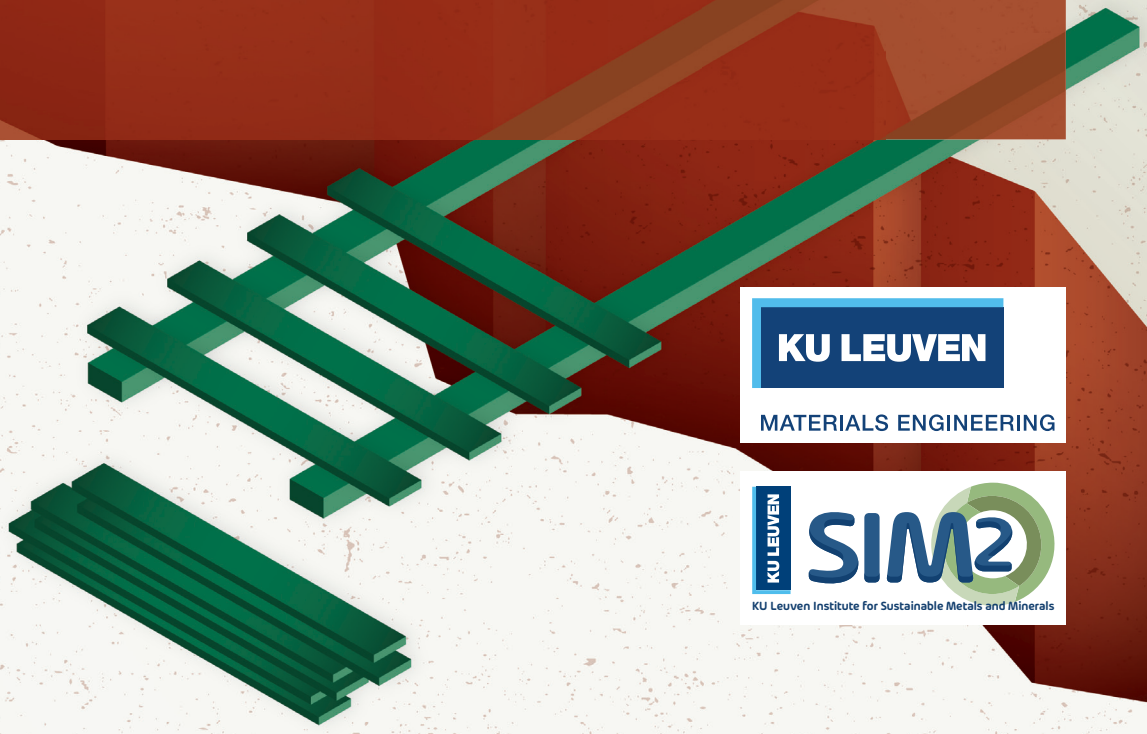
8TH INTERNATIONAL

SLAG VALORISATION SYMPOSIUM

TACKLING FUTURE CRITICAL CHALLENGES

18-20 April 2023 Mechelen, Belgium

PROCEEDINGS



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ENICON MATRIX VALORISATION: TOWARDS NEAR-ZERO WASTE IN EUROPE'S Ni/Co SUPPLY CHAIN

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Introduction

The desired transition to a climate neutral society drives humanity away from fossil fuels and puts pressure on electrification and the associated raw materials value chain. This is not only restricted to the metals required to generate green electricity; the demand for battery metals Li, Ni, and Co is expected to increase dramatically.[1] To avoid dependency on import and to grasp control on the socio-ecological situation of the sourcing of the raw materials, the EU is in on a quest for domestic extraction. The HEU ENICON project answers to this call of the EU by targeting specifically the Ni and Co supply chain.[2]

The current Ni and Co supply chain (Figure 1) relies substantially on import of ores and refined products, while domestic EU sources originate from from Co/Ni-containing sulfide ores (Nordic region) and Ni-containing laterite ores (South-East Europe). The ENICON project enhances the sustainability and domestic EU capacity by (1) tracking the losses in the supply chain using forensic geometallurgy, (2) developing a new HCl leaching process to extract Ni and Co, (3) carrying out ultra-refining towards battery grade Ni/Co, and (4) providing solutions for the residues in the current and HCl leaching based flow sheet.

