

# Processing of Sulfide-Particle-Based All-Solid-State-Battery-Electrodes from Coating to Drying: Challenges and Experimental Setup

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## Motivation

### Increased safety



### Higher energy density possible

Li-metal anode 3800 mAh / g VS. Graphite anode 360 mAh / g

### Less toxic

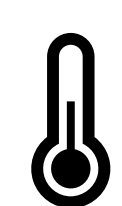
No volatile organic compounds



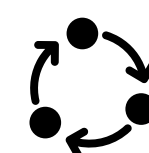
### All-solid-state battery

Compared to conventional LIB

### Higher thermal stability



### Higher cycle stability

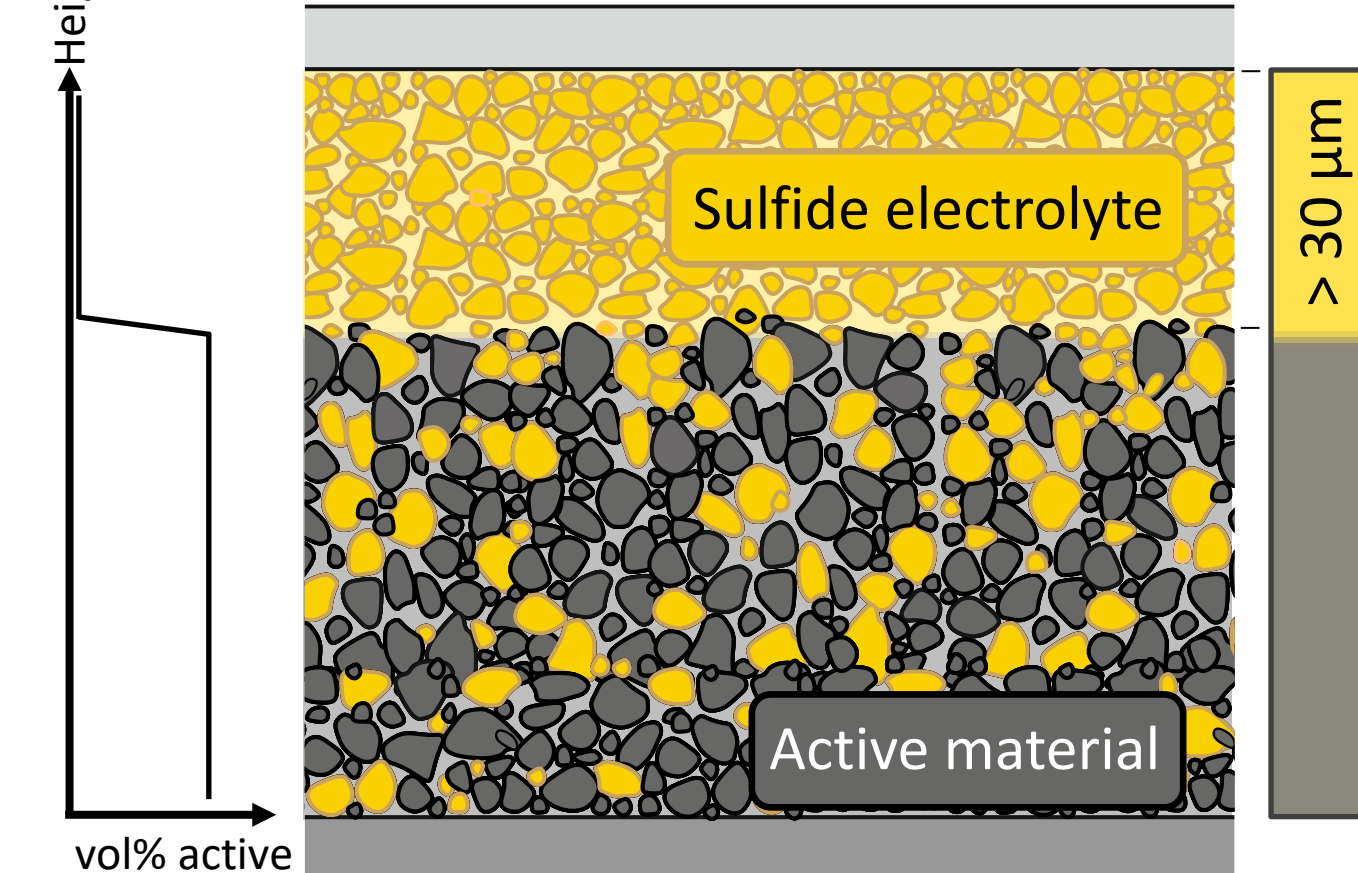


Chemical stability of solid electrolyte

[3]

