit)

Environmental Resource Processing Engineering

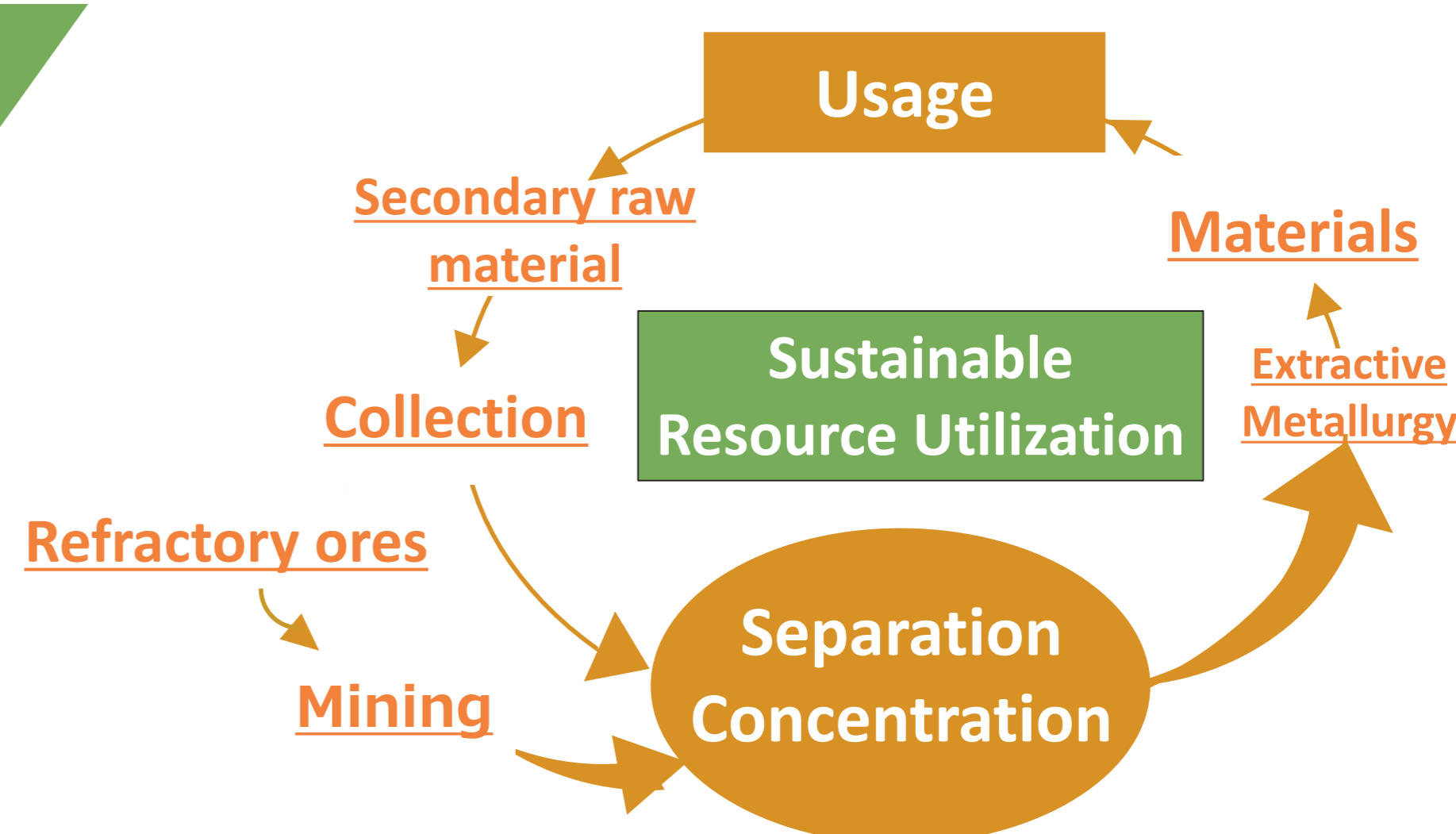
<http://www.tokoro.env.waseda.ac.jp/>

Technologies for Resource Circulation / Environmental Restoration

Valorization of the urban mine resources and refractory ores by advanced technologies for solid separation and concentration.

