

Li-ion battery-cell production at LiFeSiZE: step-by-step

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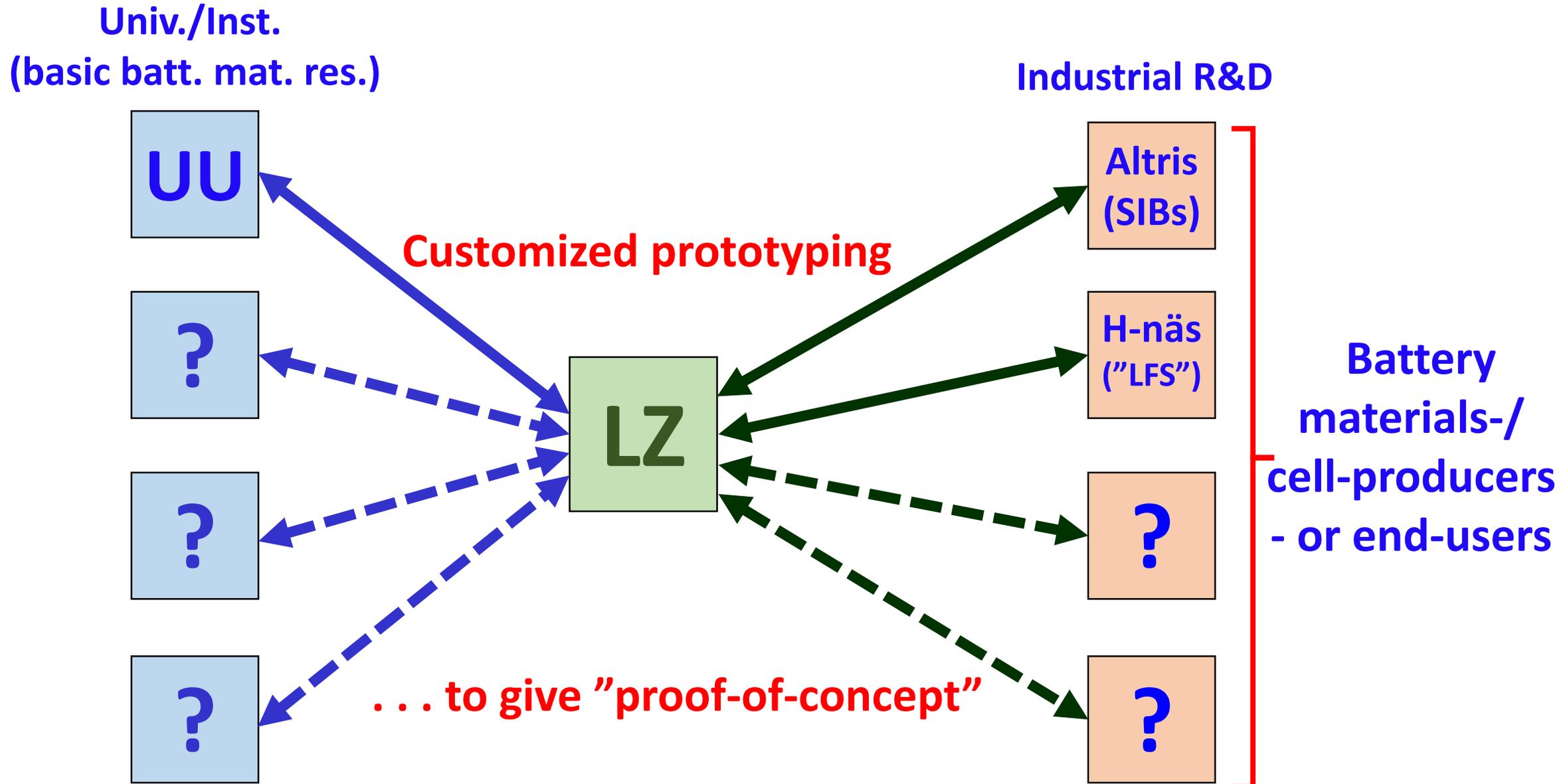
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LiFeSiZE's activities – from an R&D perspective:



WHEN is it meaningful to contemplate *proof-of-concept* prototypes?