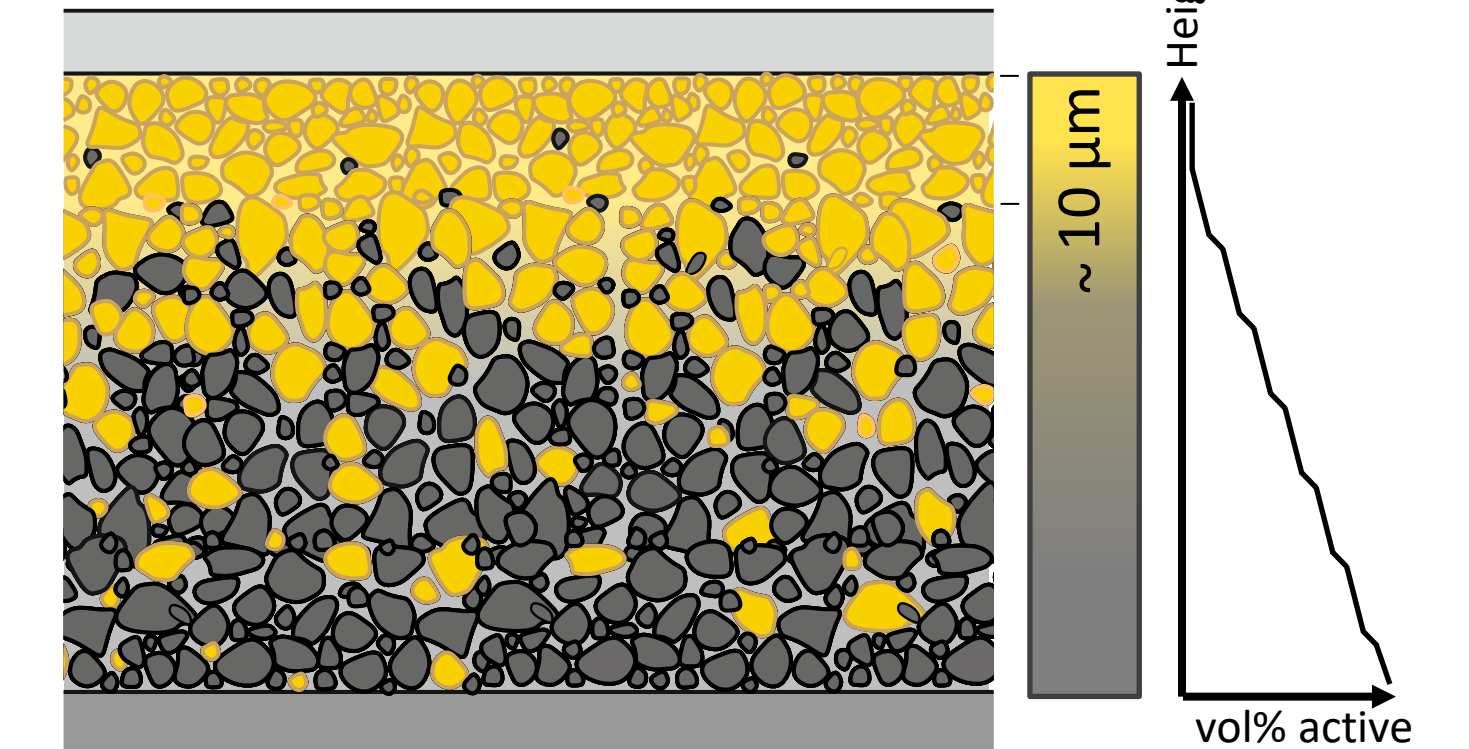
## Architecture

### Laminating multilayer



- Bad interfacial contact
- Possibly bad percolation
- High internal resistance

