

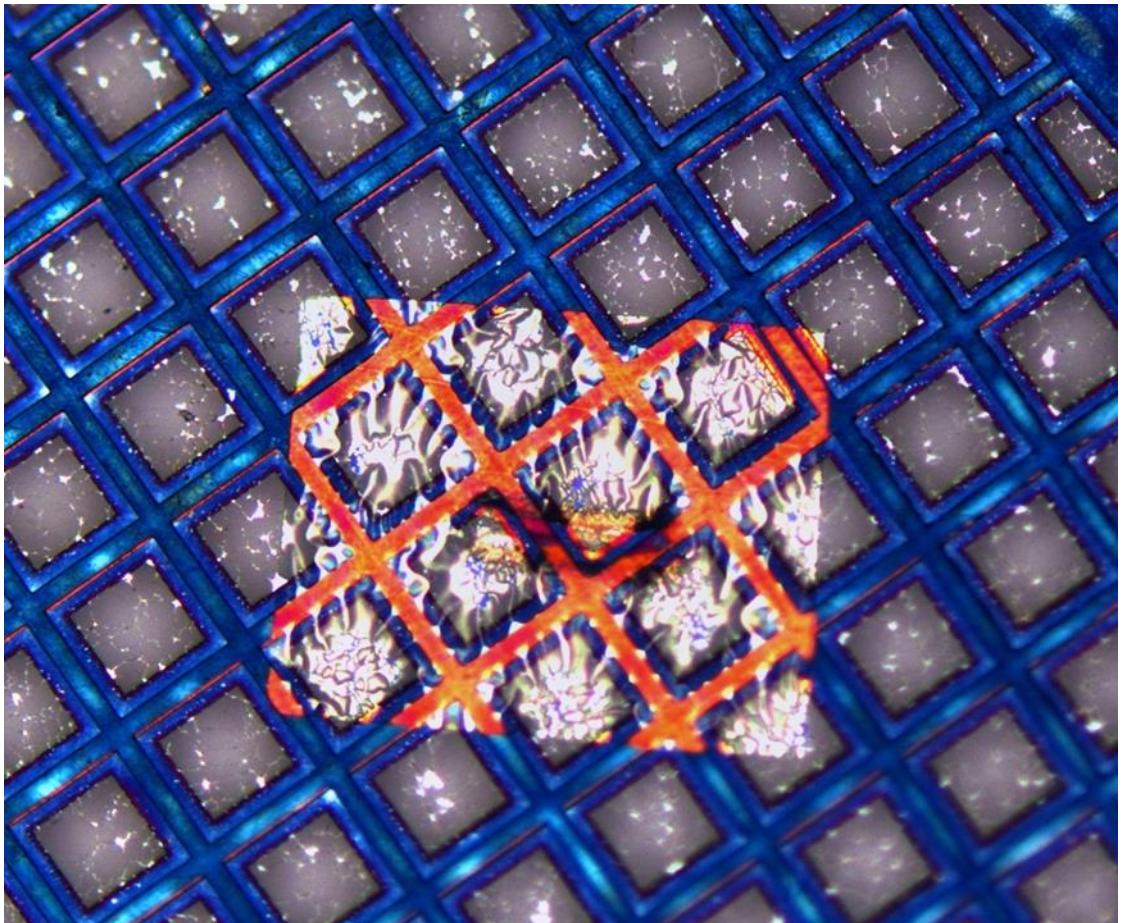
# New progress in Ultramicrotomy



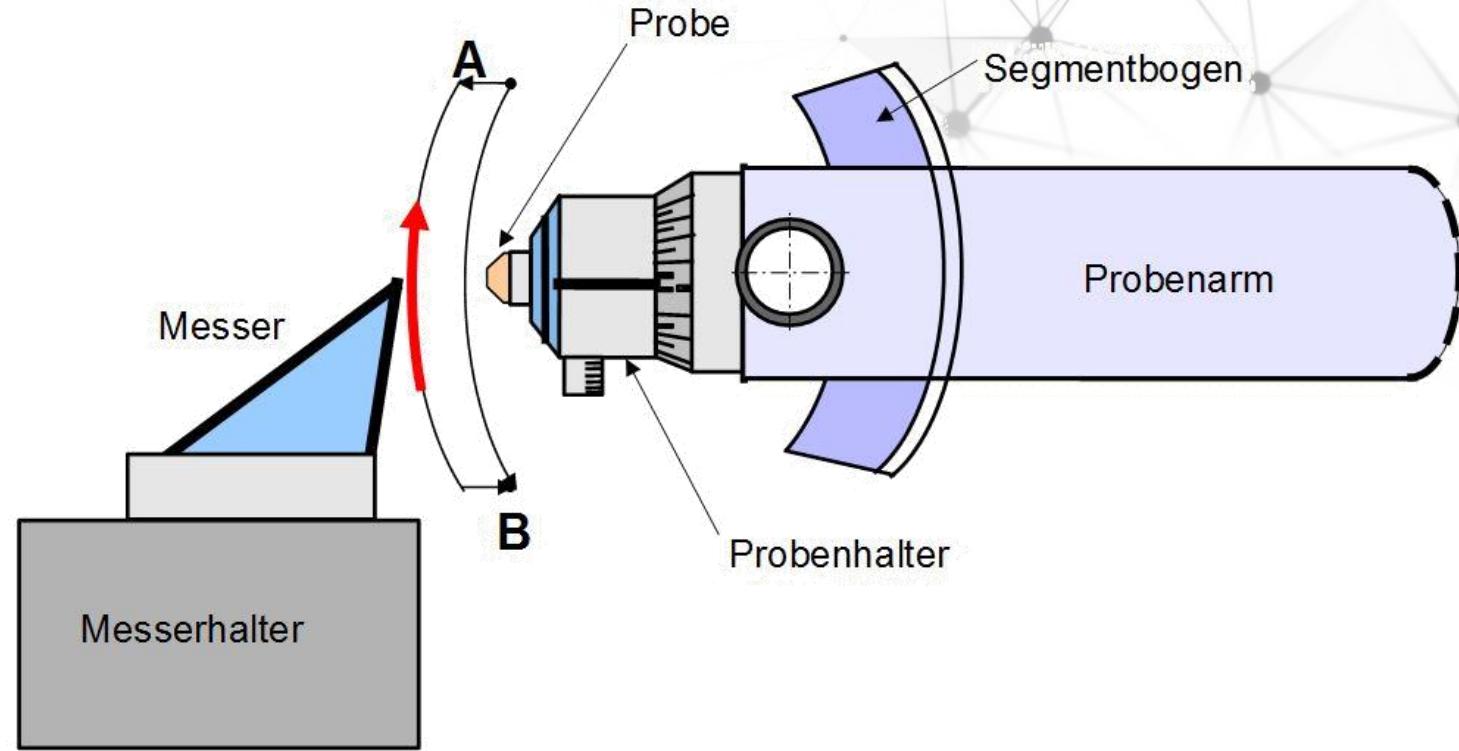
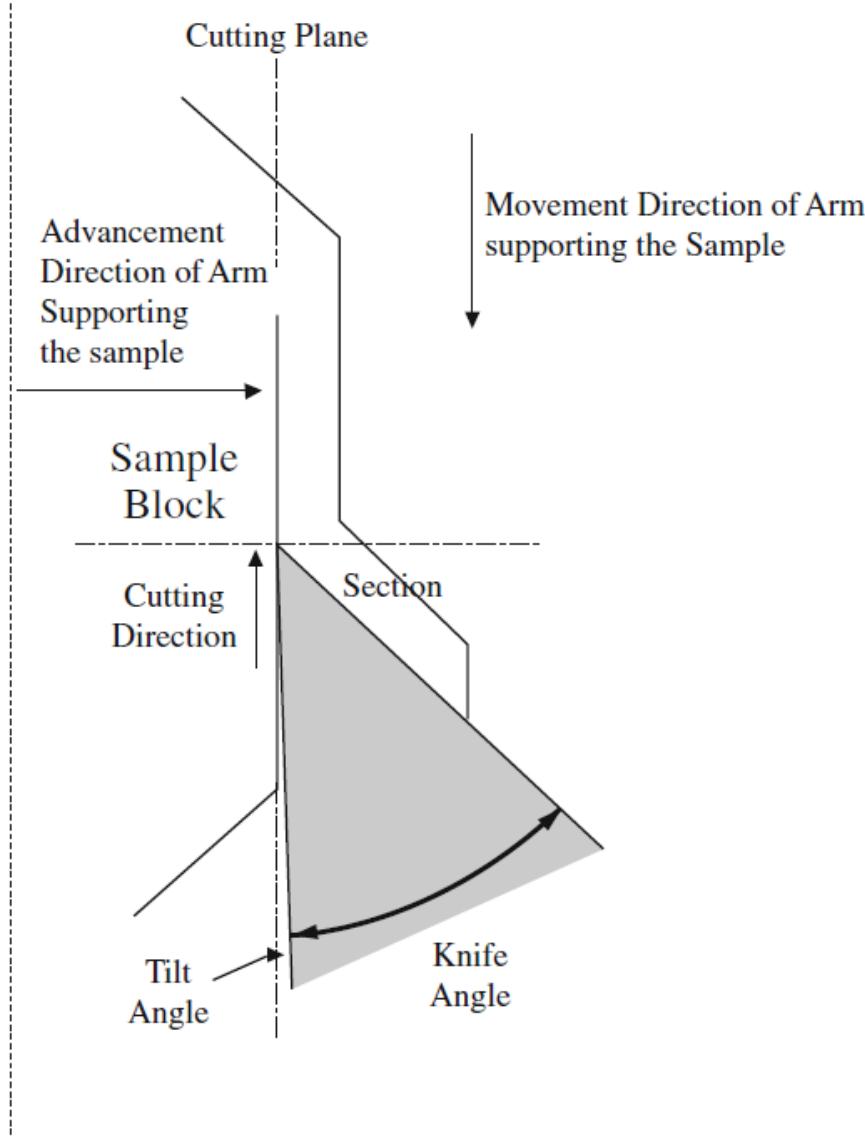
Micro- and Nanoanalytics Group  
University of Siegen, Germany