1. When you have a **safe, cheap** (green?) process for **scaling up** your synthesis from lab-scale (mg/g) to kg-scale

(Amount needed: **50-100g** >>> a “one shot” batch
≥1kg >>> slurry optimization >>> multiple batches)

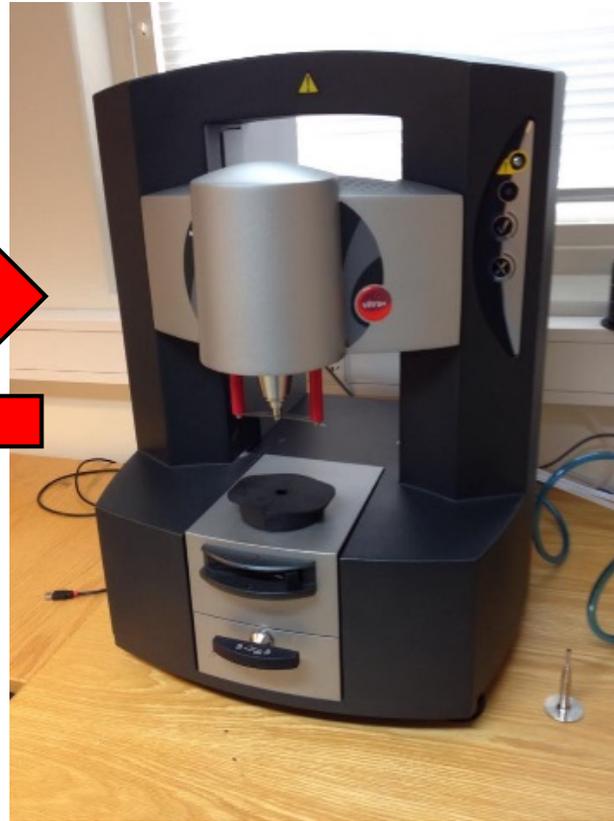
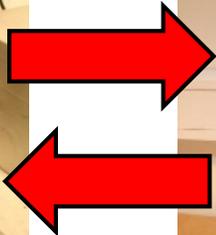
2. When the **supply** and **cost** of the raw materials involved is realistic

3. When your “new material/process” fulfils a true **market need**
>>>>> **better** performance at the same cost – OR **cheaper, safer and greener** giving at least the **same** performance, e.g., the replacement of **Co** !

Key factors relevant to battery up-scale for E-mobility or sust.-E applications

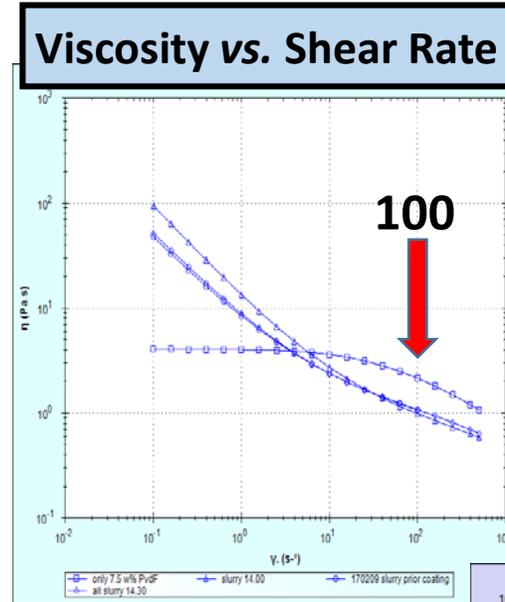
- Battery-to-device **cost** ratio
- Battery **"life-expectancy"** in the device
- The **time-scale** involved in the development
- The **huge volumes** needed in future markets

Iterative slurry optimization . . .