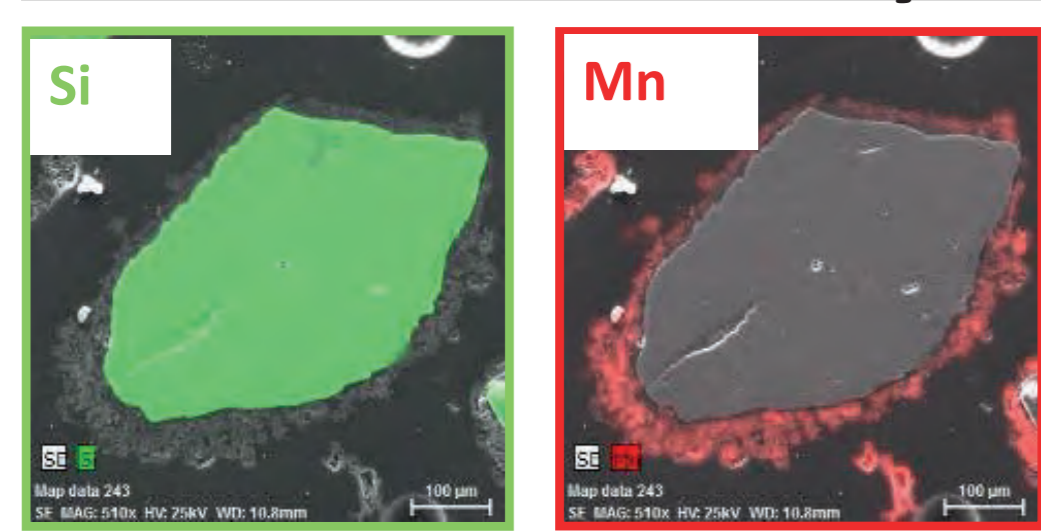


Technologies for separating and concentrating solids to determine overall process efficiency

