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

**Technologies for Resource Circulation / Environmental Restoration**

- **Crushing**, Grinding, Physical separation, Smelting, Refining, High-purity metal

**Special Grinding Technologies for Separation of Solids**

**Soil Remediation by surface grinding**
- Increase of SiO₂ exposure by removal of surface Mn
- Concentration of Mn into a fine particle fraction

**Solid analysis to investigate the mineral separation**

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

**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

**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

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

**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

**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

**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