Research highlights in Aalto University: Mineral Processing and Recycling

Prof. Rodrigo Serna

Organization: Aalto University

BATCircle Final Seminar, March 2021

Aalto University Groups

Mineral Processing and Recycling	Pyrometallurgy	Hydrometallurgy and Corrosion	Metallurgical Thermodynamics and Modelling	Electrochemical Energy Conversion	Department of Industrial Engineering and Management
Prof. Rodrigo Serna	Prof. Ari Jokilaakso	Prof. Mari Lundström	Prof. Daniel Lindberg	Prof. Tanja Kallio	Prof. Risto Rajala

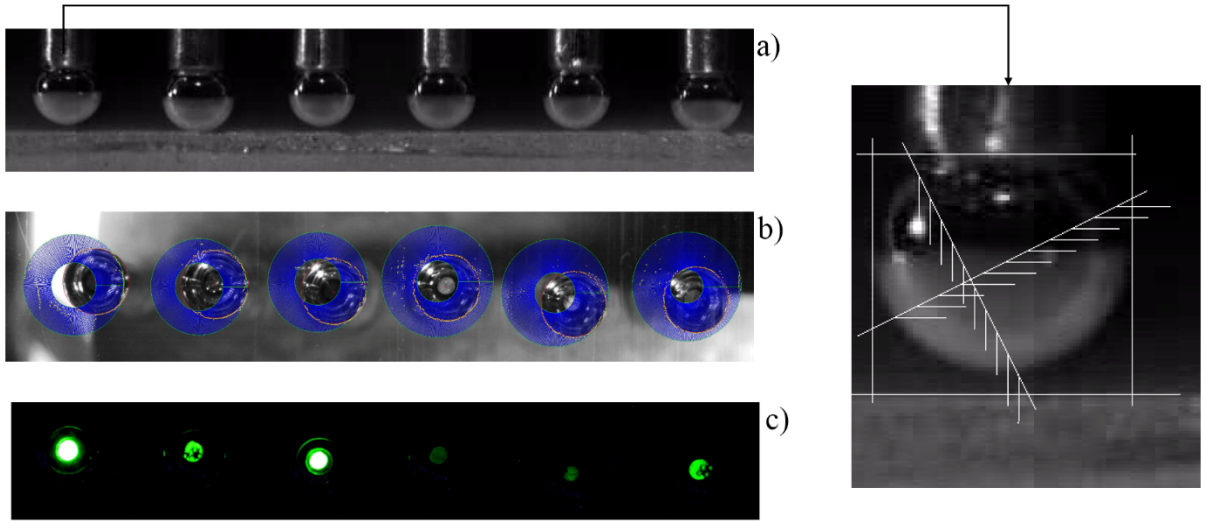
LIB-Lab: a dedicated space for high-quality research

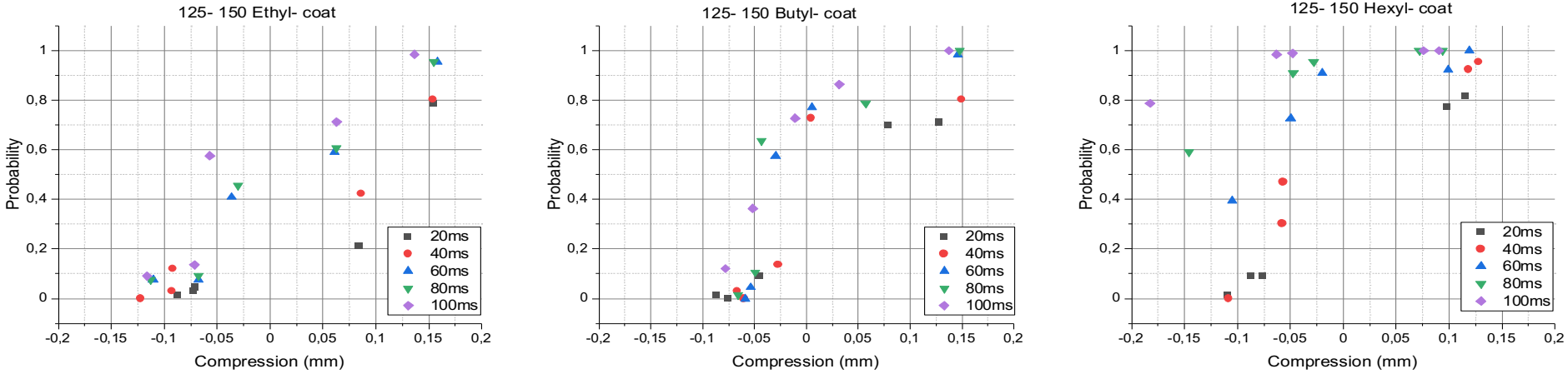
- The lab provides separate space for operations without contaminating surroundings, for safe operations during mechanical processing and hydrometallurgical experiments
- Specific procedures implemented for LIB handling
  - Dedicated isolated and filtered ventilation for the laboratory