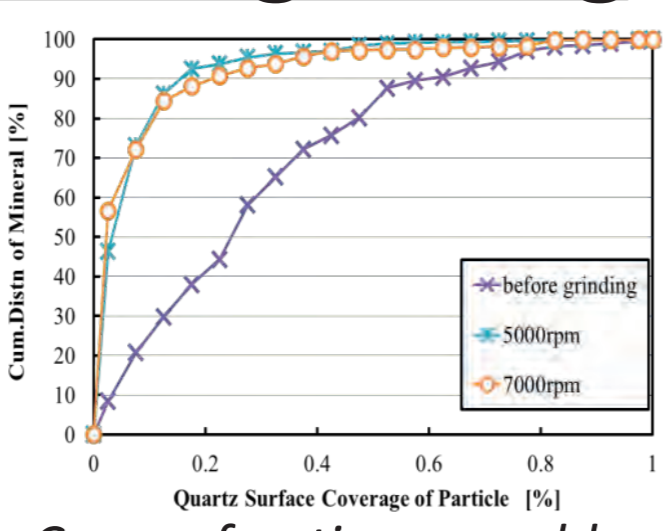


Special Grinding Technologies for Separation of Solids

Soil Remediation by surface grinding



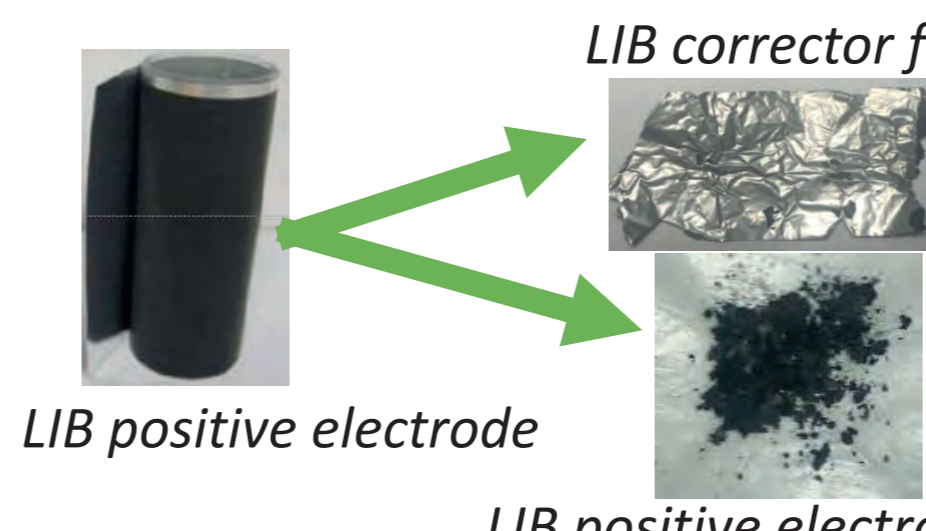
Filtration sand before surface grinding



Course fraction reusable as purified soil

- Increase of SiO₂ exposure by removal of surface Mn
- Concentration of Mn into a fine particle fraction