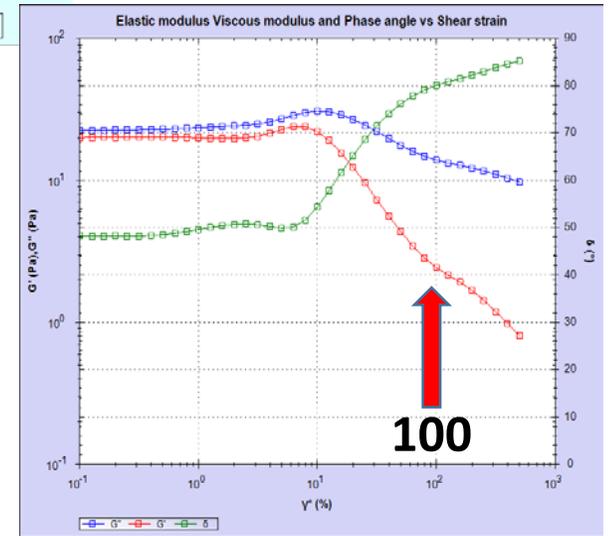
High-power mixer
(slurry preparation)

Rheometer
(slurry optimization)



Empirical !

Li₂FeSiO₄ ("LFS")
optimization



The coater-line

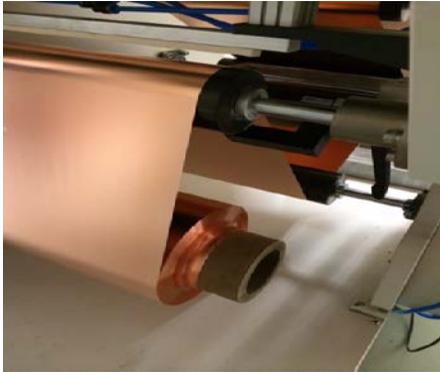


No Cu
in NIBs !

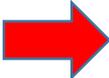
Cu- and Al-foils
(width: 180mm)