### Simultaneous multilayer coating

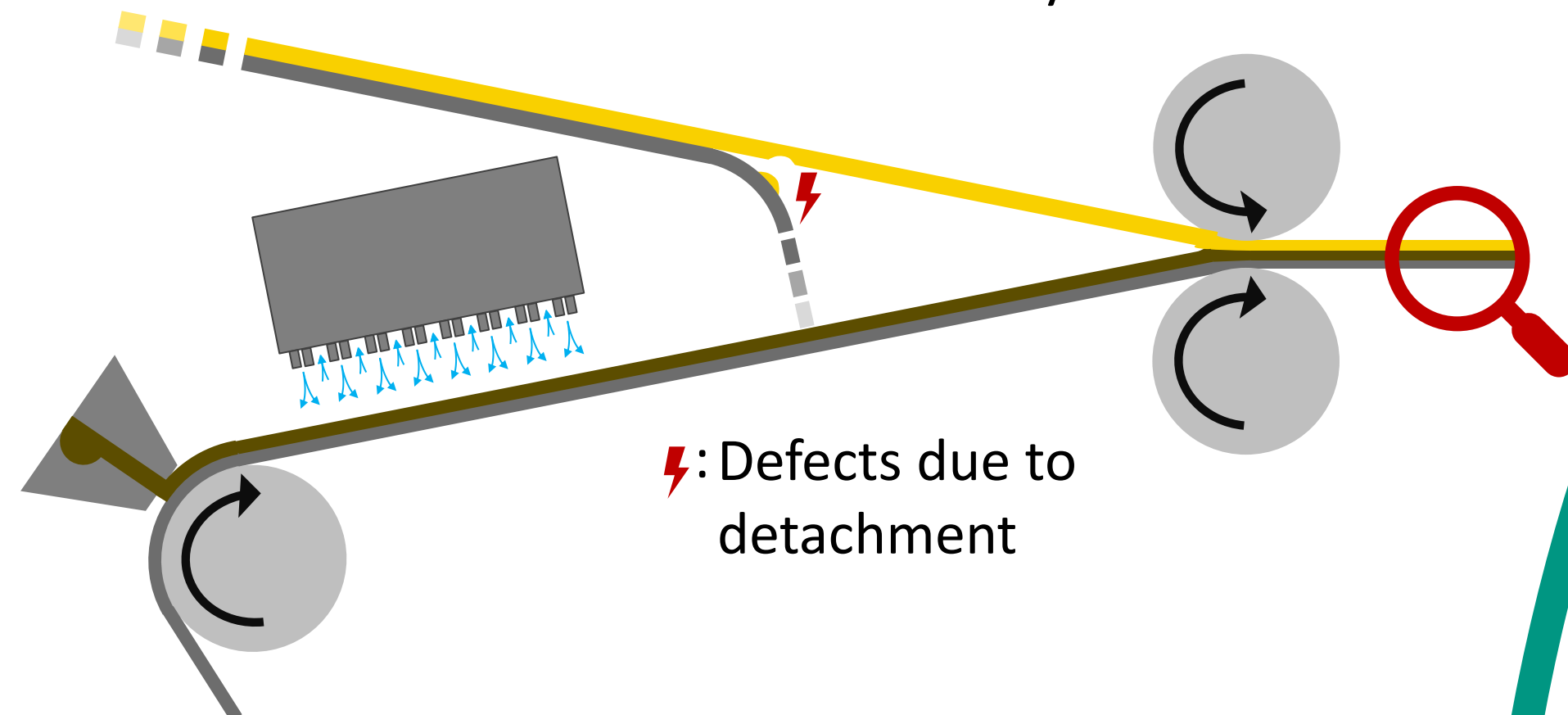


- Functional layers at different positions
- Thinner separator → energy density ↑
- Targeted optimization of power vs. energy density