Marco Hepp

LMN Seminar  
18.11.2020



# Basics of Ultramicrotomy



# Preparation steps PEMFC

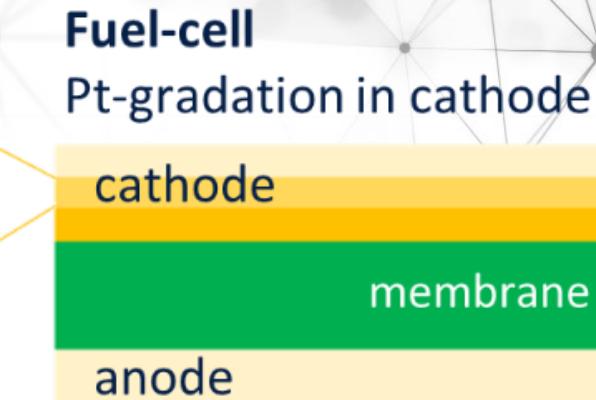


Leica Microsystems

**cutting**



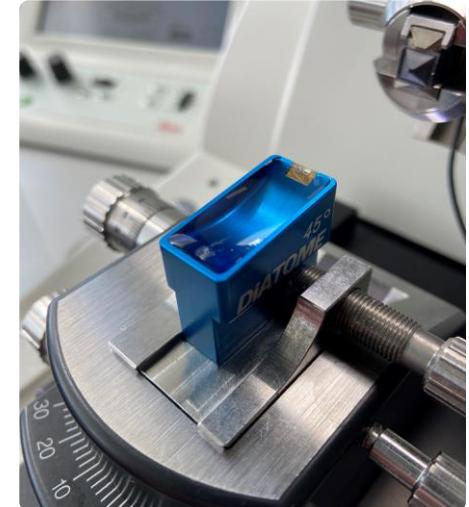
**embedding**



**trimming**



**microtoming**



<https://wiki.polymerservice-merseburg.de/index.php/Ultramikrotomie>

# Preparation steps PEMFC



Leica Microsystems

**cutting**



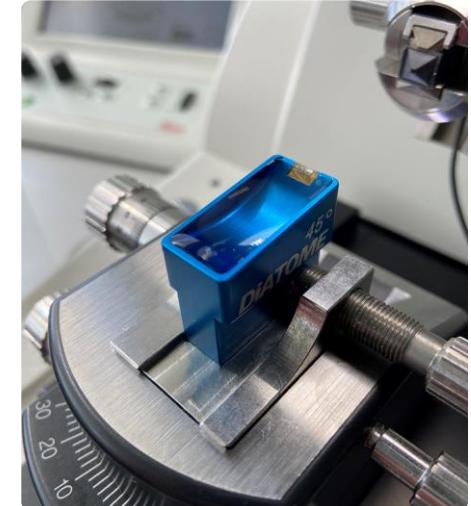
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**trimming**