Nissi, J. 2019, “Development of safety protocols in Aalto university LIB recycling laboratory”, M.Sc. Thesis, Aalto University.

Progress towards a new characterization method for battery minerals flotation

- Testing of attachment time, probability and distance as a quantitative indication of hydrophobicity of microparticles

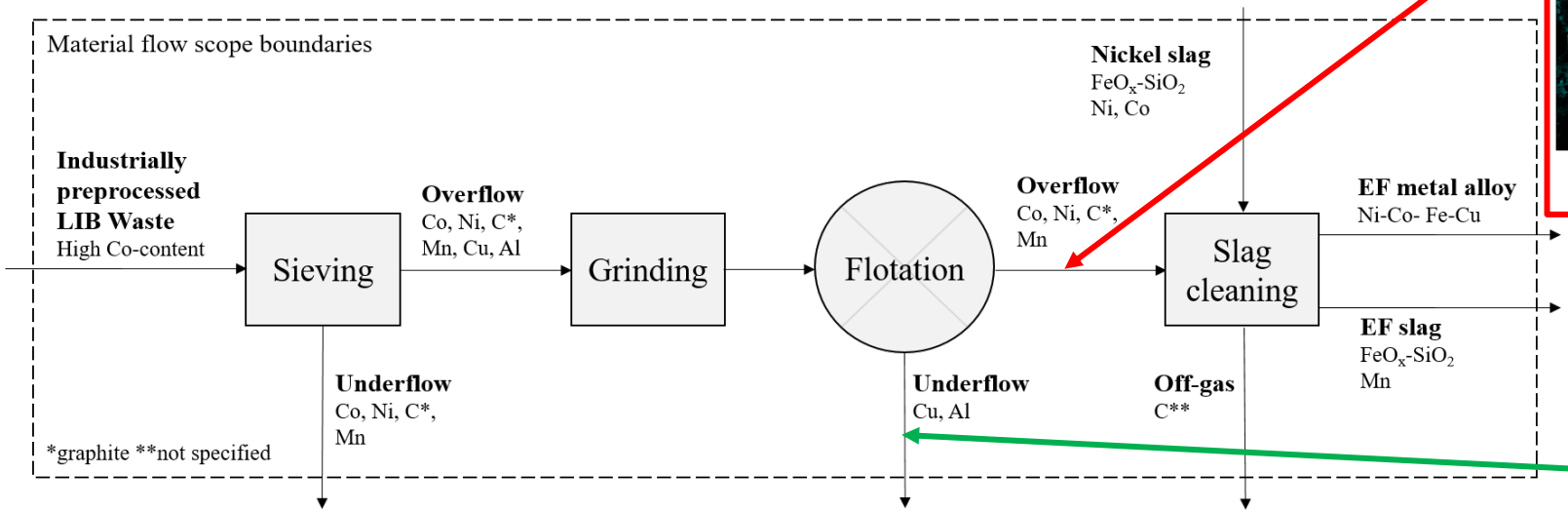


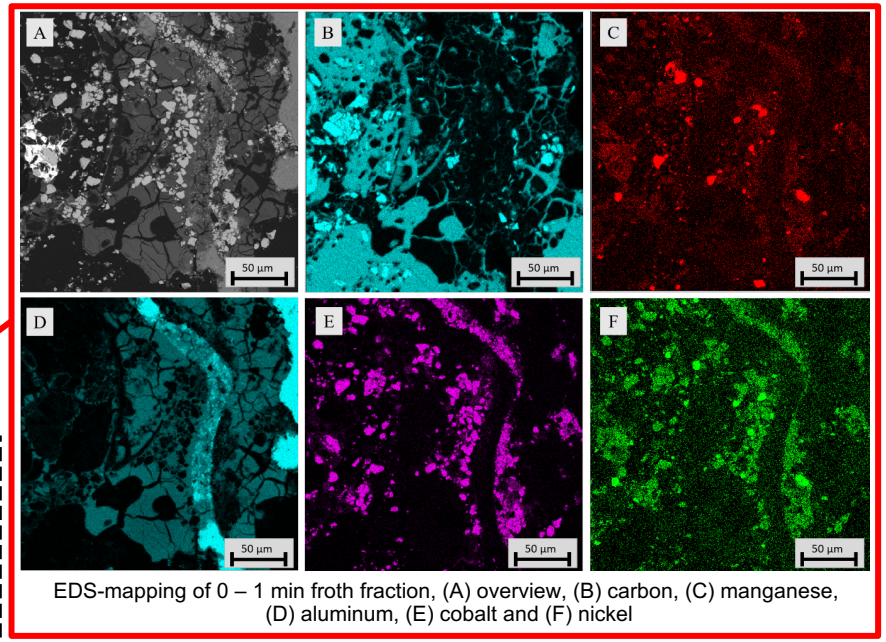


Mkurazhizha H., Hartmann R., Serna-Guerrero R. (2021) In Preparation

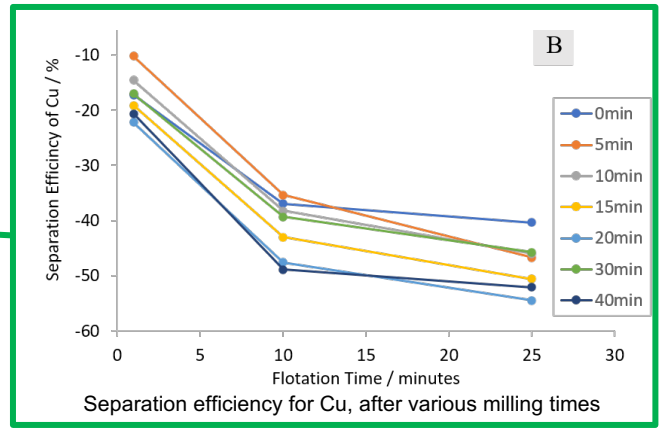
Froth flotation for the recovery of valuable components from EoL-LIBs

- Recovery of Cu and Al from back mass
- Integration with pyrometallurgical processes for Ni and Cu slag cleaning





EDS-mapping of 0 – 1 min froth fraction, (A) overview, (B) carbon, (C) manganese, (D) aluminum, (E) cobalt and (F) nickel



Separation efficiency for Cu, after various milling times

Ruismäki, R., Rinne, T., Dańczak, A., Taskinen, P., Serna Guerrero, R. & Jokilaakso, Metals 2020, 10(5), 680

Thesis and publications

- Nissi, J. 2019, “Development of safety protocols in Aalto university LIB recycling laboratory”, M.Sc. Thesis, Aalto University. Available at: (https://aaltodoc.aalto.fi/handle/123456789/41634)