High-selective separation by novel electric pulsed charge

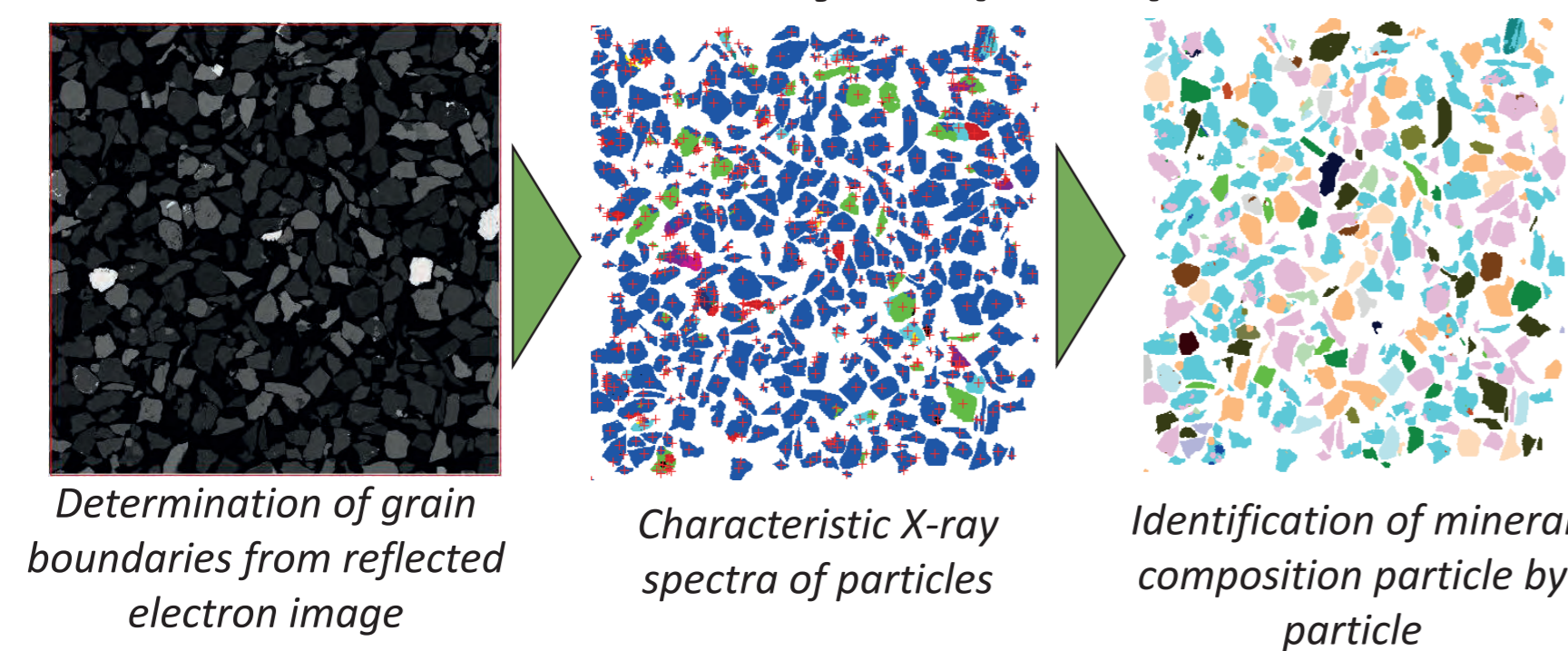


LIB positive electrode particles

- Selective separation and peeling at interface by control of voltage, current, resistance and discharge path in electric pulsed charge
- Creating a new recycling loop

Solid analysis to investigate the mineral separation

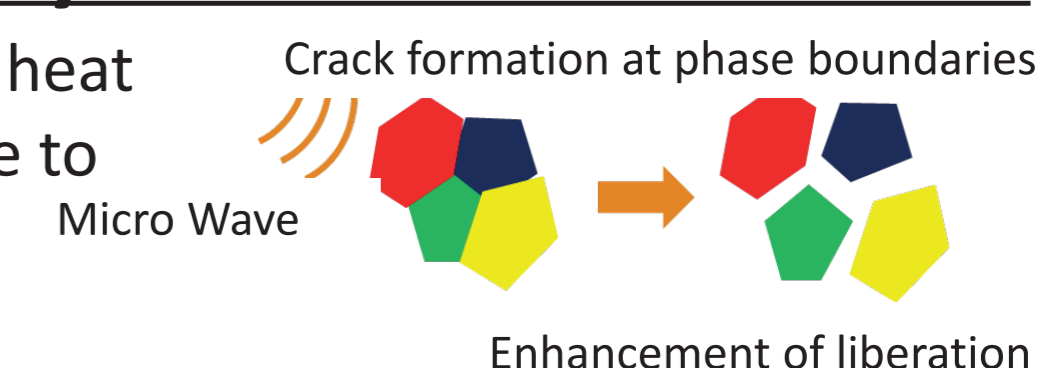
Mineral Liberation Analyzer (MLA)



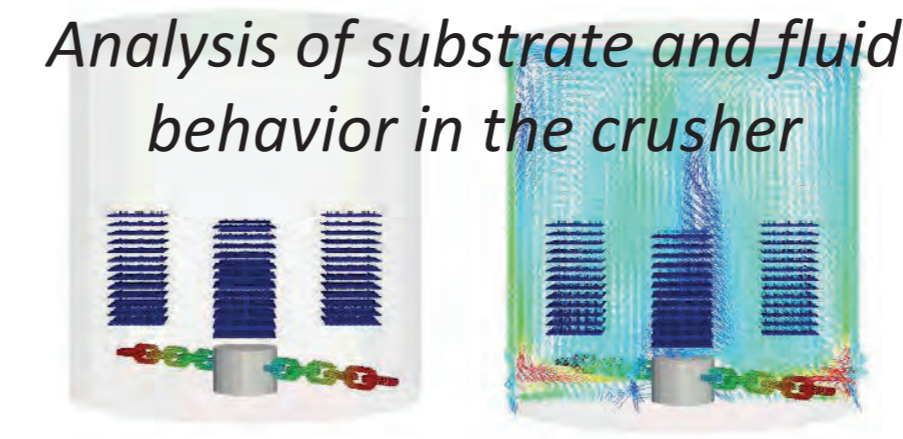
- Identification of the mineral phases
- Quantification of liberation degree and weight ratio of each mineral