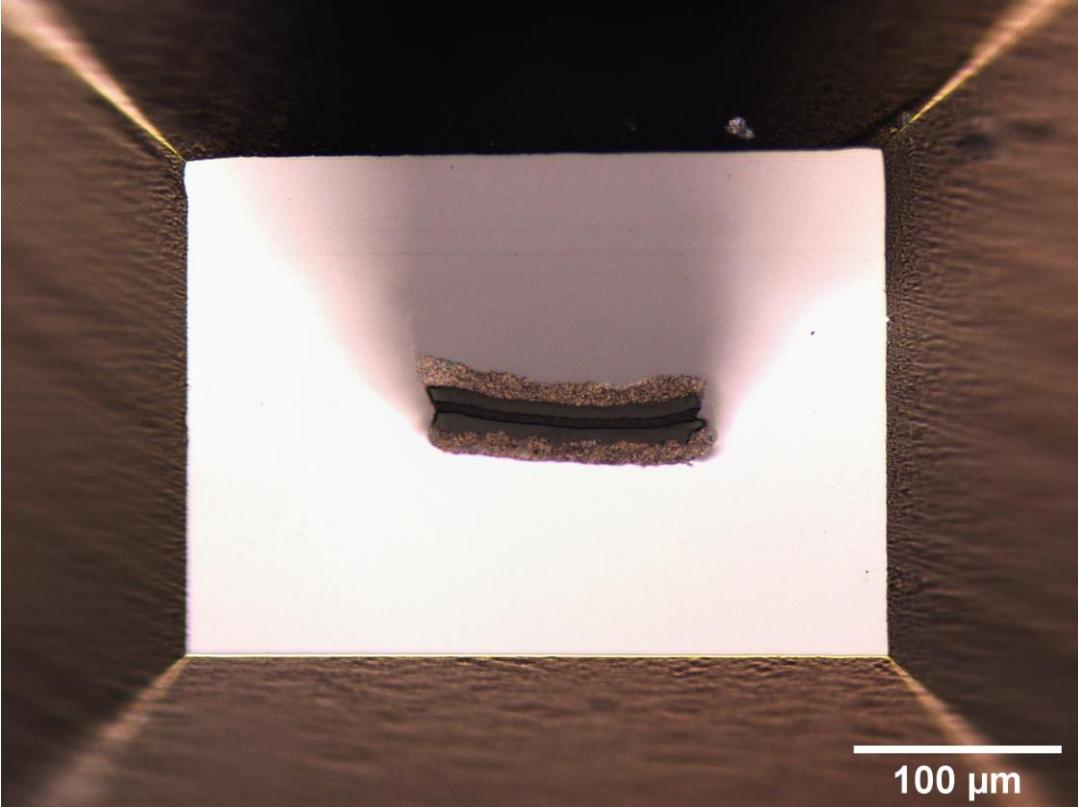
**microtoming**



<https://wiki.polymerservice-merseburg.de/index.php/Ultramikrotomie>

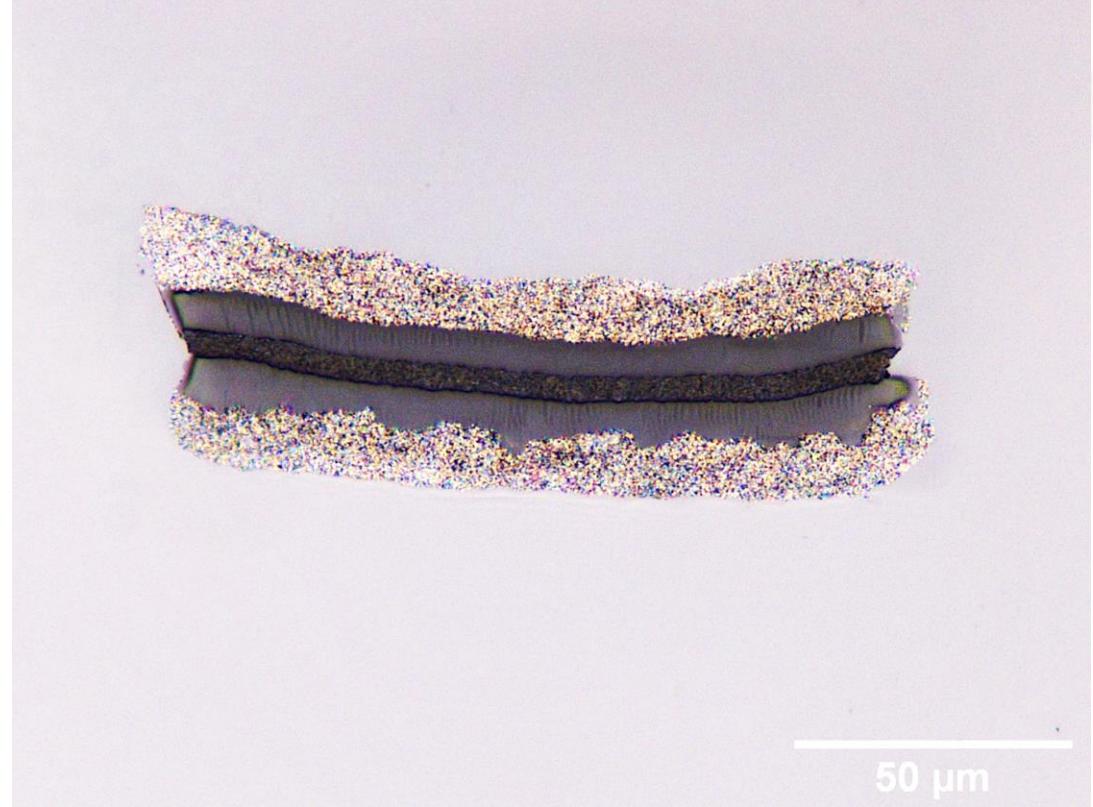
# Results - Optical Microscopy

View →

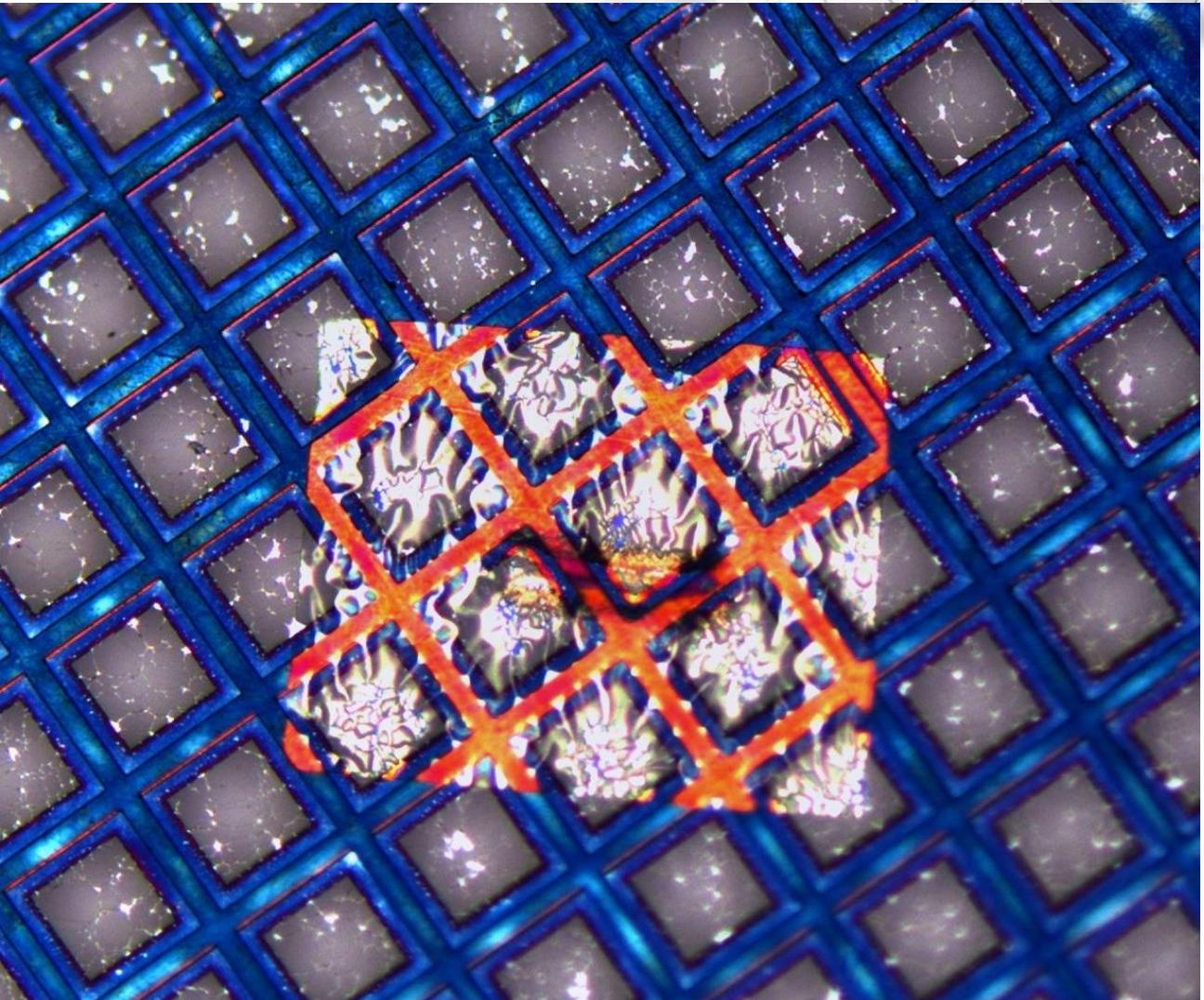
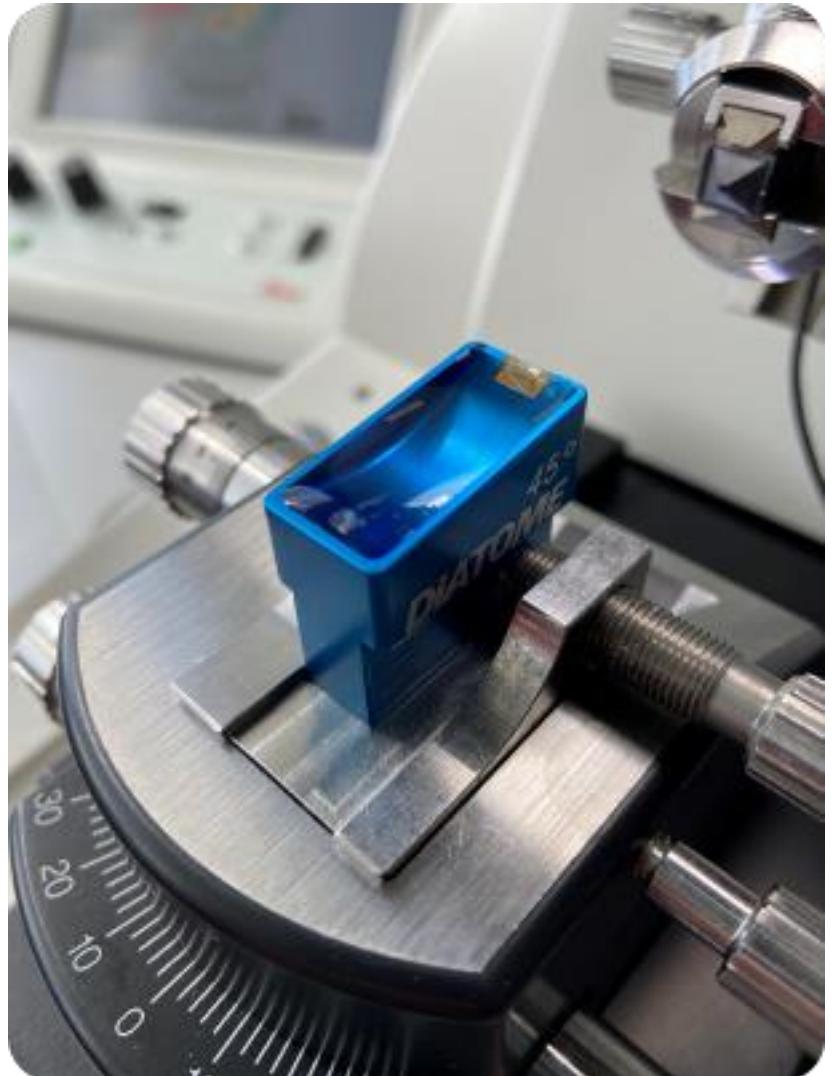


