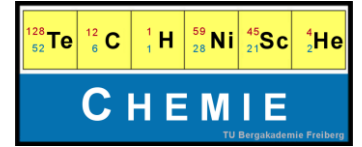




TUBAF

Die Ressourcenuniversität.
Seit 1765.

ANZAPLAN
dorfner group



CARBONATION OF LITHIUM-CONTAINING PRIMARY AND SECONDARY RAW MATERIALS USING CO₂

CO₂-LiPriSek

Dr. Doreen Kaiser

TU Bergakademie Freiberg



Lithium for electromobility

Use of local raw materials

- Independence from resources
- Problem: low Li-content

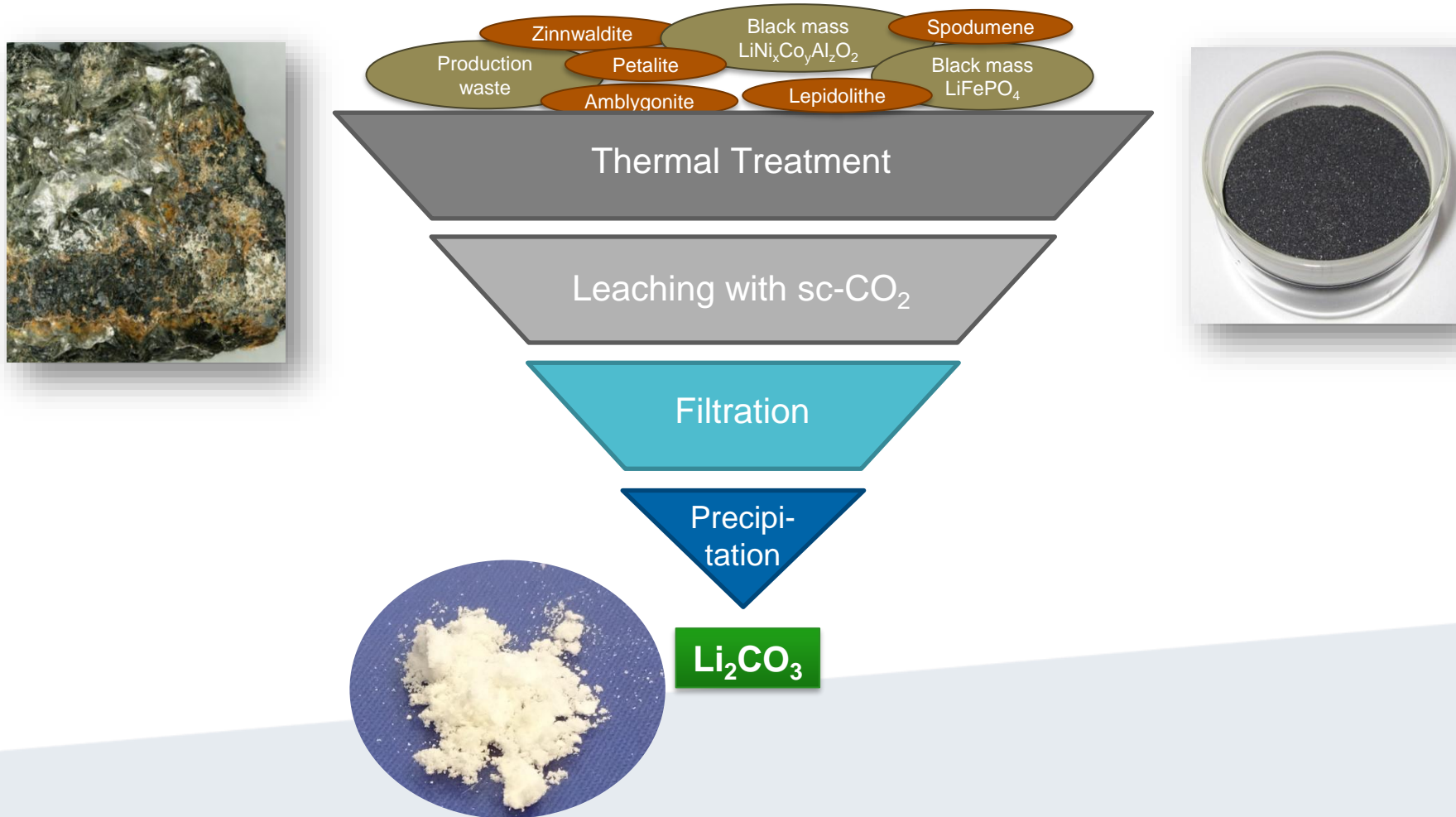
Recycling of spent LIBs

- Independence from resources
- Problem: established processes aimed on recovery of Co, Ni and Mn