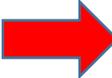
Operational units in the coater-line



Unwinding



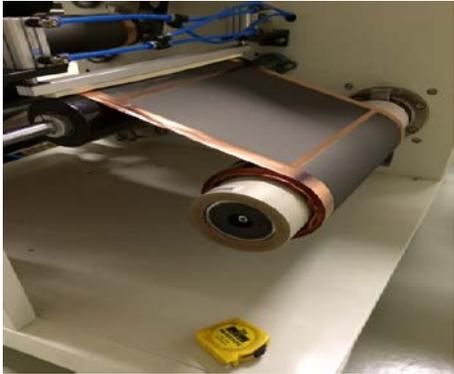
Coating



Drying

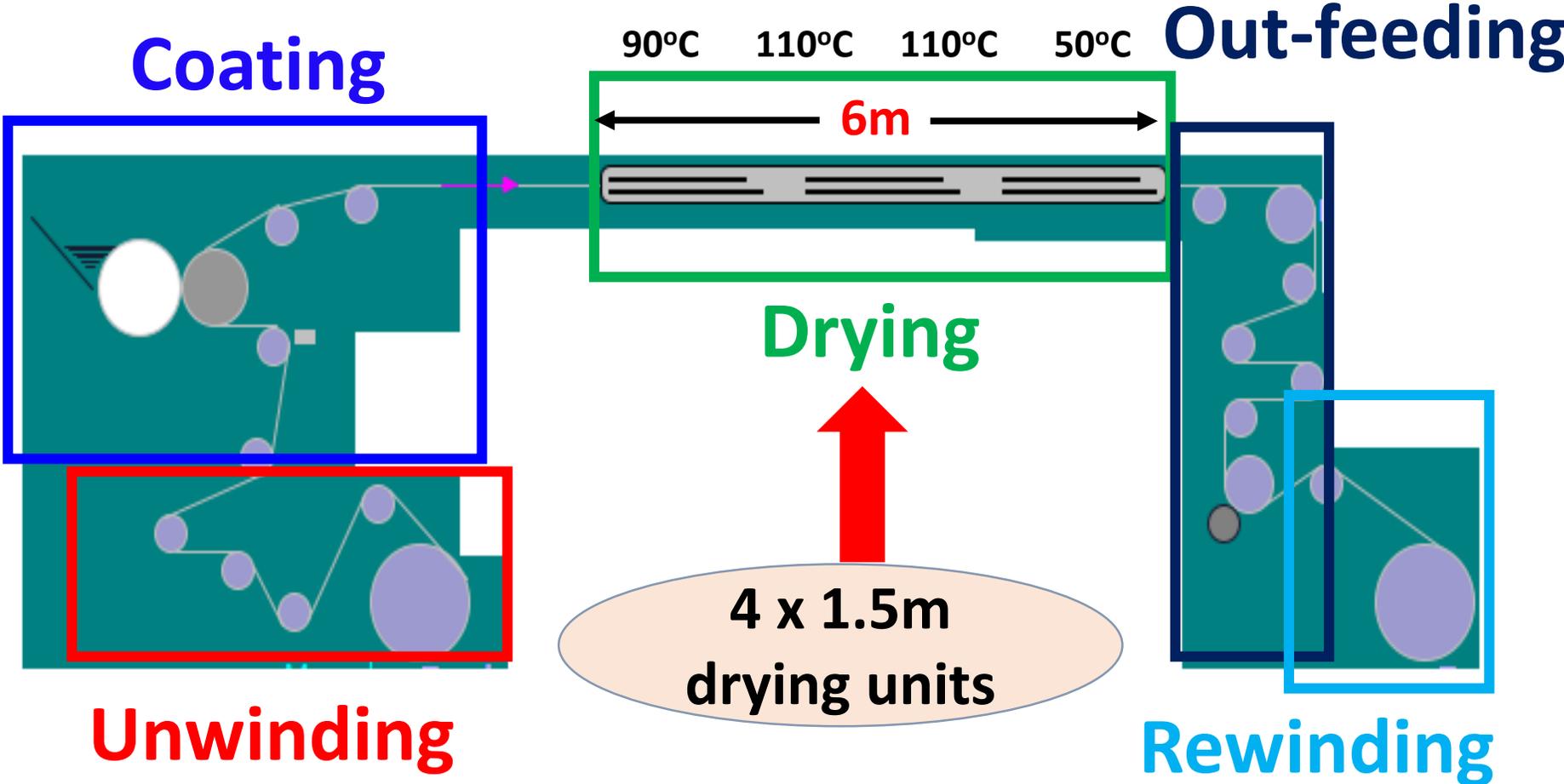


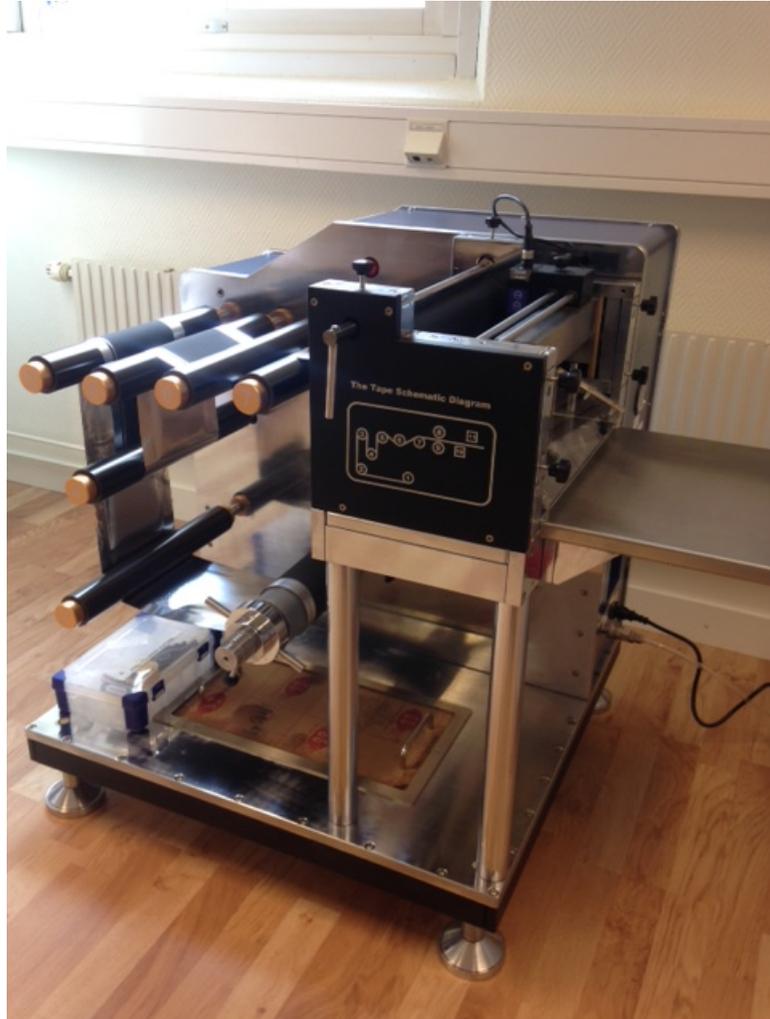
Out-feeding



Rewinding

Operational units in the coater-line (schematic)