The core of the project enumerated in previous sentence is also reflected in the WP structure (Figure 2), where also the regular soft WPs are shown. This paper describes the Mineral matrix valorisation (WP4) in more detail.

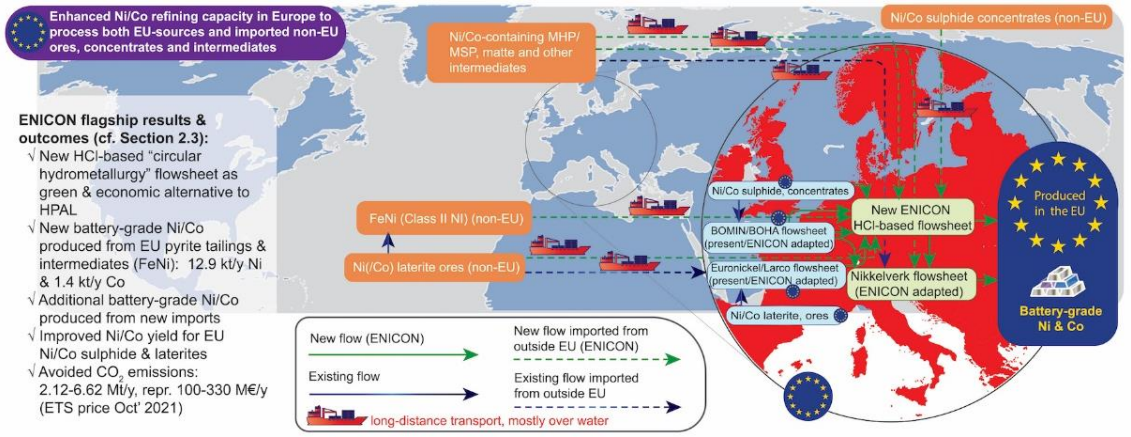

Figure 1: ENICON abstract, current and potentially new streams in the Co/Ni supply chain (high resolution version can be visited at[2])

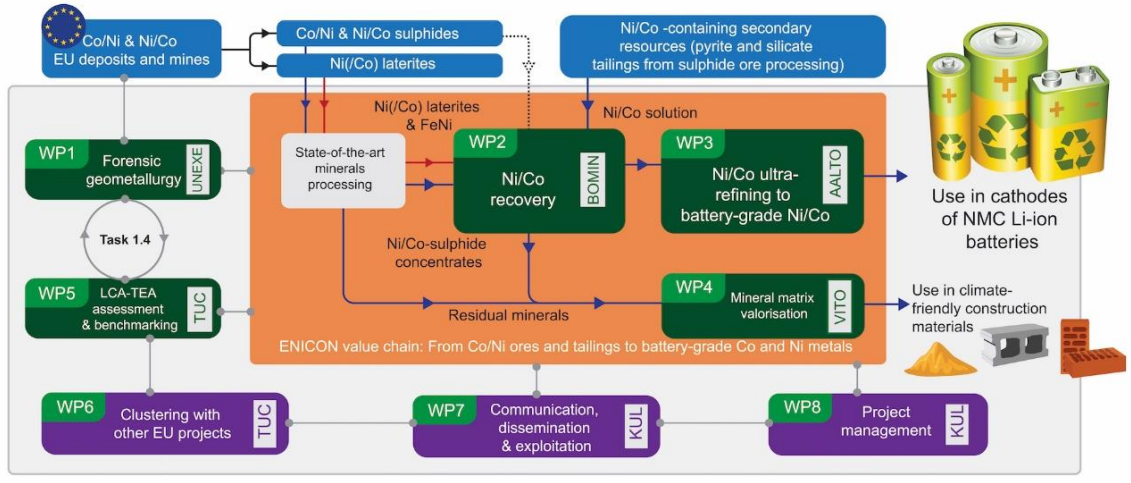

Figure 2: Work package structure of the ENICON project (high resolution version can be visited at[2])