## Processing

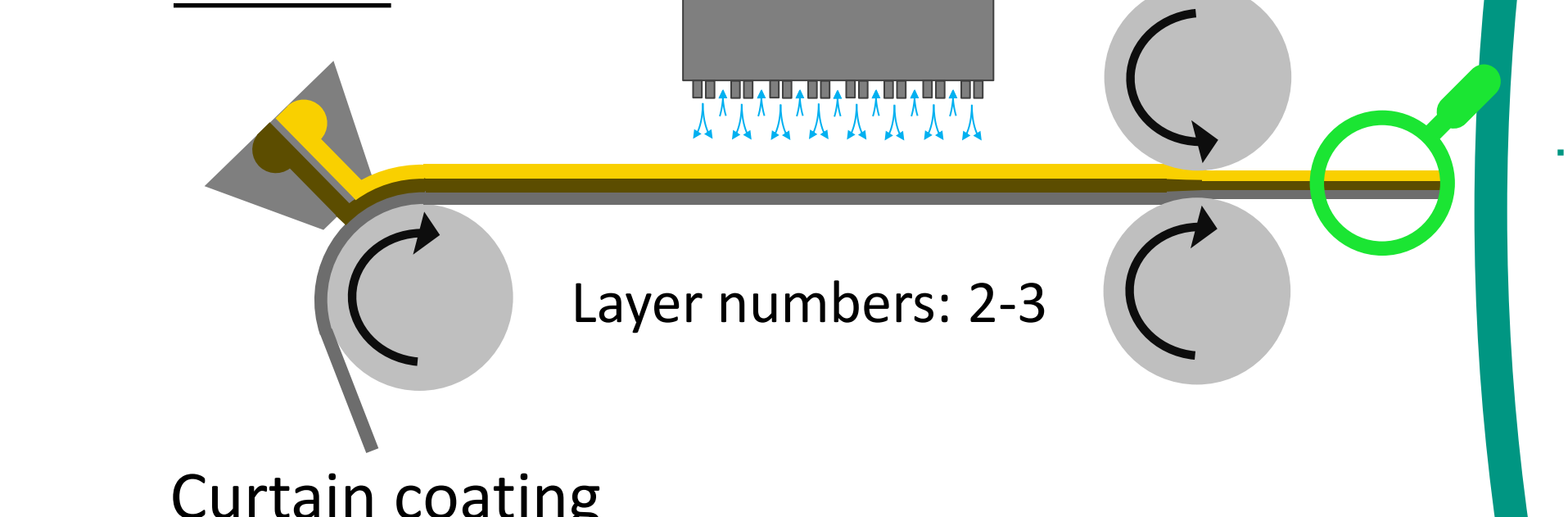
### Laminating multilayer

Layer numbers: 2

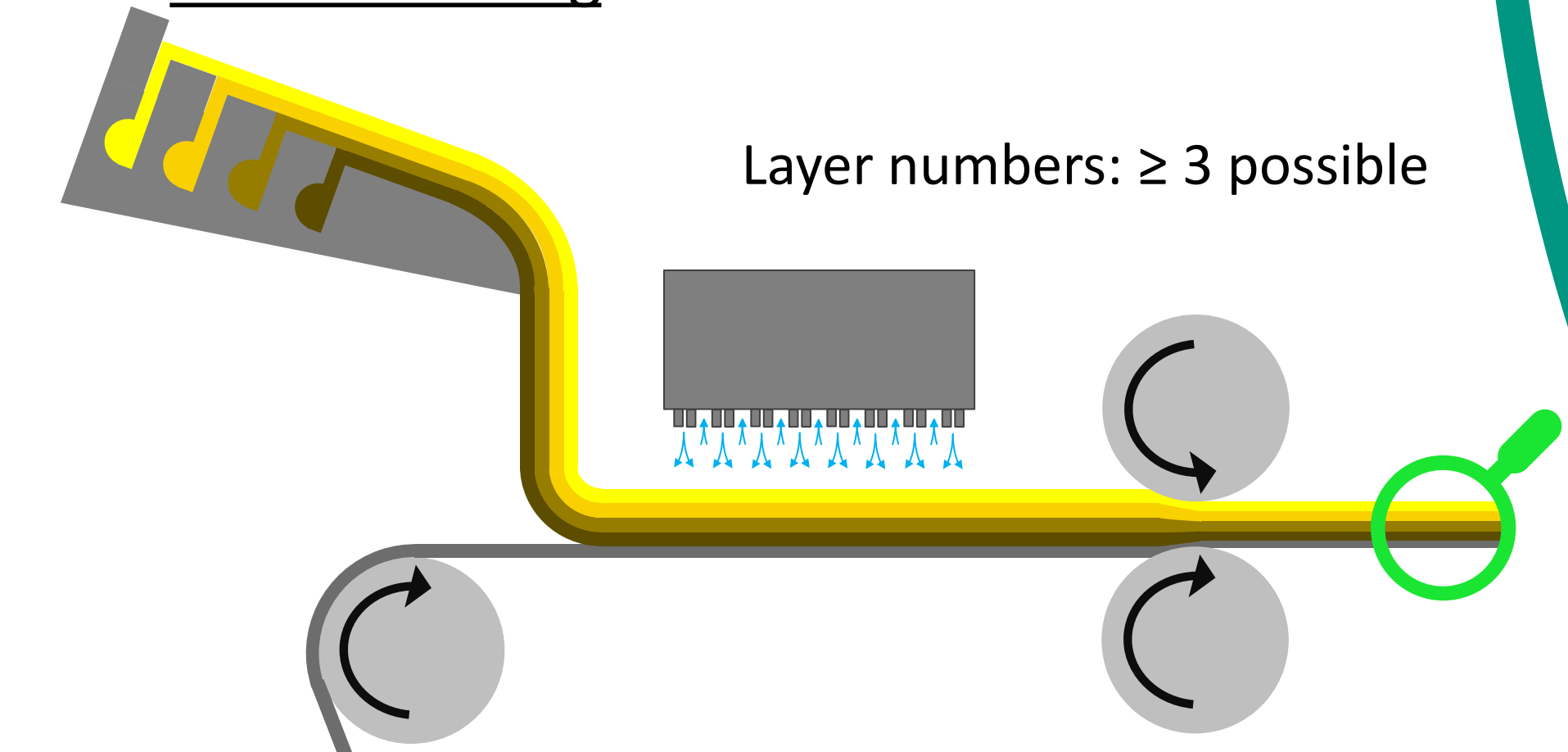