**Electrode cross-cutter
(100mm widths)**

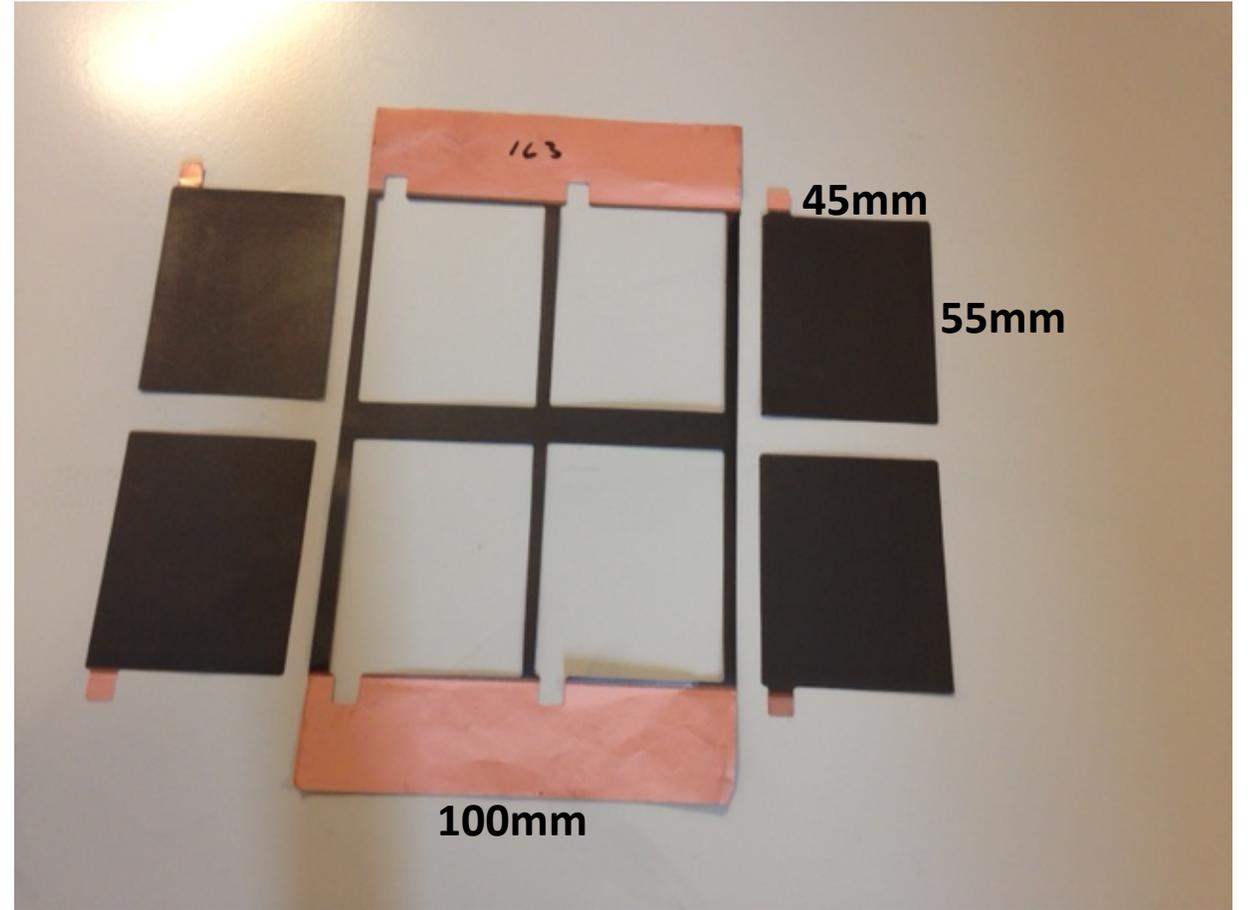
**Determines electrode porosity
>>> cell performance !**



**Electrode "hot-calenderer"
(90-110°C)**



Electrode punch . . .



