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RENOVATE

A circular and chemistry-neutral approach for recycling and recovery of battery waste feeds

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BATTERY
2030+

Consortium

1 National Universities Consortium:

National Interuniversity Consortium of Materials Science and Technology

3 Universities: Politecnico di Milano, Pavia and Milano-Bicocca

2 Research Centres: Karlsruhe institute of technology, Iberian Centre for Research in Energy Storage

2 Batteries Manufacturers: FAAM, SVOLT

2 Large Chemical Companies: SYENSQO and Organik Kimya

2 SMEs: LOMARTOV, BALance Technology Consulting

1 Producer Responsibility Organisation: ERP



Project content: objectives and ambition



Develop and demonstrate innovative and sustainable **recycling technologies at TRL4** for the European battery value chain by **reusing 95+%** of EoL batteries, battery components and industrial side streams.

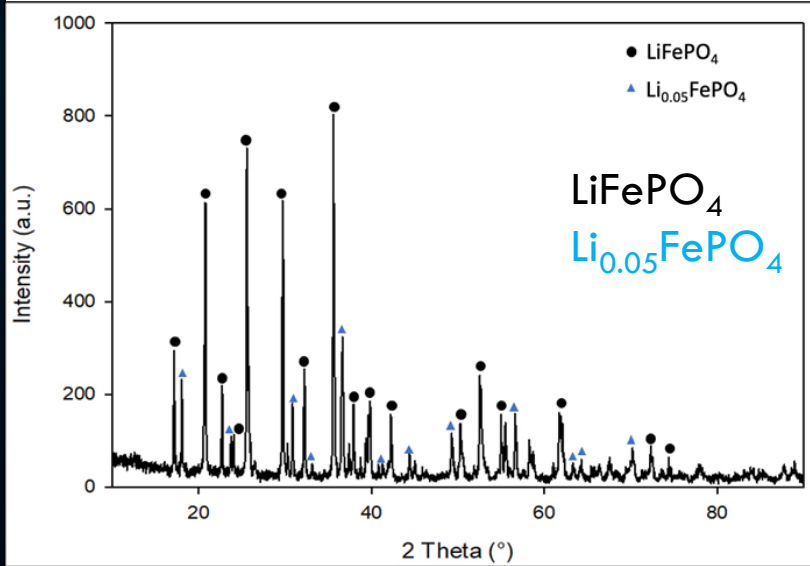
- Higher recycling efficiency through selective separation of the components (HVF)
- Higher profitability by recovering non-CAM materials (electrolyte, PVDF and graphite)
- Two novel technologies for direct re-use of LFP from EoL batteries and manufacturing scraps
- Green chemical paths with a closed loop vision to extract and refine CRMs from black mass streams (e.g.: Co, Ni, Mn, Li)
- Valorisation of the side streams coming from the recycling processes by means of a fully circular approach

- Assessment of quality of recovered materials through reuse in battery cells (closed loop).
- Full LCA and LCC analysis of the processes
- Digital architecture to be supportive acting as a cross-cutting Digital Design Support System (DDSS)
- Predictive regulatory framework models for harmonized up-scaling of RENOVATE solutions

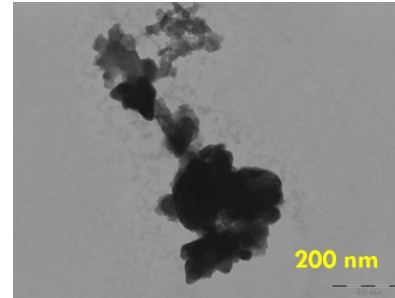


LFP Direct Recycling (M3): preliminary results

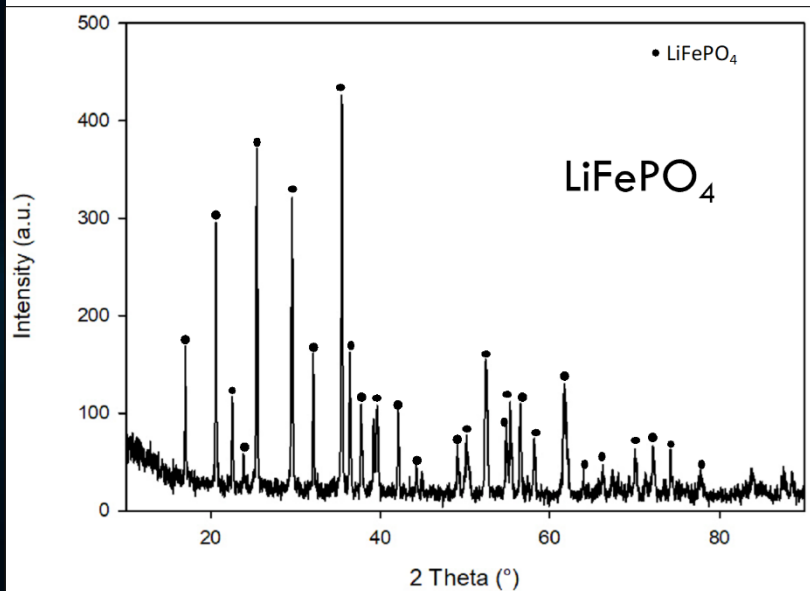
EoL-LFP
cylindrical cells



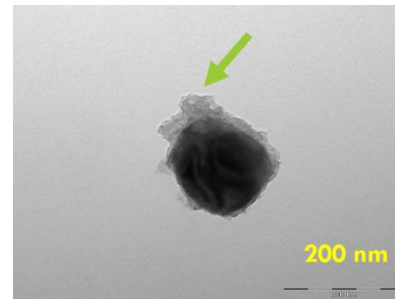
EoL LFP cathode



Sample	Li / Fe / P (atomic ra2o)
Spent LFP	0.84 / 0.98 / 1.00



EoL LFP cathode



Sample	Li/Fe/P (atomic ra2o)
Regenerated LFP	1.0 / 1.0 / 1.0

- **1st RENOVATE regeneration method:**
 - Li source, one step, L.T., dry route

- ✓ Li stoichiometry
- ✓ No Fe-Li antisites
- ✓ Carbon coating



RENOVATE and the Roadmap

1) Which objectives of my project could be added to the roadmap goals?

- Innovative and disruptive recycling technologies
- Design for Recycling and Sustainability
- Digital solutions for the recycling processes
- Sustainability assessment

1) What are the expectations of my project from the future roadmap?

- New calls
- Outline/implementation of strategies for innovative battery value chain
- Dissemination/training/education