Control of minerals separation by microwave irradiation

- Selective liberation of mineral phases by heat
- a. crack formation at phase boundaries due to different thermal expansion
- b. selective change of surface properties



Optimization of grinding operations by simulations

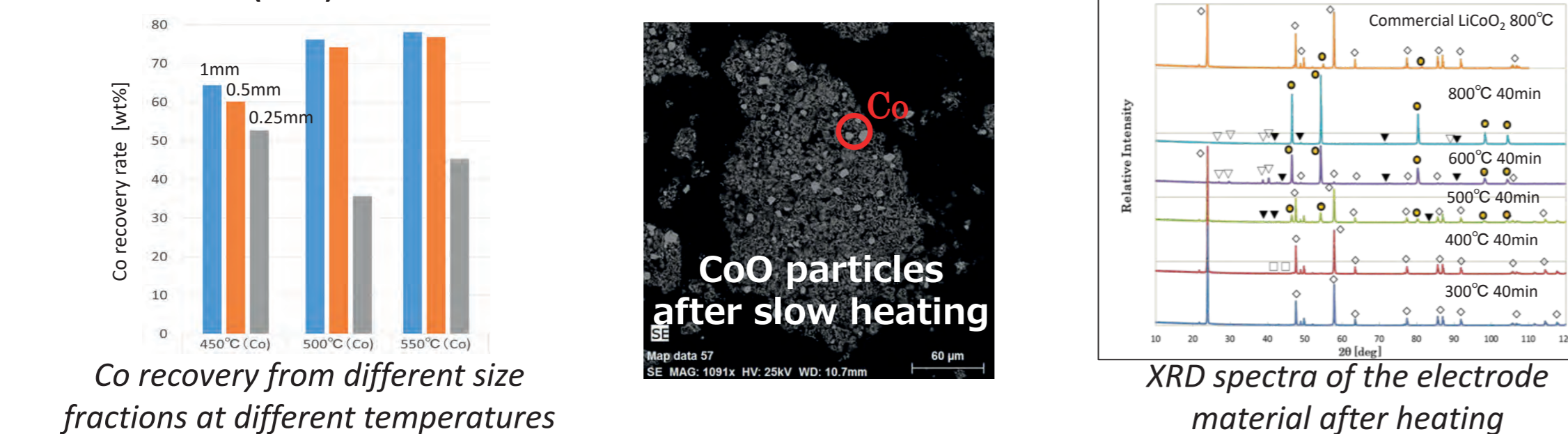


- Estimation of grinding performances by analysis of collisions between stirrer and substrate
- Possible elucidation of stirring and granulation mechanisms