- Ruismäki, R., Rinne, T., Dańczak, A., Taskinen, P., Serna Guerrero, R. & Jokilaakso, A. 2020 Integrating Flotation and Pyrometallurgy for Recovering Graphite and Valuable Metals from Battery Scrap. Metals 2020, 10(5), 680; https://doi.org/10.3390/met10050680
- Mkurazhizha H., Hartmann R., Serna-Guerrero R., Qualitative analysis to determine the wettability of microparticles towards predictive flotation modelling: An Automated Contact Timer Apparatus (ACTA) approach (to be submitted 4/2021)
- Mkurazhizha H., Hartmann R., Serna-Guerrero R., 2021,”Automated Contact Timer Apparatus (ACTA) as a predictive flotation device: A pyrrhotite study” (to be submitted 5/2021)
- Rinne, T., Ruismäki, R., Dańczak, A., Serna Guerrero, R. & Jokilaakso, A. 2021, “Integrating Flotation and Pyrometallurgy for Recovering Graphite and Valuable Metals from Battery Scrap part II: Optimization of Ni Slag Cleaning Process Parameters” (to be submitted 4/2021)
- Rinne, T., Ruismäki, R., Dańczak, A., Serna Guerrero, R. & Jokilaakso, A. 2021, ”Applying a Cu/Al-rich Material Stream Recovered by Waste LIB Flotation in a Pyrometallurgical Cu Slag Cleaning Process” (to be submitted 5/2021)

Thank you !