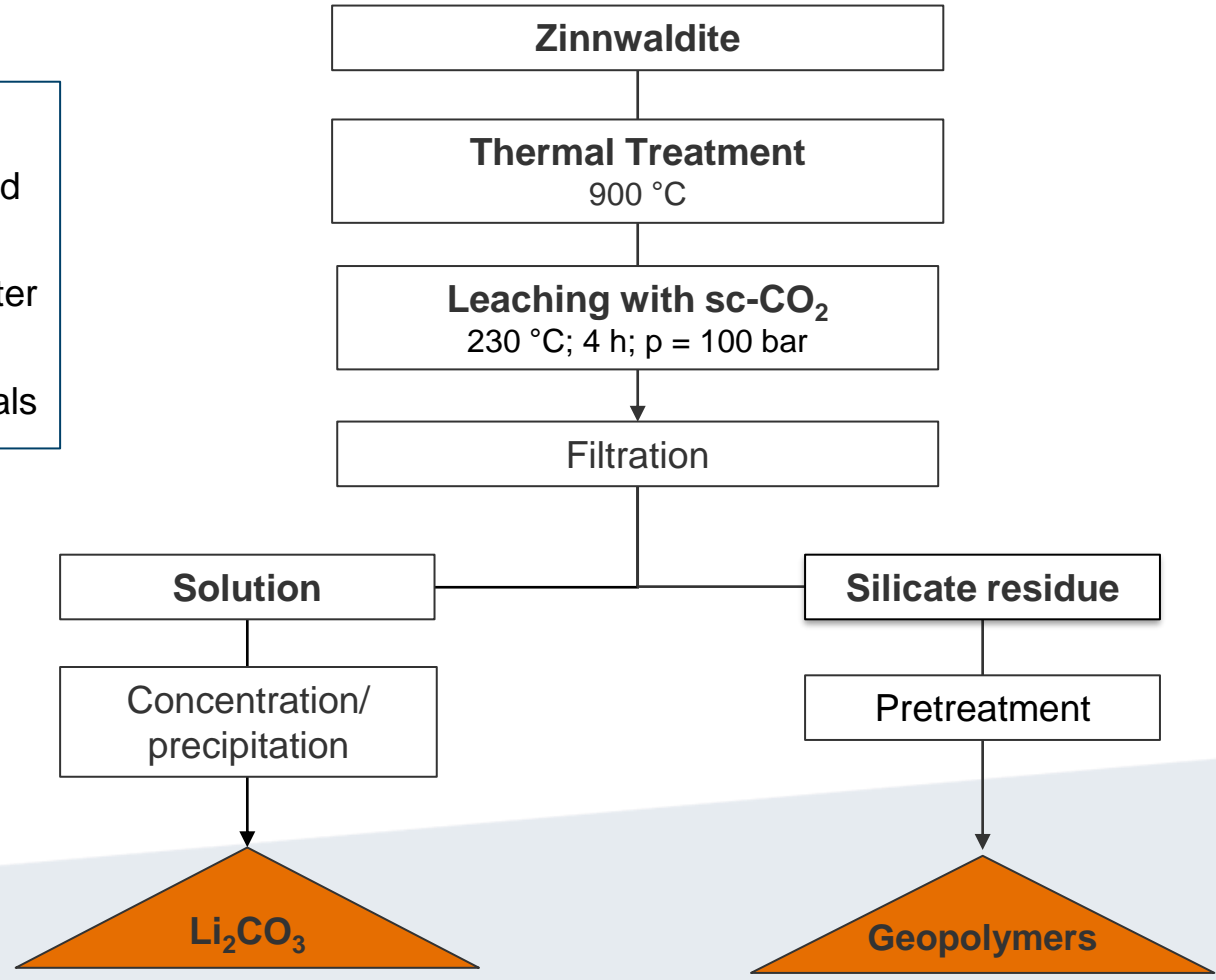
Increasing Lithium demand

Project idea: COOL process



COOL process: primary raw materials

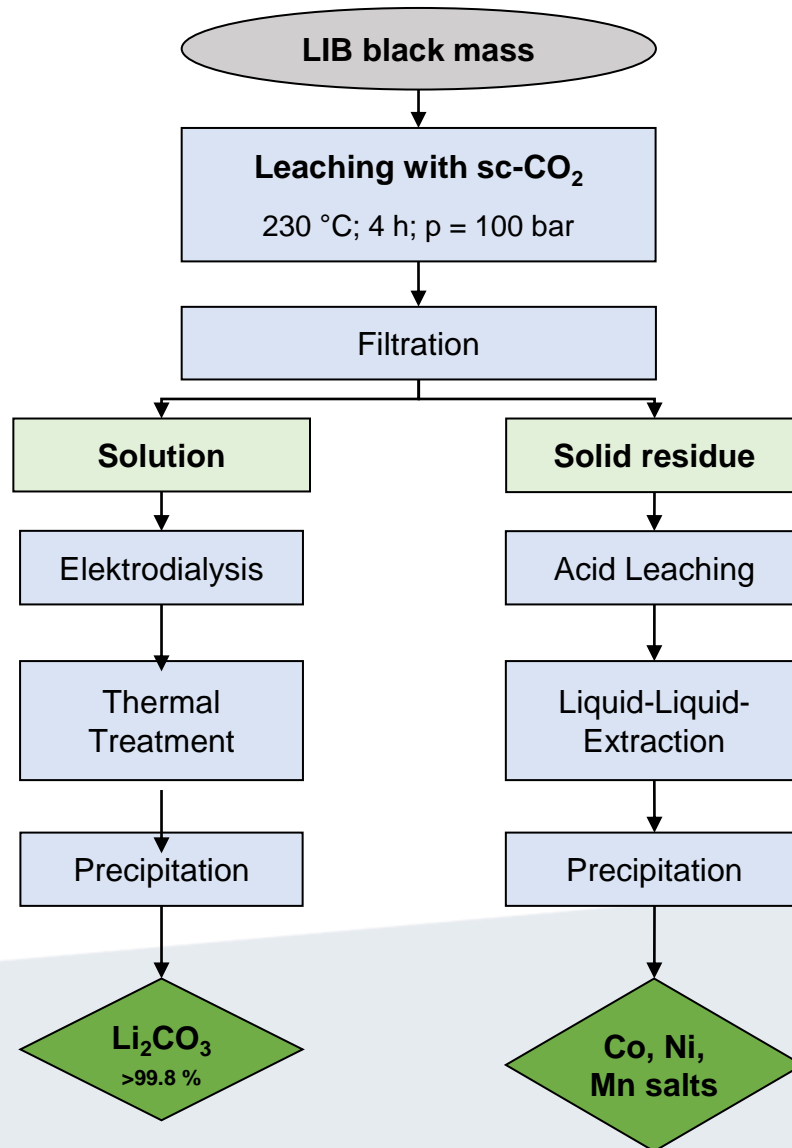
- Li recovery**
- ✓ High Li selectivity and yield
 - ✓ No chemical cost
 - ✓ No complex waste water treatment
 - ✓ Wide range of raw materials



- Geopolymers**
- ✓ CO₂ free building materials
 - ✓ No stockpiling of the silicate residue
 - ✓ Wide range of application fields (e.g. paving stones, facade panels)