Pretreatment Operations for Improving the Solid Separation

Recovery of Co from Li-Ion batteries by slow heating

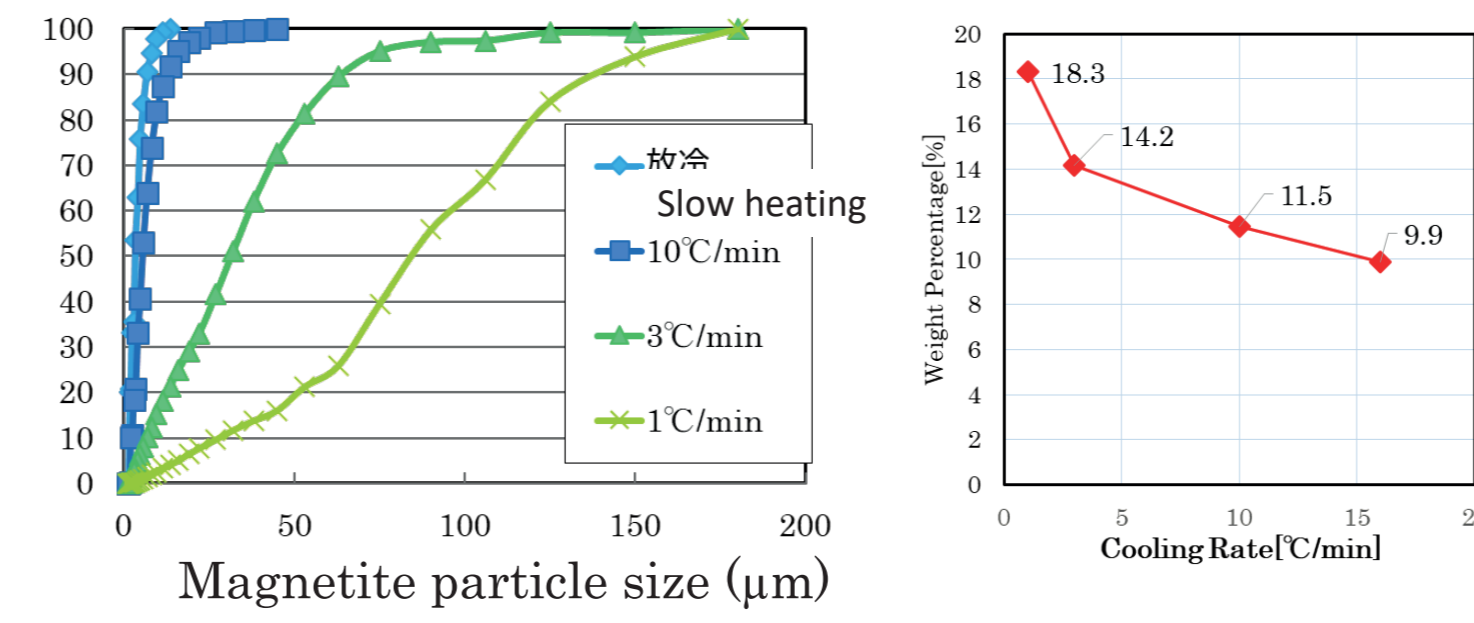
- Process analysis to improve the recovery of valuable metals from Li-ion batteries (LIB)



Co recovery from different size fractions at different temperatures

Recovery of magnetite by slow-cooling crystallization

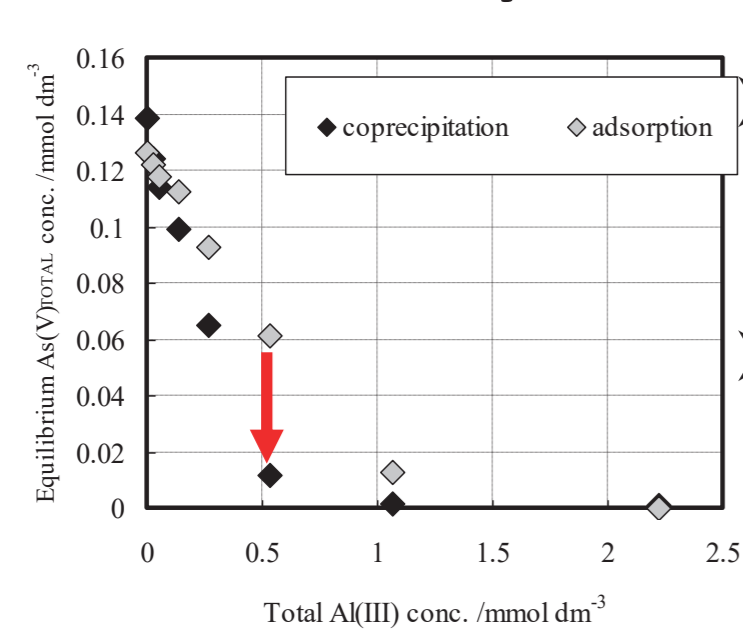
- Study of the separation of magnetite from an amorphous phase slag via smooth-cooling crystallization and magnetic separation



- Magnetite particle size and precipitation rate increased by decreasing the cooling rate