**20x**

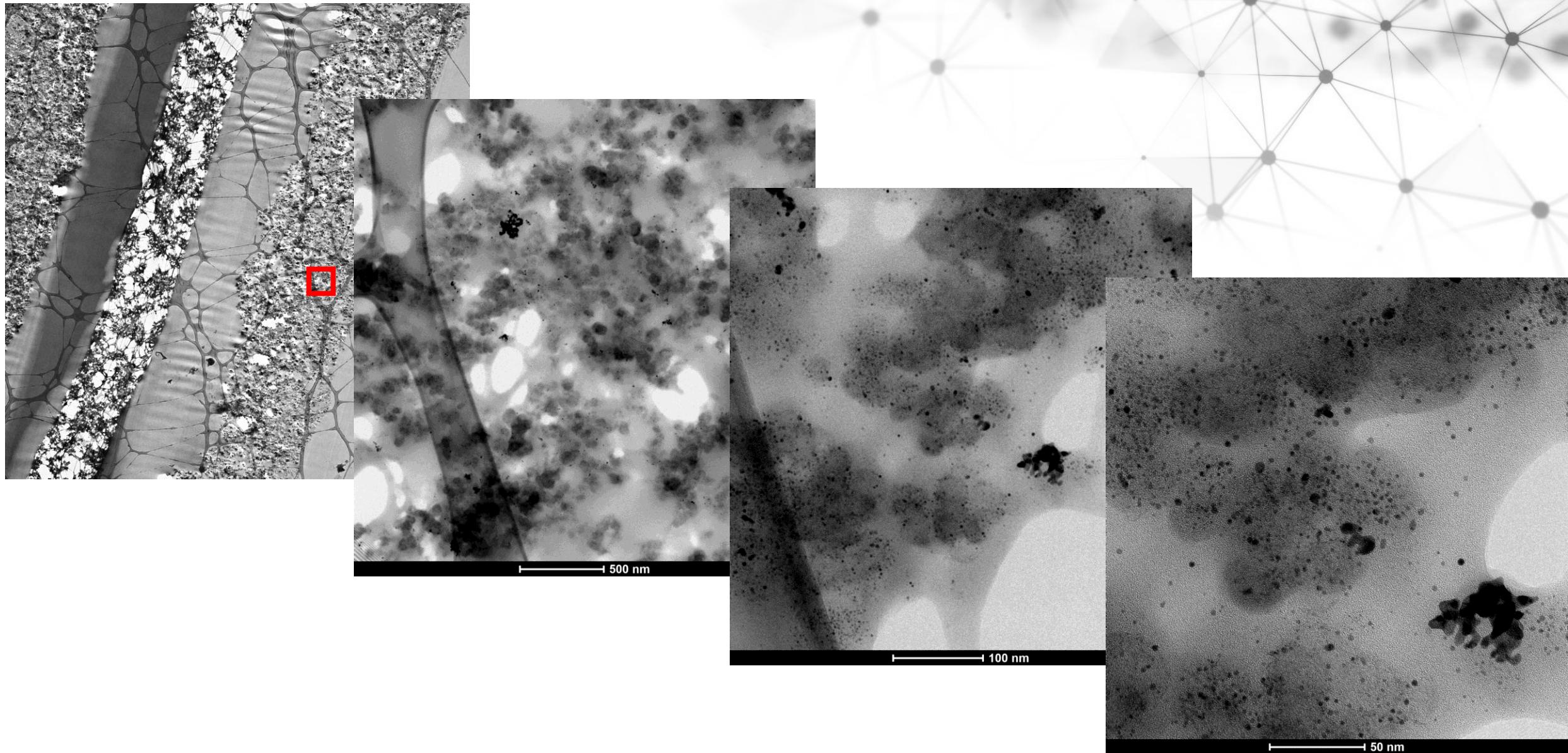
**50x multifocus**



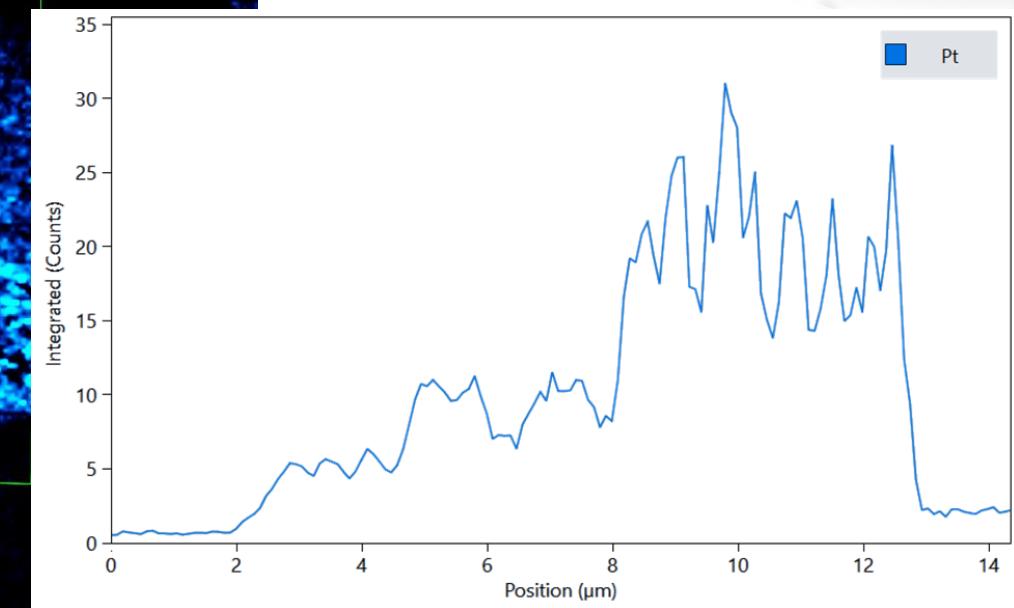
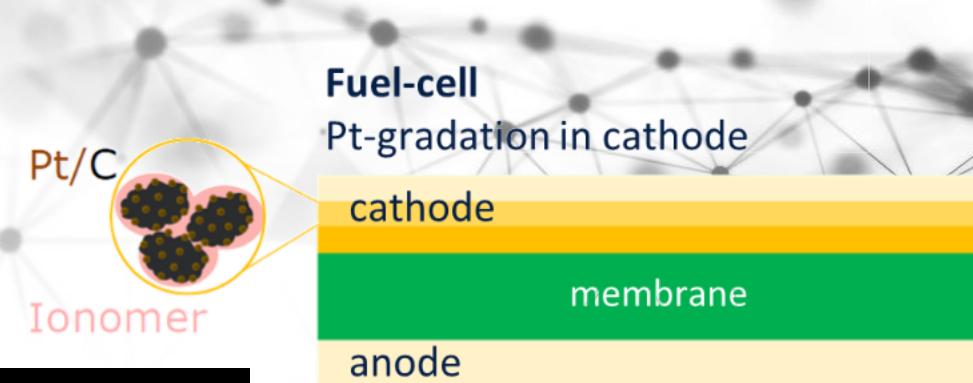
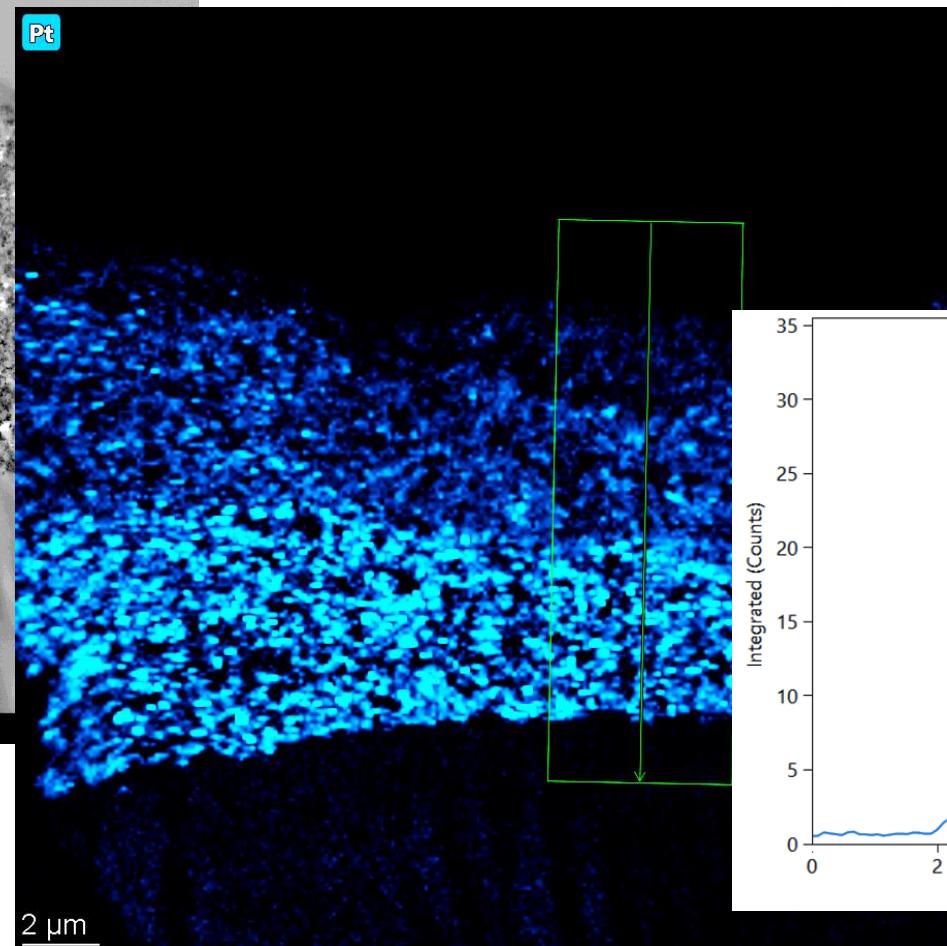
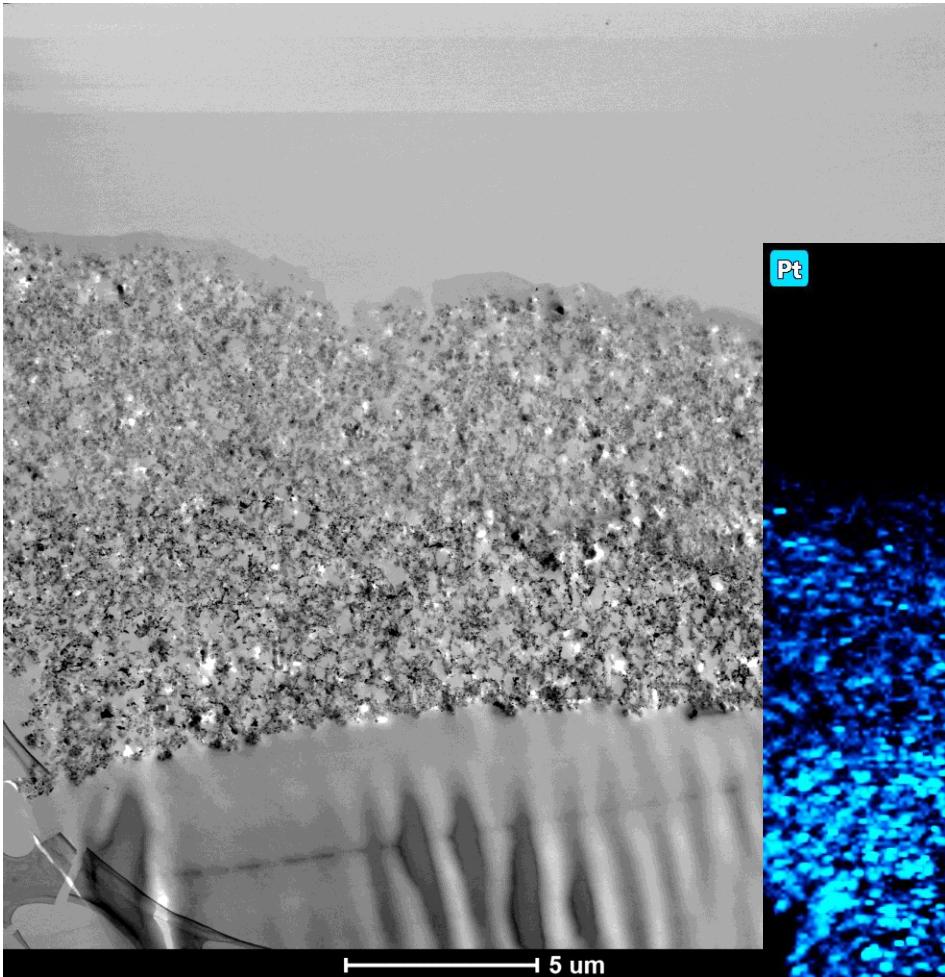
# Sample on TEM-grid