 - ✓ Reduction CO₂ emission



COOL process: secondary raw materials

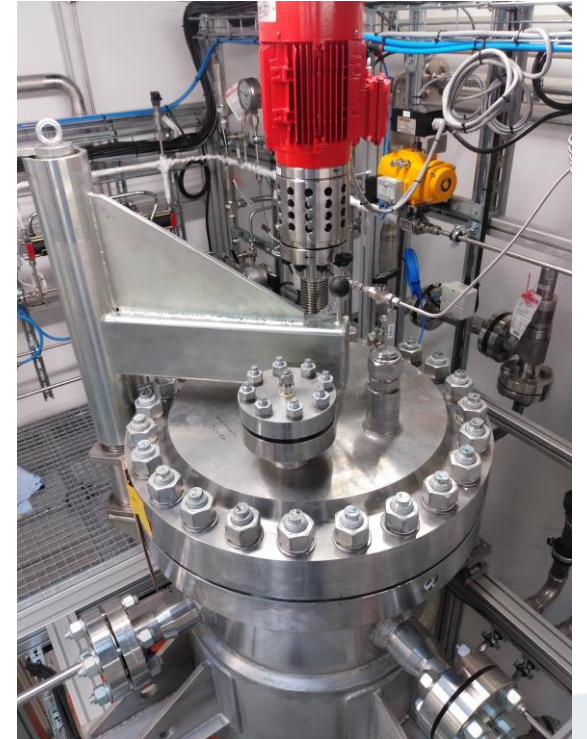


Advantages of the COOL-process:

- ✓ Utilization of CO₂ as the only chemical
- ✓ Low chemical cost
- ✓ No complex waste water treatment
- ✓ High Li **selectivity** (> 94 %) and **yield** (> 94.5 %)
- ✓ Isolated crude product has **battery grad** quality
- ✓ Solid residue can use for Co, Ni and Mn recovery
- ✓ High flexibility regarding different raw materials