Matrix valorisation

The matrix valorisation in ENICON provides a toolbox of solutions to utilise a range of residues coming from the Co/Ni flowsheet. Tailings, slags, and HCl-leach residues are studied in mineral carbonation, alkali-activation, and co-calcination processes (Figure 3). The silicate tailings originate from a mine where Cu and Ni ores are extracted. In the flotation process used for the extraction of the Cu-rich and Ni-rich concentrates, the tailings are generated. A separation of sulfide minerals is also carried out, resulting in (relatively) low-sulfide tailings, i.e. silicate tailings. These tailings are studied in mineral carbonation processes for carbon storage, due to the abundance of Mg-silicate minerals in their phase composition.

The HCl-leach residues are generated in the novel ENICON flowsheet. The HCl-leaching process is the key technology developed in ENICON to extract Ni and Co from sulfide and laterite ores and intermediate. The solid residue after leaching will be investigated for its applicability in mineral carbonation, alkali-activation and co-calcination. After an initial screening based on the composition of the leach residues, a larger batch of selected samples is evaluated for performance criteria.

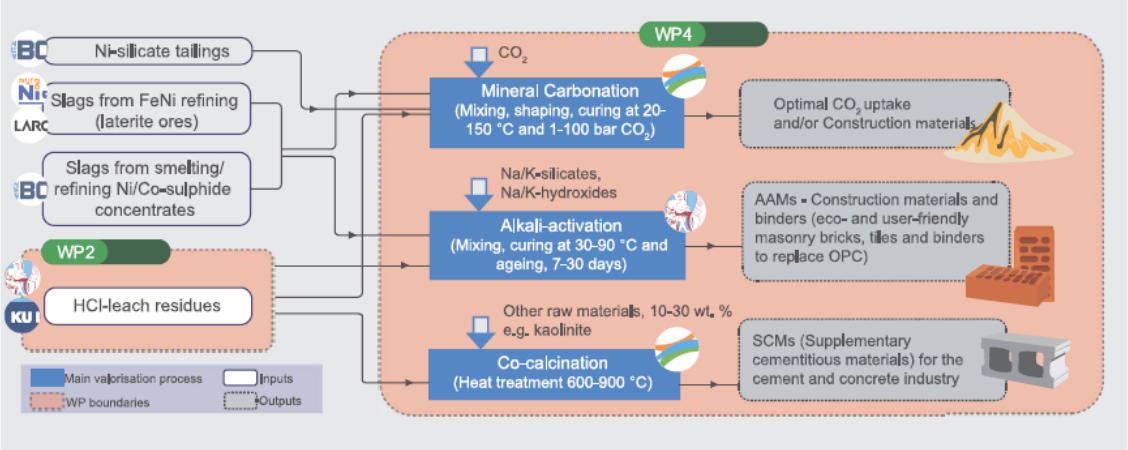

Figure 3: Technologies to study in the matrix valorisation WP4 in ENICON

The slags in the ENICON project are coming from the production of ferronickel (in the laterite flowsheet) or Co/Ni matte (in the sulfide flowsheet) and are therefore fayalitic in composition, i.e. close to Fe_2SiO_4. Despite this similarity, the slags from Boliden Harjavalta, Euronickel, and Larco are different in nature due to their distinct chemistry and cooling conditions. Therefore, they present a wide variety of phase compositions to investigate in the carbonation and alkali-activation processes.[3,4,5]. This variation might lie at the basis of the first innovations in the ENICON project, although also parameters in the processes themselves are foreseen to be studied.

Conclusions

The ENICON project targets to increase the sustainability of the Co/Ni supply chain in the EU, anticipating the necessary increase in production to meet the EU's envisioned battery material demand. Matrix valorisation is part of the study. The tailings, slags, and leaching residues of current and future flowsheets are considered to make the future battery grade Co/Ni supply chain a near zero-waste system.

Acknowledgements

ENICON project, https://enicon-horizon.eu/, has received funding from the European Union's Framework Programme for Research and Innovation Horizon Europe under Grant Agreement No. 101058124.

References

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