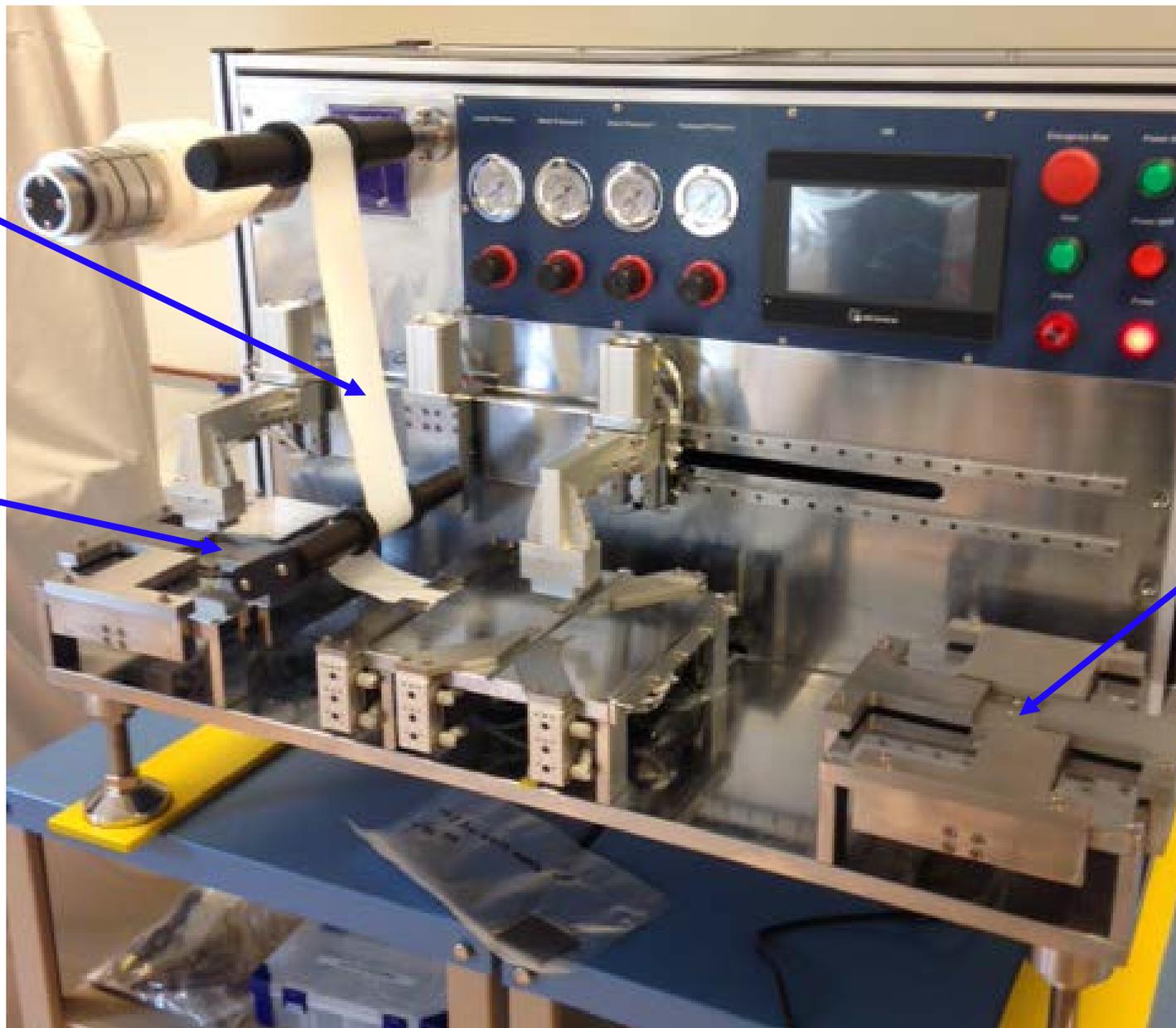
- . . . giving 4 electrodes/100mm length
- **double-sided coating**
- **anode 1mm larger than cathode**
(a 0.5mm anode "picture frame")