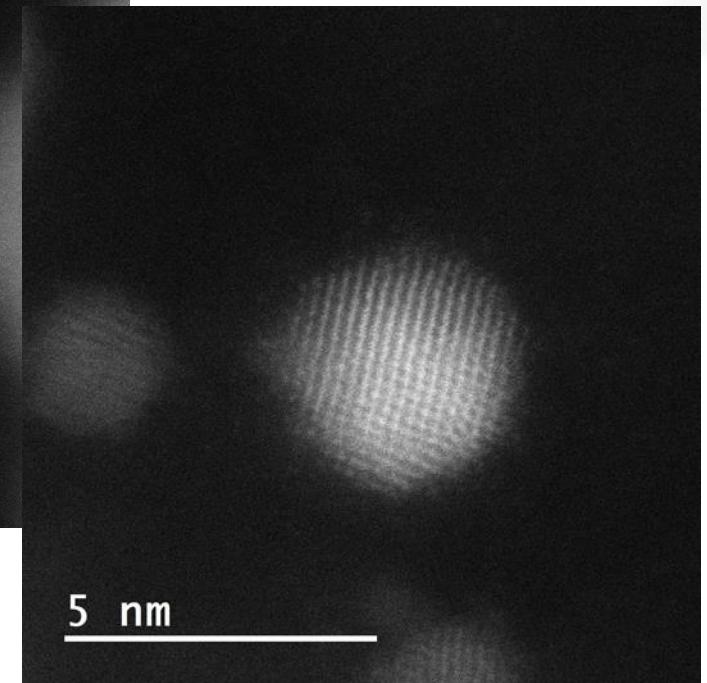
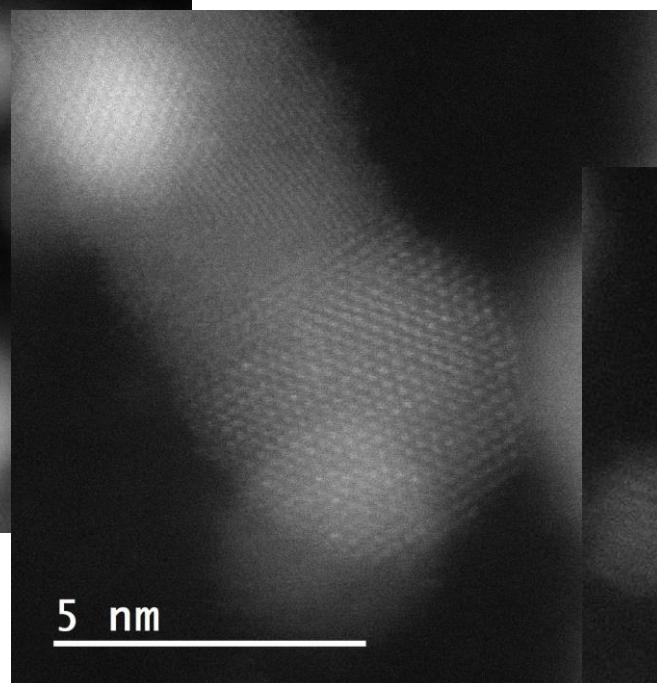
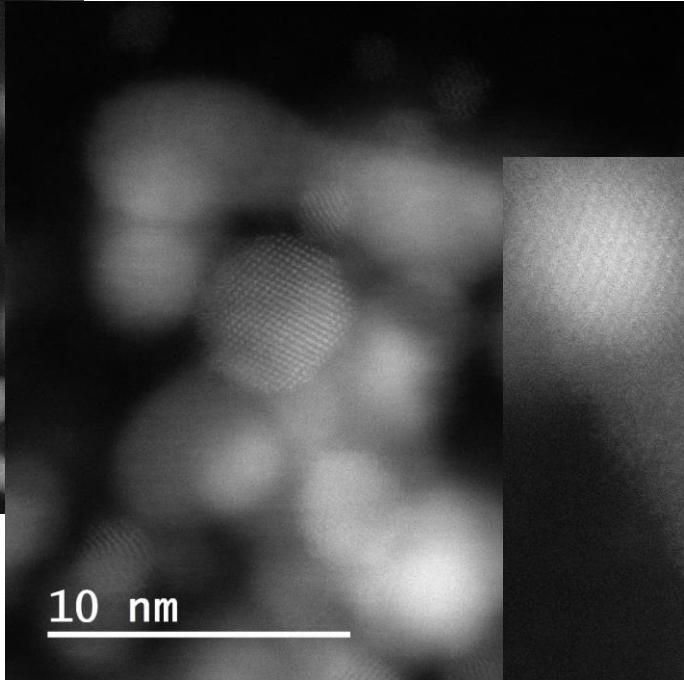
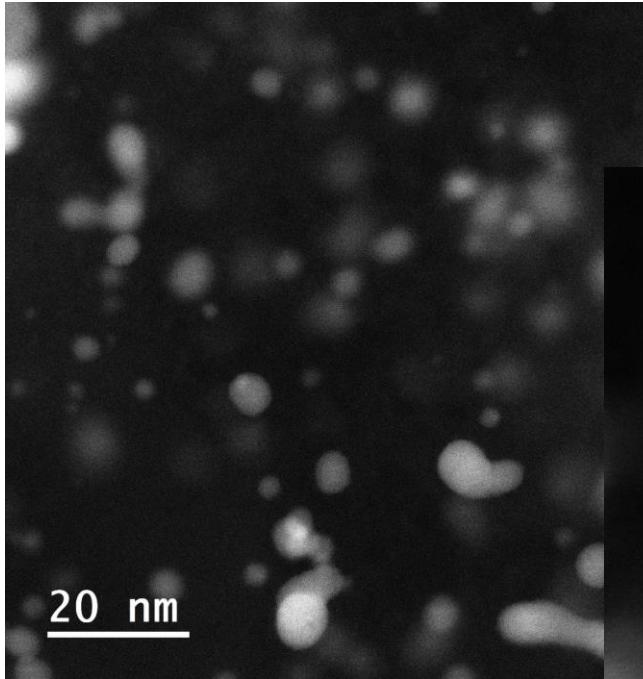
# TEM-BF