### Simultaneous multilayer coating

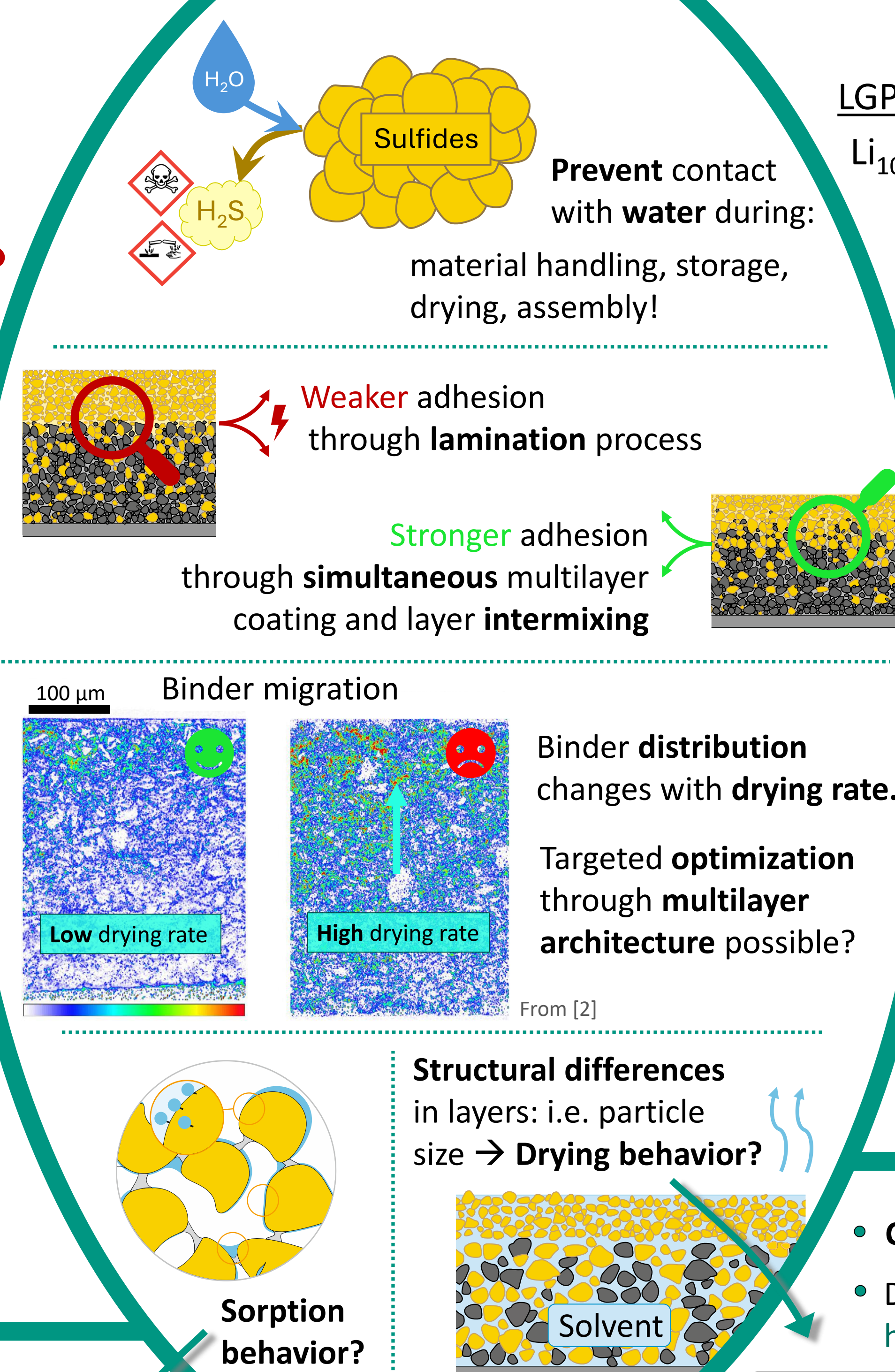
Slot-die



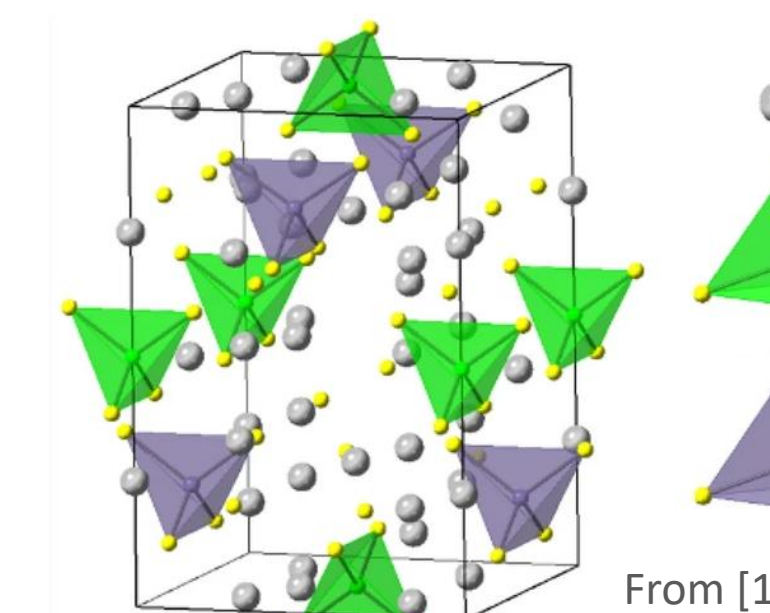
Curtain coating



## Challenges

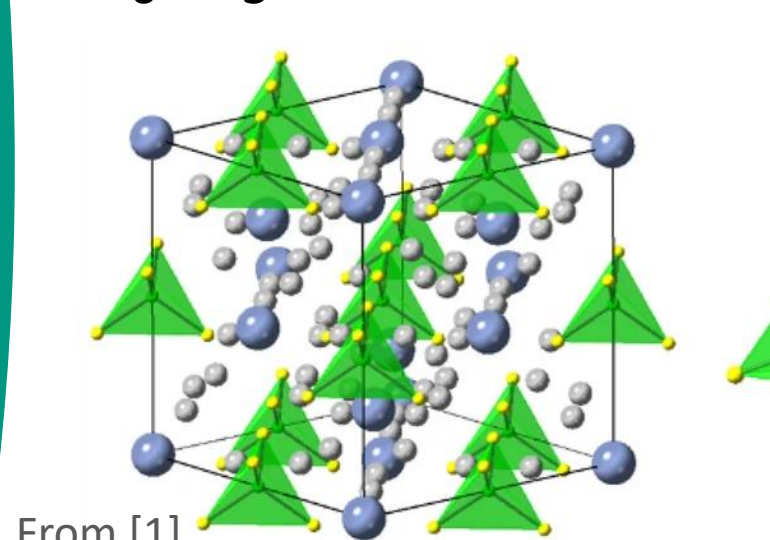


### LGPS Thio-LISICON-Type



- Tetragonal structure
- $Li^+$  movement through 1D channels
- Very high ionic conductivity  $10^{-2}$  S/cm