Separator

Anode
stack

Cathode
stack

"Zig-zag"
electrode
auto-stacker





Tab welder



Ultrasonic tab welding



Battery – before pouch packaging



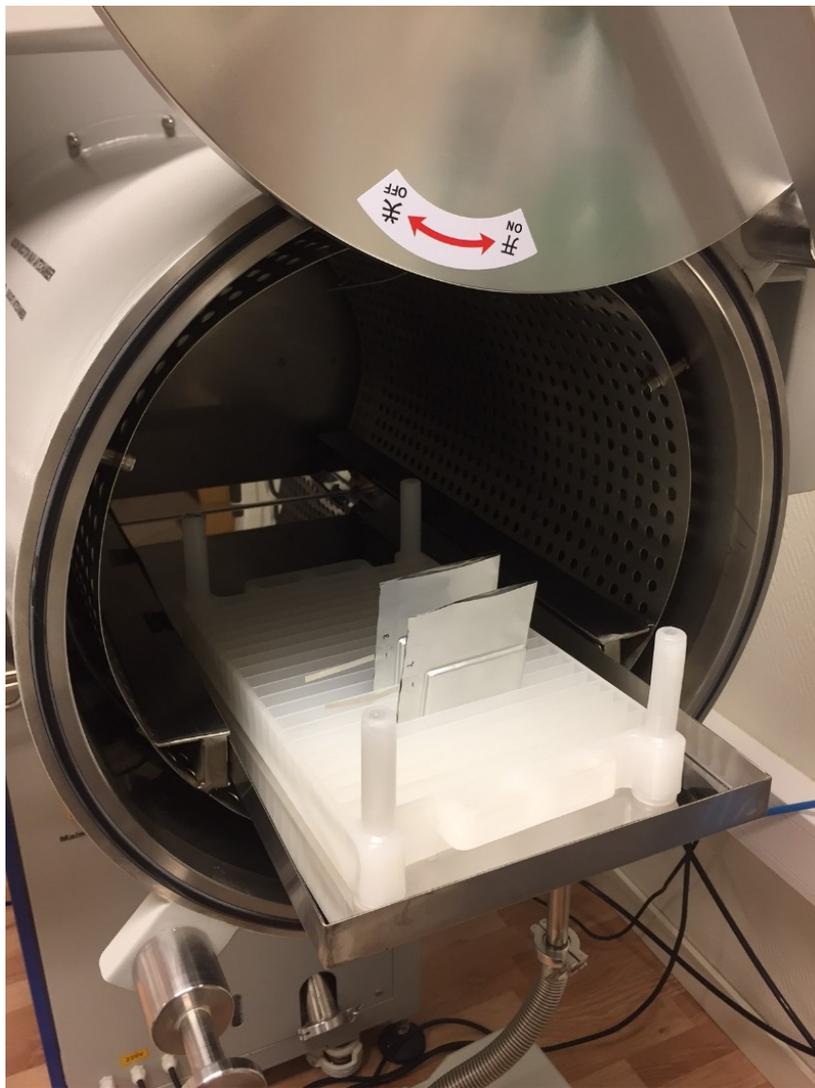
Pouch former



Pouch sealer

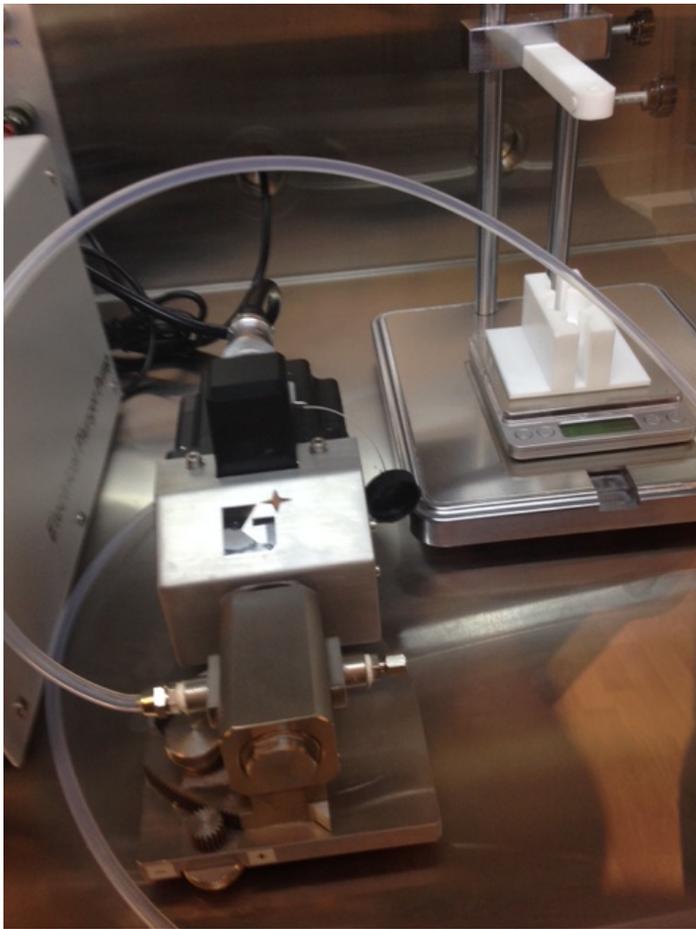


Cells placed in a glovebox rack-sealed along three sides prior to electrolyte injection



Cells on their way into the heatable, evacuable glovebox ante-chamber (typical treatment: overnight at 75°C)

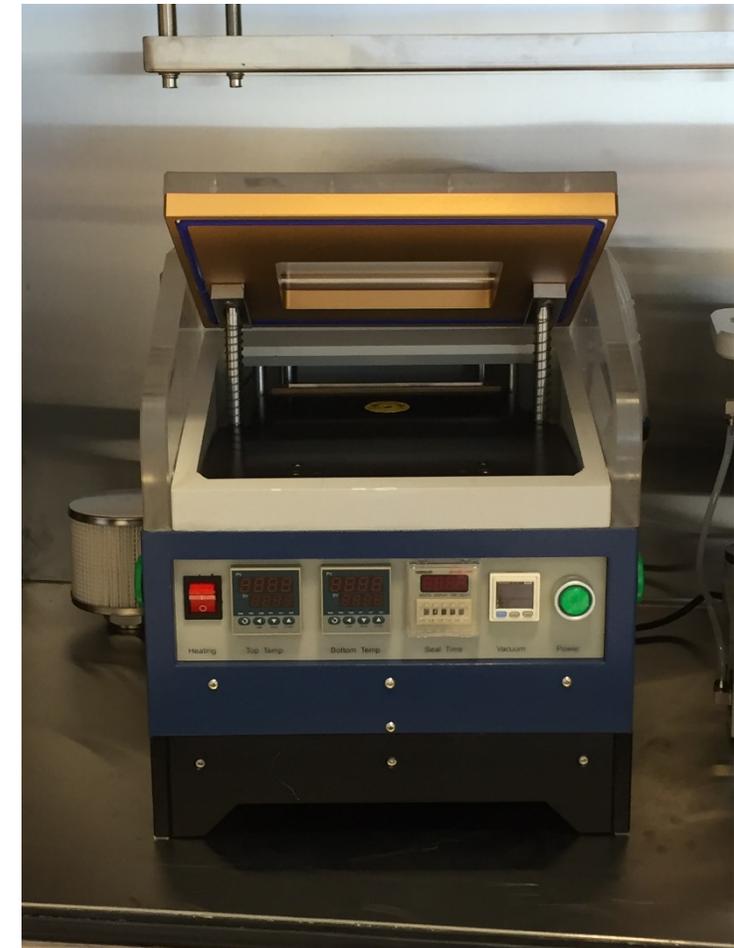
Ar-glovebox: used for the last three stages of the process



Electrolyte injection



Electrolyte infiltration



Battery pre-sealing

Electrode utilization!

These last three stages are performed in a <1ppm Ar glovebox



**Cell pre-cycling
and final testing
(up to 100A –
and 200°C)**



**A Li-/Na-ion battery-cell prototype –
with space left for the
precycling/degassing/resealing steps**

- **Up to 6mm thick**
- **Up to 3-4Ah: dependent
on cathode material**

Reproducibility of coating loadings