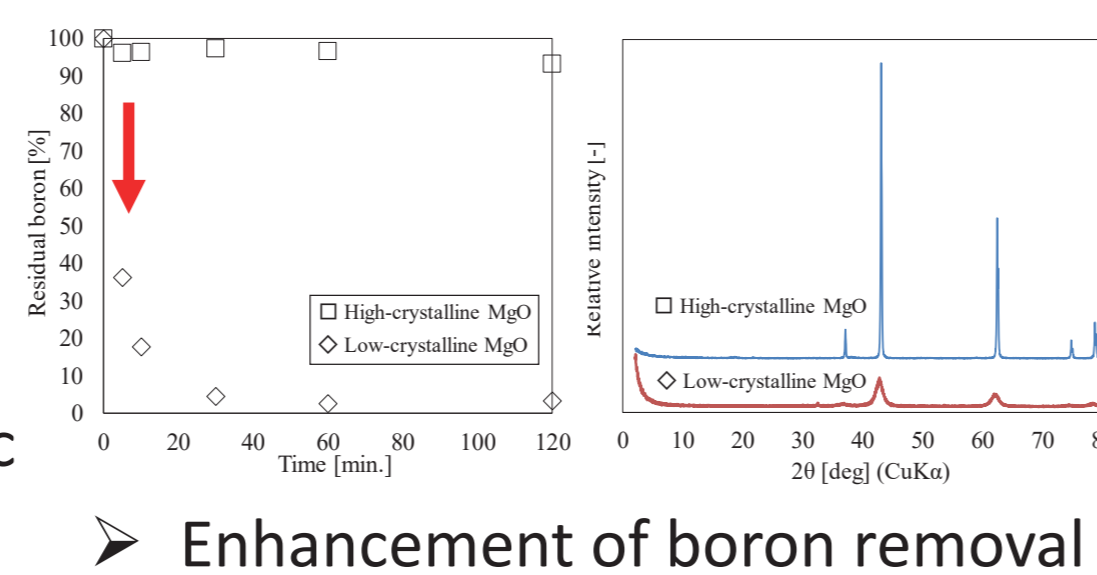
Advanced Technologies for Environment Remediation

As removal by surface precipitation



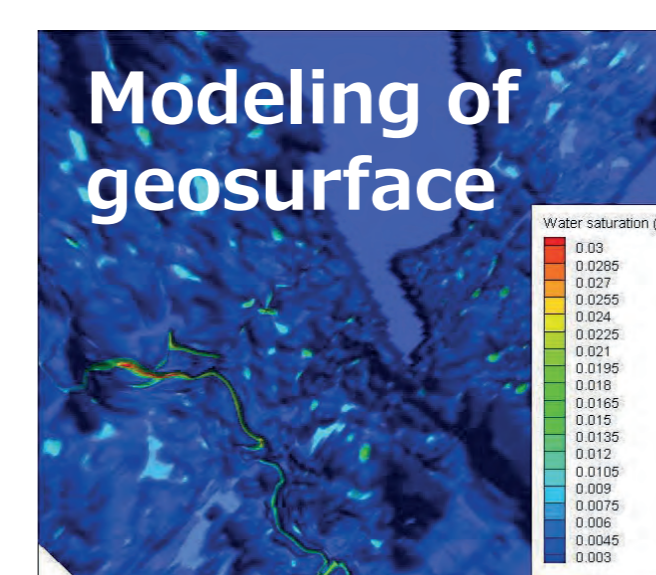
- Study and optimization of surface precipitation
- Removal and recovery of inorganic elements in high efficiency

Removal enhancement by amorphization



- Calcination of MgCO₃ to MgO and quenching to suppress crystallization
- Enhancement of boron removal

Process optimization by combination of geochemical modeling and fluid analysis



- Creation of ground model from terrain data and reproduction of the dynamic shape water bodies
- Prediction of concentration profiles by considering chemical equilibria