### Argyrodites LiPSX



- Cubic structure
- Very good processing properties
- High ionic conductivity  $10^{-3}$  S/cm

### Solvents

Non-polar! Toluol, Xylol, Hexan / Heptan

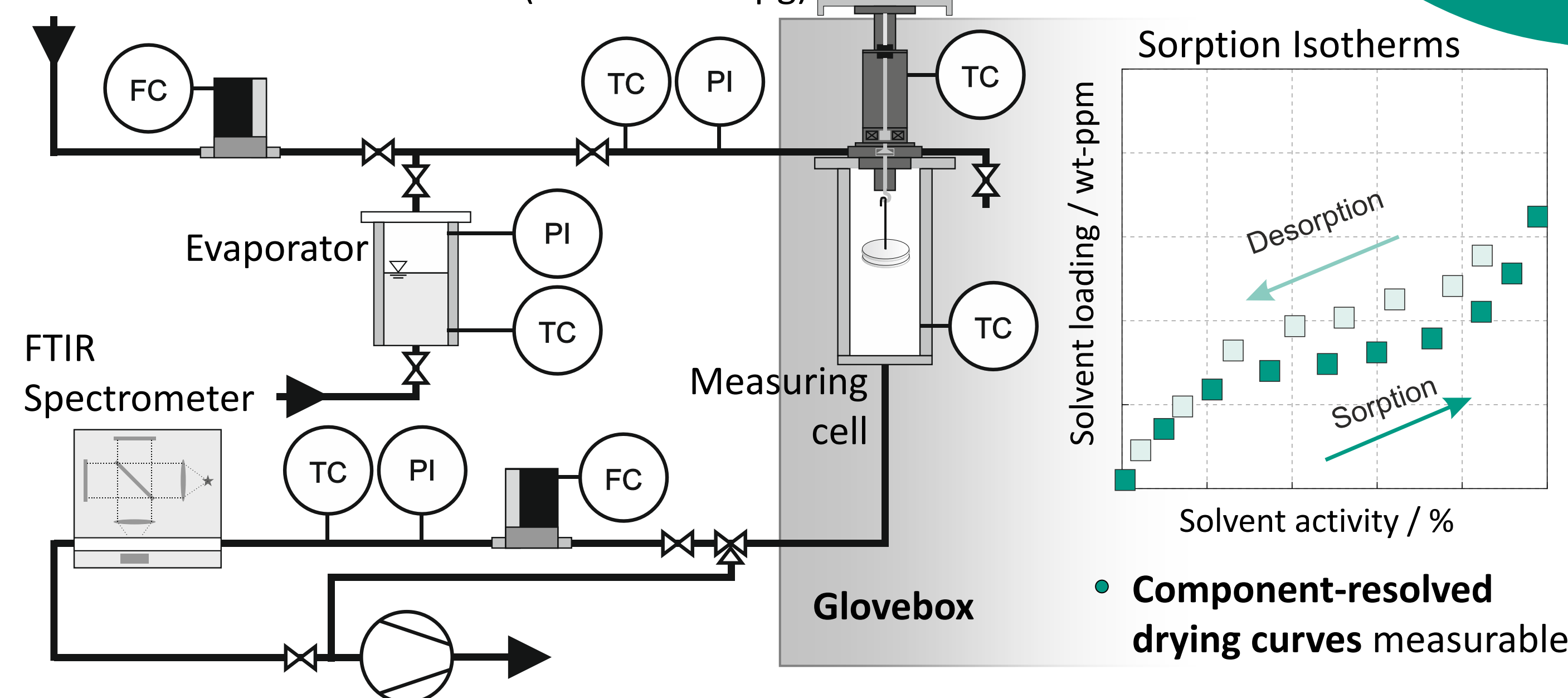
### Binders

Styrene-Butadiene-Rubber (SBR), Silicon-Rubber (SR)

[3]