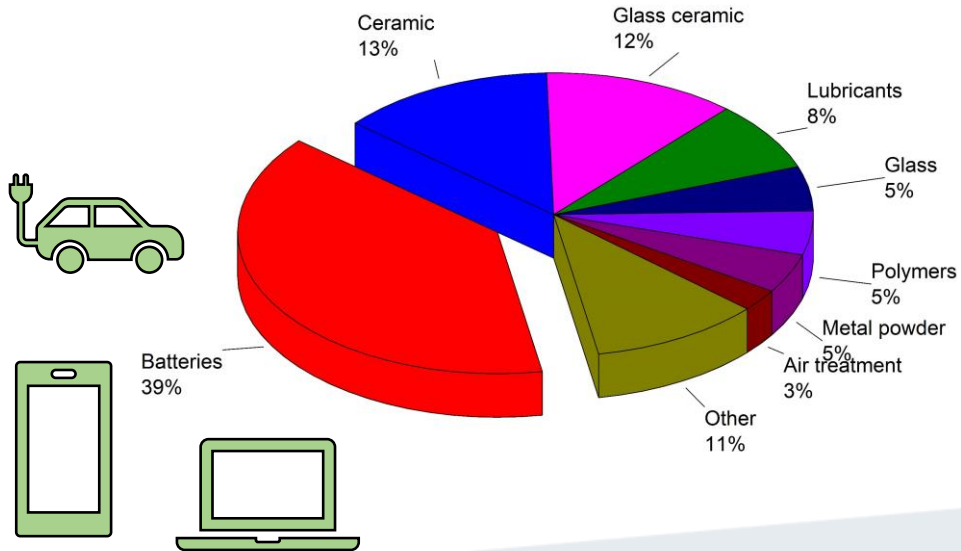
What is the innovation?

- Combination of recycling and utilisation of local raw material
- Sustainable, flexible and efficient process
- Holistic utilisation of the raw materials → Zero waste!
- CO₂ and water as the only chemicals → No complex and cheap waste management
- Individual process steps are established procedures → Fast up-scaling
- Established up to 200 L for different raw materials



Product application

Li₂CO₃



Geopolymers



Terrace stones

Paving stones



Thermal insulation,

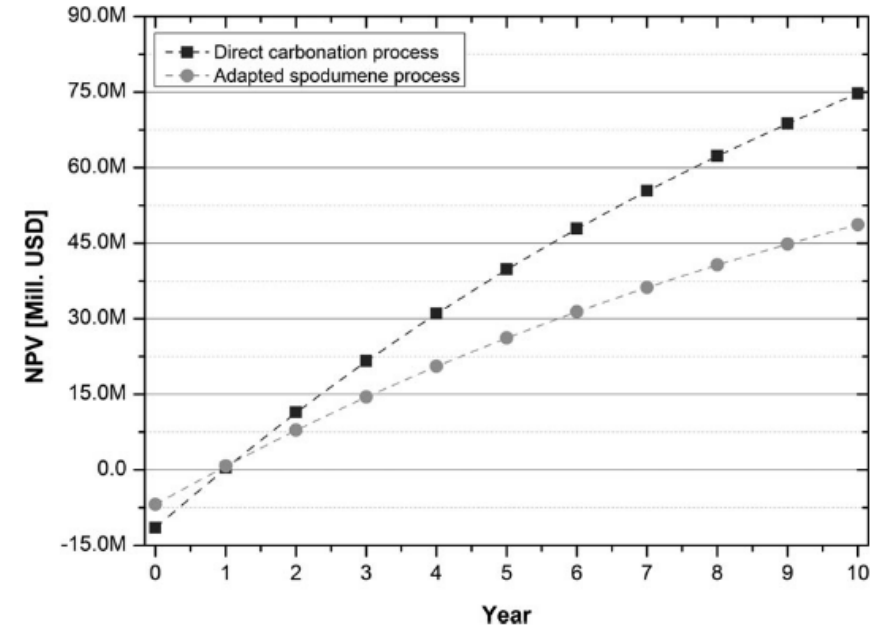


Concrete

Business case

- Current price Li_2CO_3 (battery grade): ~70 \$/kg
- Scenario without utilization of co-products:
 - Plant size 2000 t/a; operating hours: 8000 h/a

	COOL process	Spodumene process
CAPEX	11.5 Mio. \$	6.8 Mio. \$
OPEX	8 Mio. \$	12.5 Mio. \$



➔ COOL process: lower operating costs due to the absence of chemical costs

Outlook

- COOL process is patented → DE 10 2015 221 759 A1
- Up-Scaling investigations with further raw materials
- Build up an pilot plant in Spain for treatment of primary raw materials as well as geopolymer production
- Optimisation of geopolymer production
- Further testing of geopolymers in different areas of application (e.g. house and road construction, Underground backfill)
- Adaption of business case:
 - Geopolymer production
 - LIB recycling

Thank you for your attention!