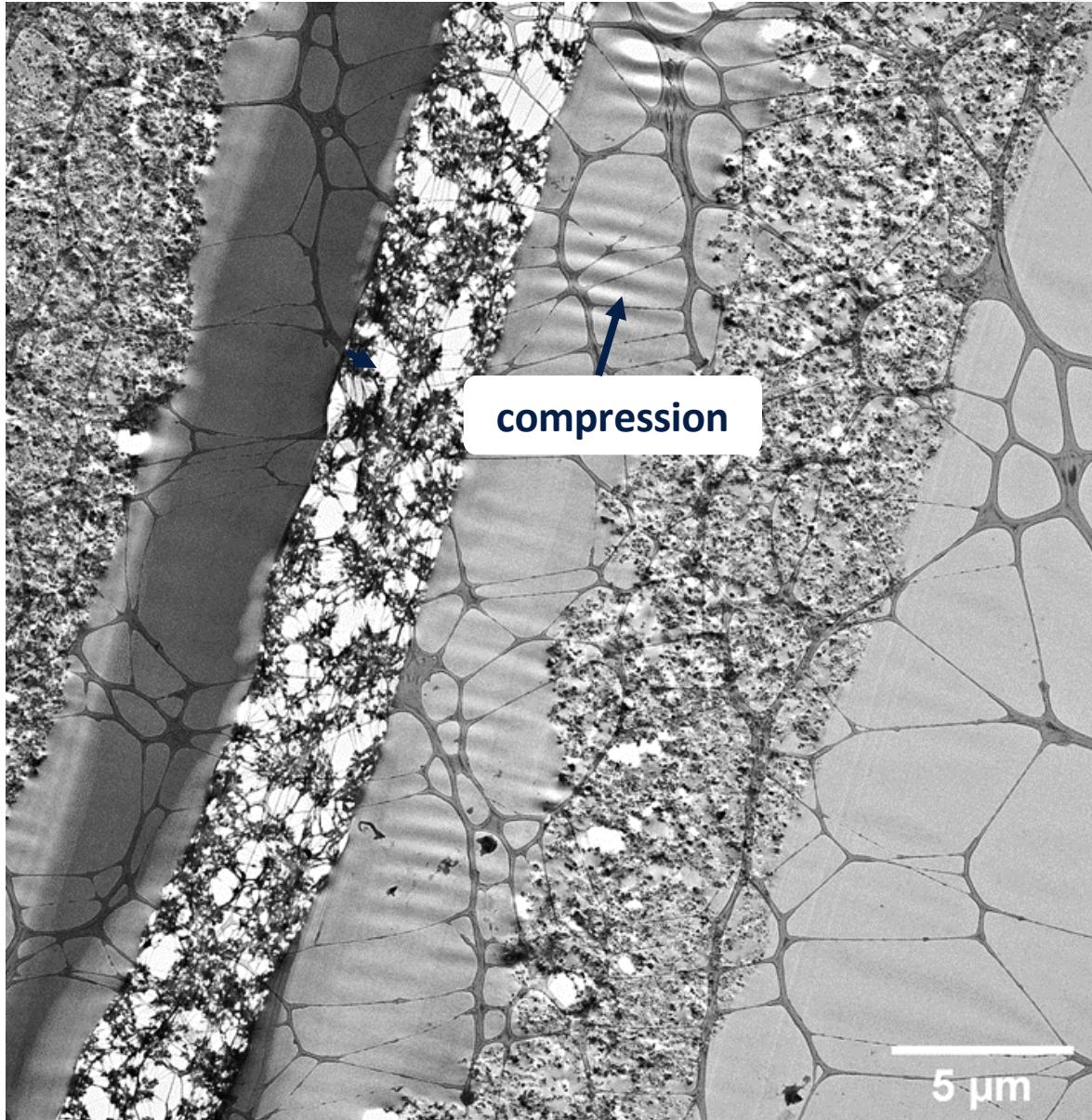
# STEM-EDX



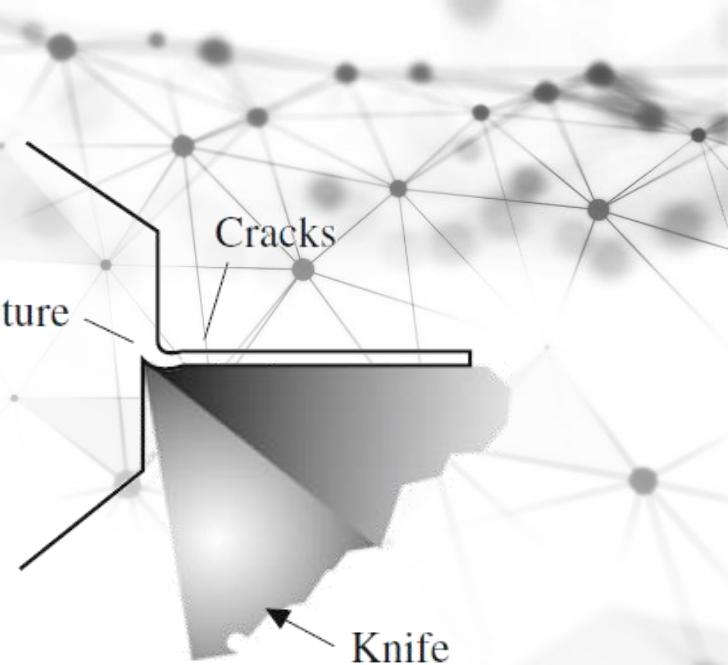
# STEM High Resolution



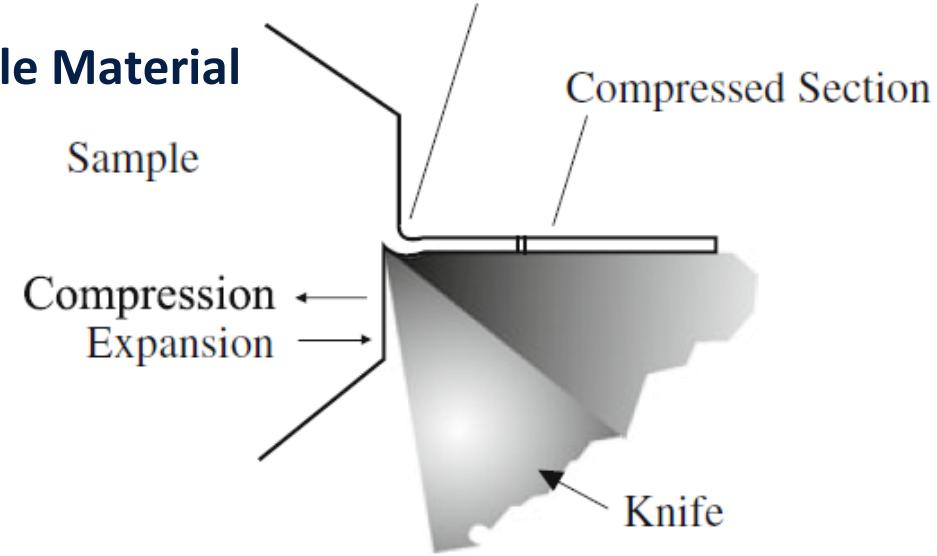
# Artifact



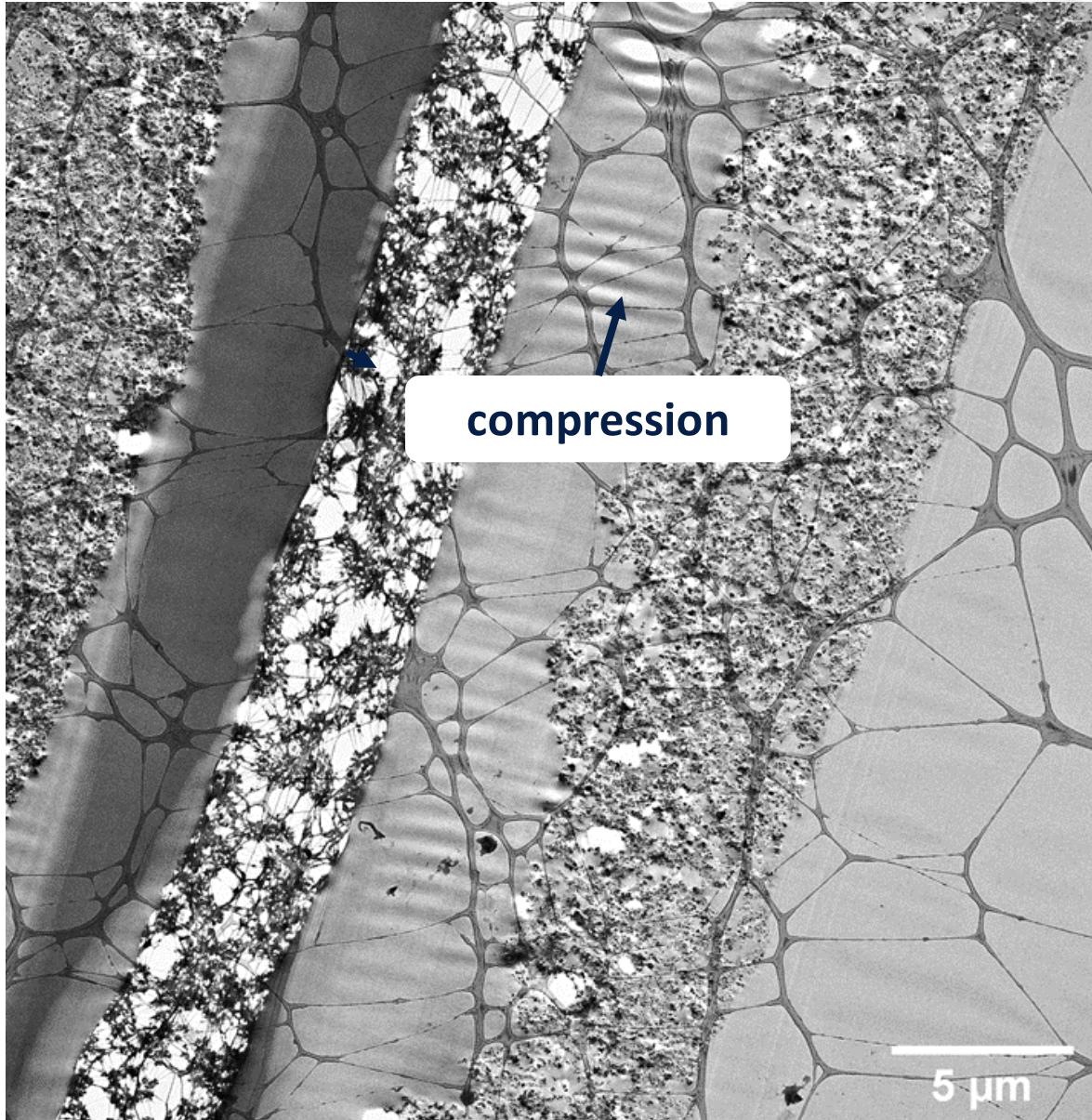
## Brittle Material



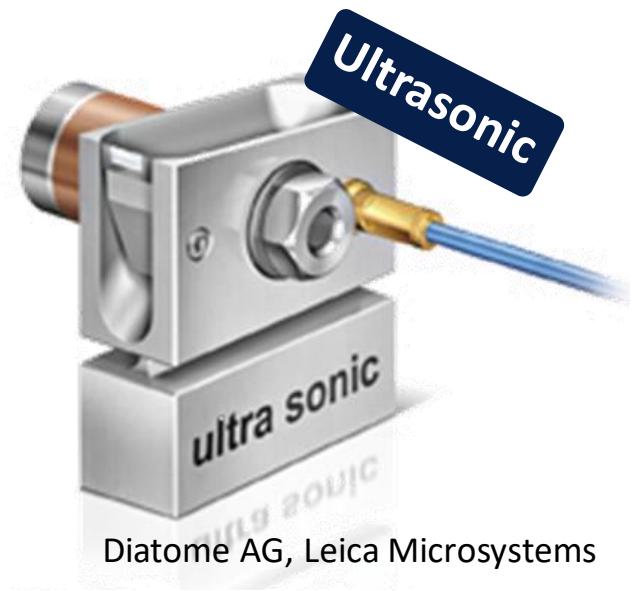
## Ductile Material



# Artifact

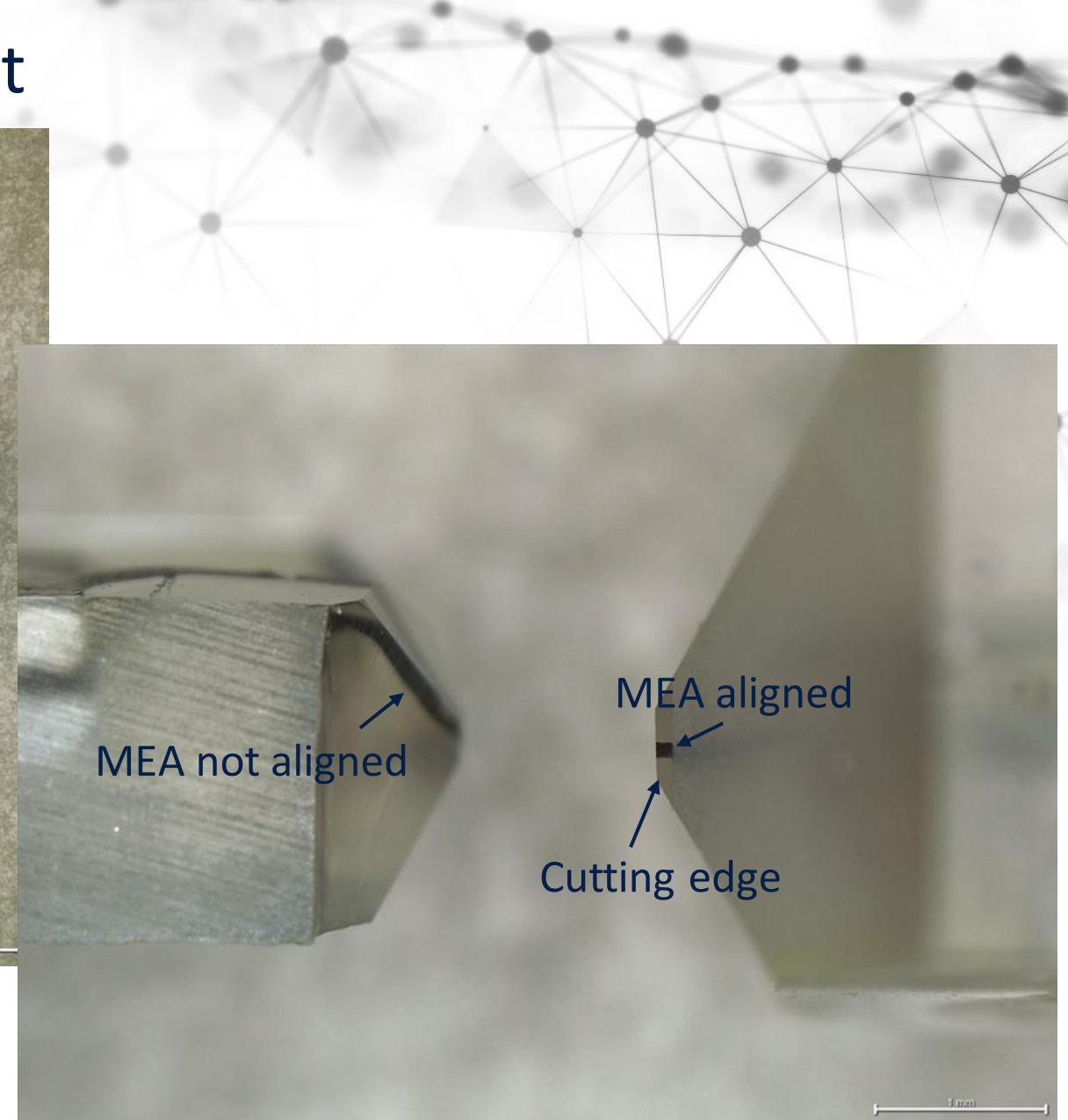
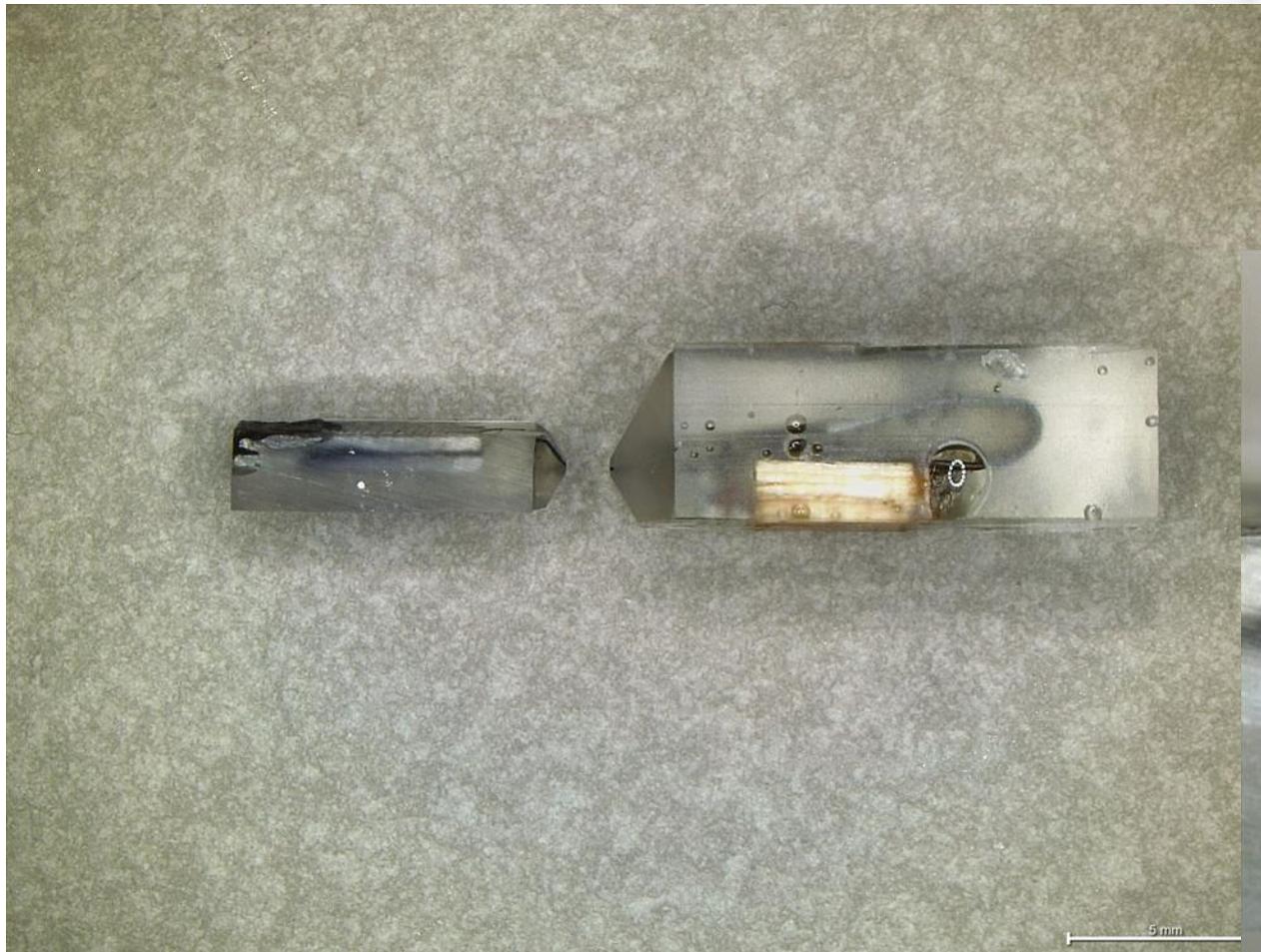