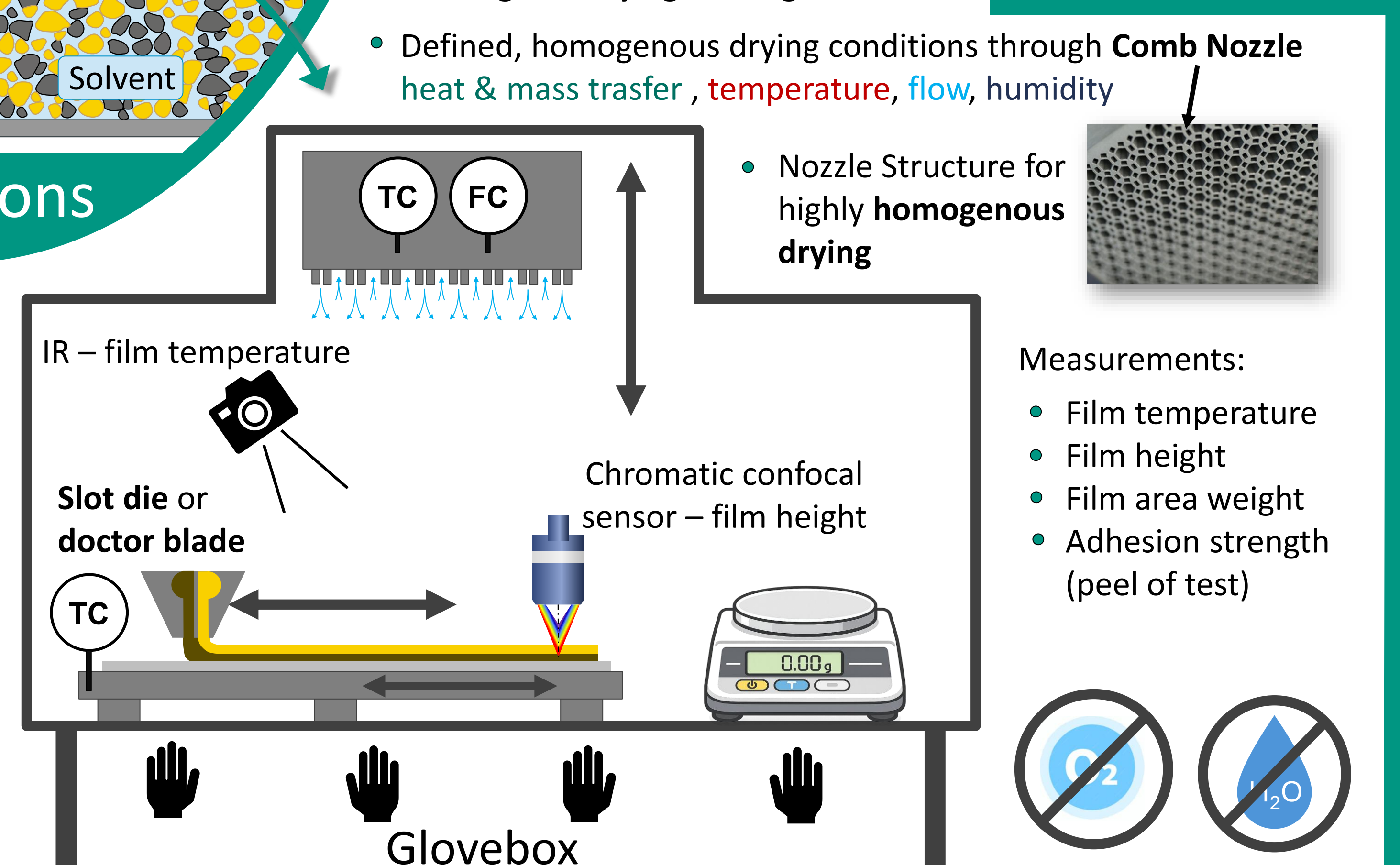
## Setup: Kalibra

Magnetic suspension balance (Resolution 1 μg)



## Questions

## Setup: Hopsi



[1] Wu, Z., Li, X., Zheng, C. et al. Correction: Interfaces in Sulfide Solid Electrolyte-Based All-Solid-State Lithium Batteries: Characterization, Mechanism and Strategy. *Electrochem. Energy Rev.* 6, 19 (2023). <https://doi.org/10.1007/s41918-023-00187-5>  
 [2] M. Müller, L. Pfaffmann, S. Jaiser, M. Baunach, et al.: Investigation of binder distribution in graphite anodes for lithium-ion batteries. *Journal of Power Sources* Volume 340, 1 (2017). <https://doi.org/10.1016/j.jpowsour.2016.11.051>  
 [3] T. Schmaltz et al.: Solid-State Battery Roadmap 2035+ (2022); <https://doi.org/10.24406/publica-68>