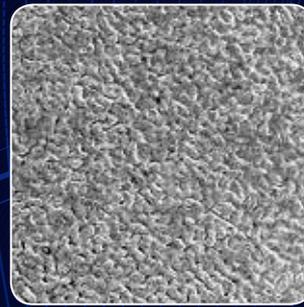


# PVD Lithium Thin Foil

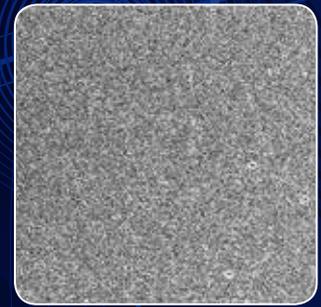
Li Web Coaters and Coating Processing  
Custom Samples and Batch Production  
Coating Equipment Engineering

# Lithium PVD coating advantages and performance capabilities

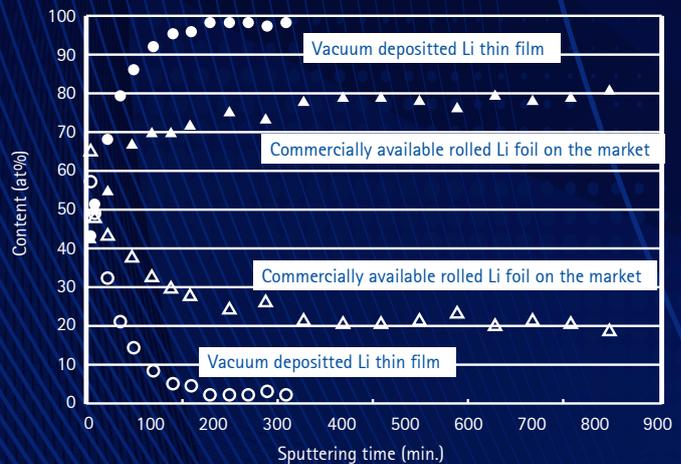
- Different substrates**  
 1...20 microns thick Lithium coatings can be deposited in one pass onto thin metallic foils or thin metallized polymer films
- High Purity Li**  
 Since Lithium is deposited in high vacuum, it comes out in a "pure" state: vacuum deposited Lithium has minimal oxide layers. Lithium batteries benefit by high levels of purity.
- High surface activity**  
 Coating deposition conditions provide high Lithium surface activity, what is inaccessible for traditional rolling.
- Low cost**  
 PVD processing has an important feature: the less metal is required, the lower is the product cost. As a result, there is cost advantage with PVD coated Lithium in comparison with conventional rolling.



Battery separator material "Celgard" with 2.5 microns of Lithium (x2000).

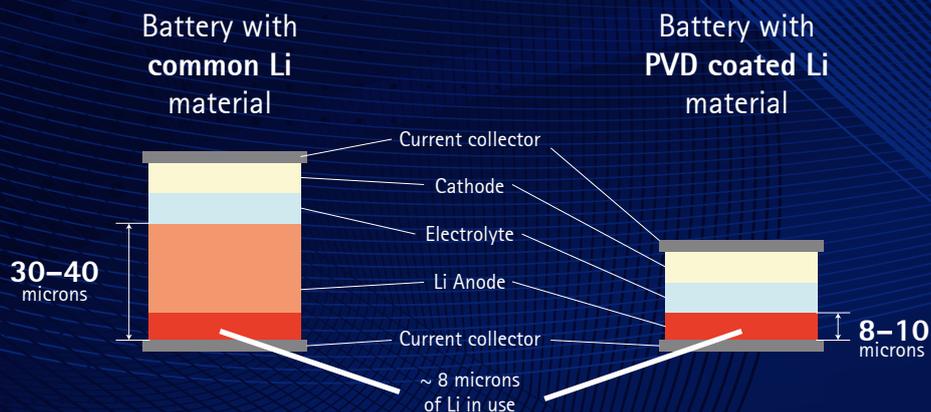


17 microns thick Copper foil with 19 microns of Lithium (x 500).



XPS analysis of Li metal Comparison of vacuum deposited Li thin film and rolling Li foil  
 Courtesy of SUMITOMO: SEI technical Review, Number 61, January 2006

- Optimal thickness**  
 Lithium coating thickness could be selected correspondingly the battery chemistry. No excess Lithium!



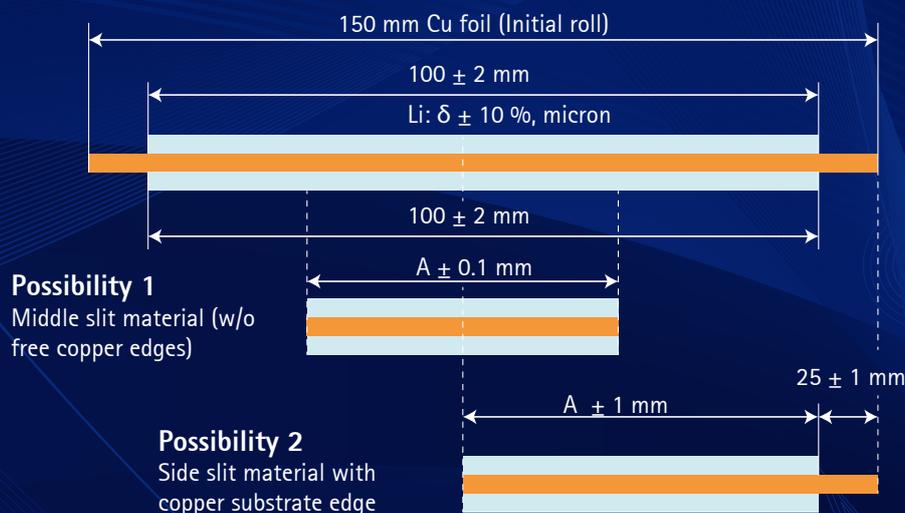
Comparison of batteries with conventional rolling and PVD coated Li

## Capabilities of PVD Lithium coating equipment in Sidrabe laboratory

- SIDRABE has research and development areas for Li coating investigation and samples manufacturing under contracts with potential customers. We keep SIDRABE made two Laboratory Roll-to-Roll Lithium coaters associated with Dry Room and web slit machine inside it. Coated material is transferred into the Glove box for packaging into sealed metal-polymeric bags filled with Argon.
- Both web coaters are equipped with the processor drums, where coating deposition heat is transferred through the gas gap (so-called "venting drums", designed by SIDRABE). The web effective cooling allows to deposit thick layer in the single pass. At preliminary works execution we obtain actual information on design and process parameters on coming production scale equipment.
- Sidrabe can steadily deposit up to 20 microns of continuous single-sided or double-sided Li on more than 8...10 microns thick metallic foil and up to 10 microns of Li on PP or PET films. In case of PET film it is necessary to deposit preliminary a metallic sub-layer to prevent Li interaction with polymer moisture.



An example of double-side Li coated foil and initial roll slit geometry





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