# Solutions

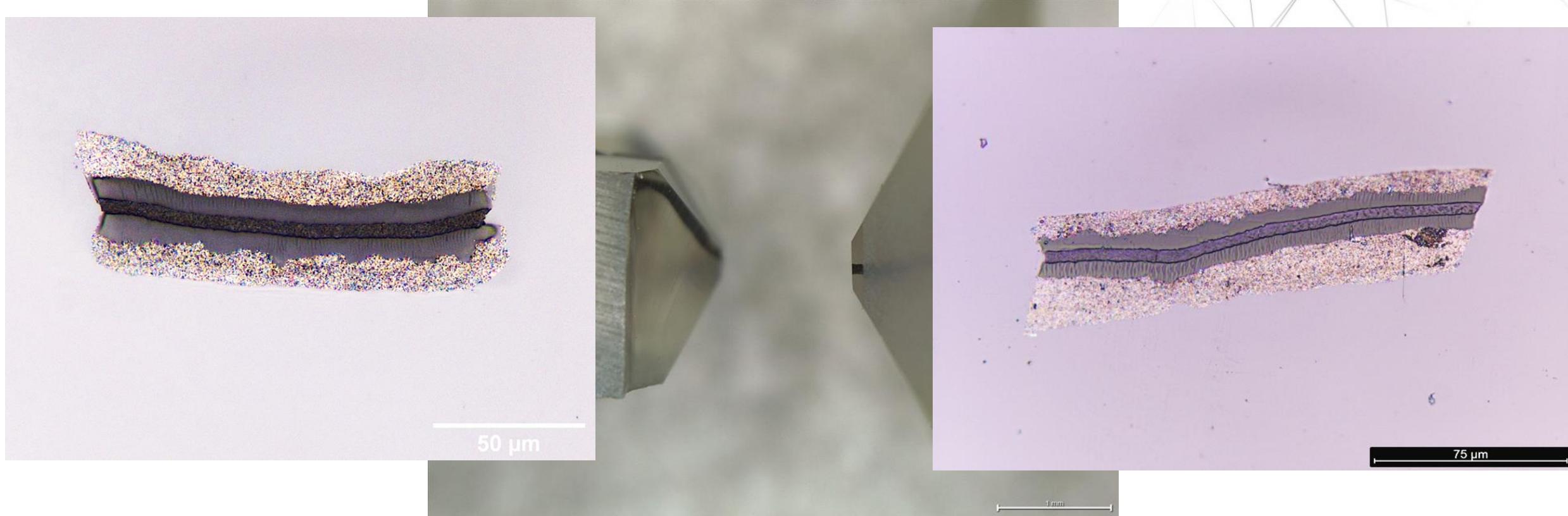


Diatome AG, Leica Microsystems

# Thickness Measurement - Alignment



# Thickness Measurement



# Perspective: Preparation of highly reactive materials and devices



Ultramicrotome

LN<sub>2</sub>-Cryochamber



Cryosphere



Reduction of  
reactivity & artifacts



Solar-cell



TEM



TEM transfer holders  
Cryo & Inert-gas

# Conclusion and outlook

- Ultramicrotomy can produce high quality cross-sections of PEMFC for observation with OM, SEM and TEM
- Evaluation of catalyst layer structure, contacting between the layers and Pt-distribution is possible
- Alignment of embedded samples has to be optimized
- Next steps: Ultrasonic-Cutting and Cryo-Cutting of reactive samples

