Sample preparation and imaging

Application study

Technoorg-Linda Co. Ltd., 2017

Technoorg-Linda Co. Ltd.

SEMPrep2

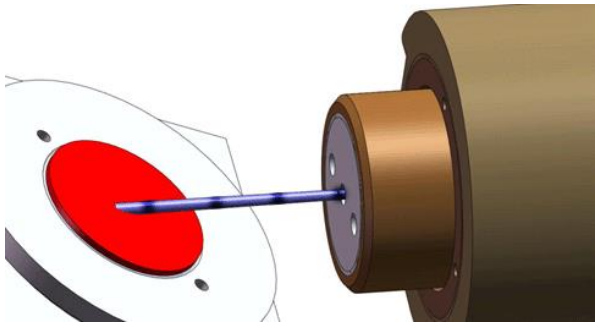
SEMPrep2 ion mill was used to prepare SEM samples (polishing and slope cut)

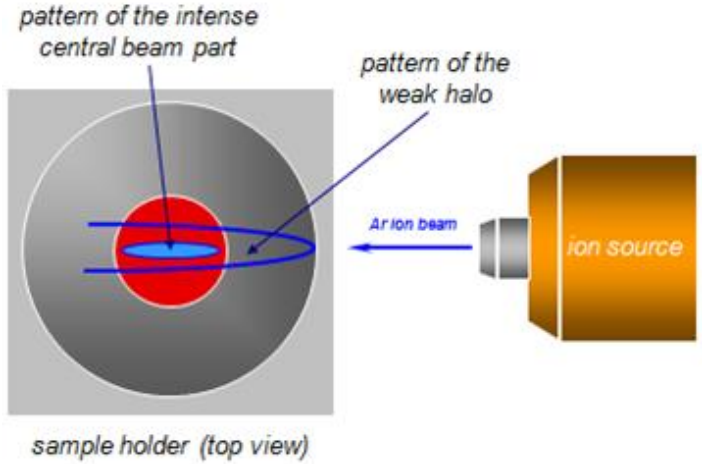
Phenom World B. V.

Phenom XL SEM

Phenom XL SEM was used to take SEM images

BROAD BEAM ION POLISHING

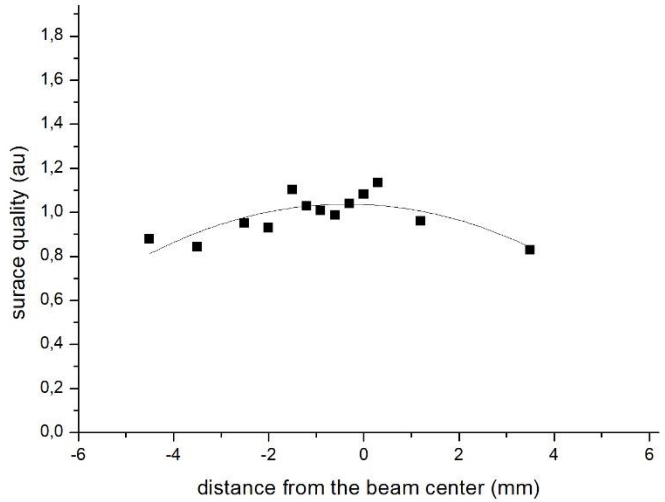


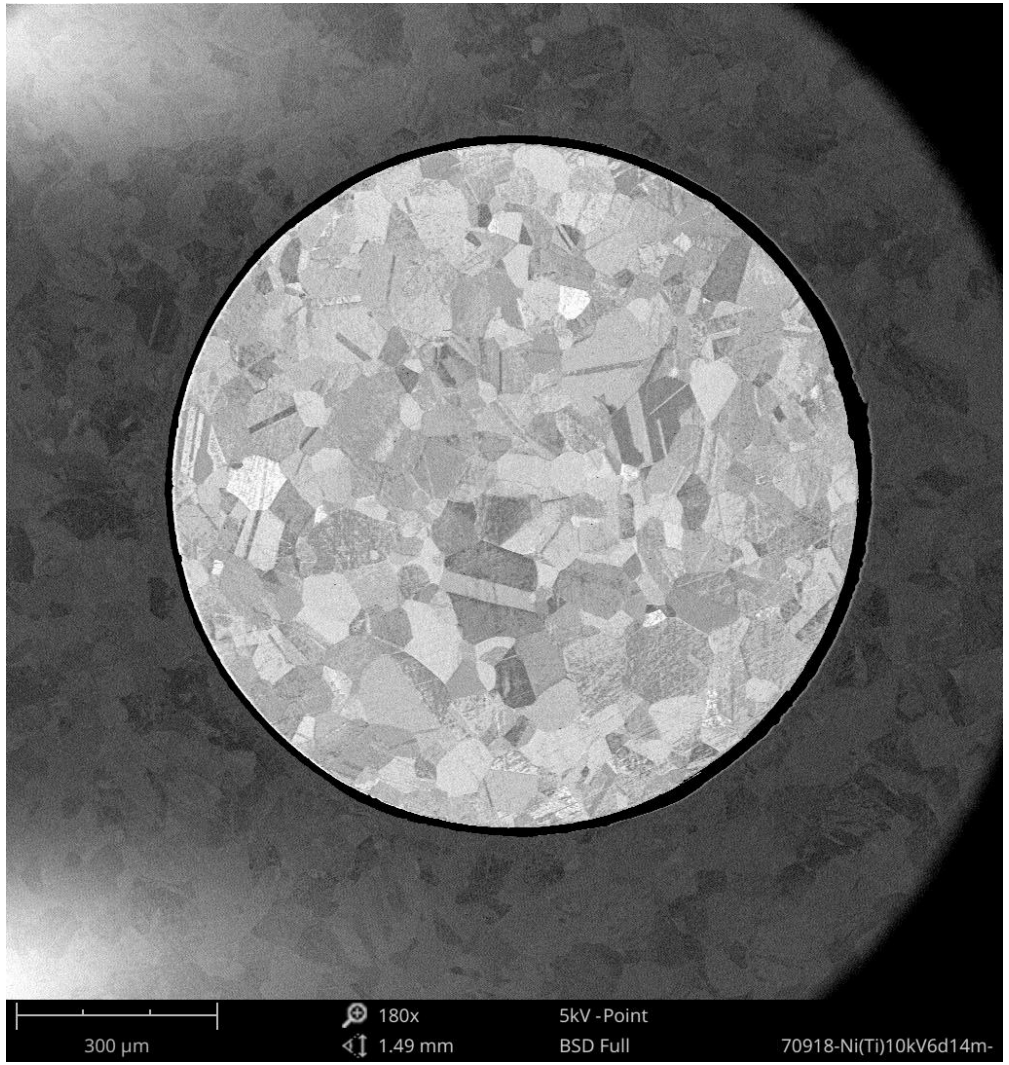


During polishing the sample is **rotated** and **tilted** in the angle range 3º-7º.

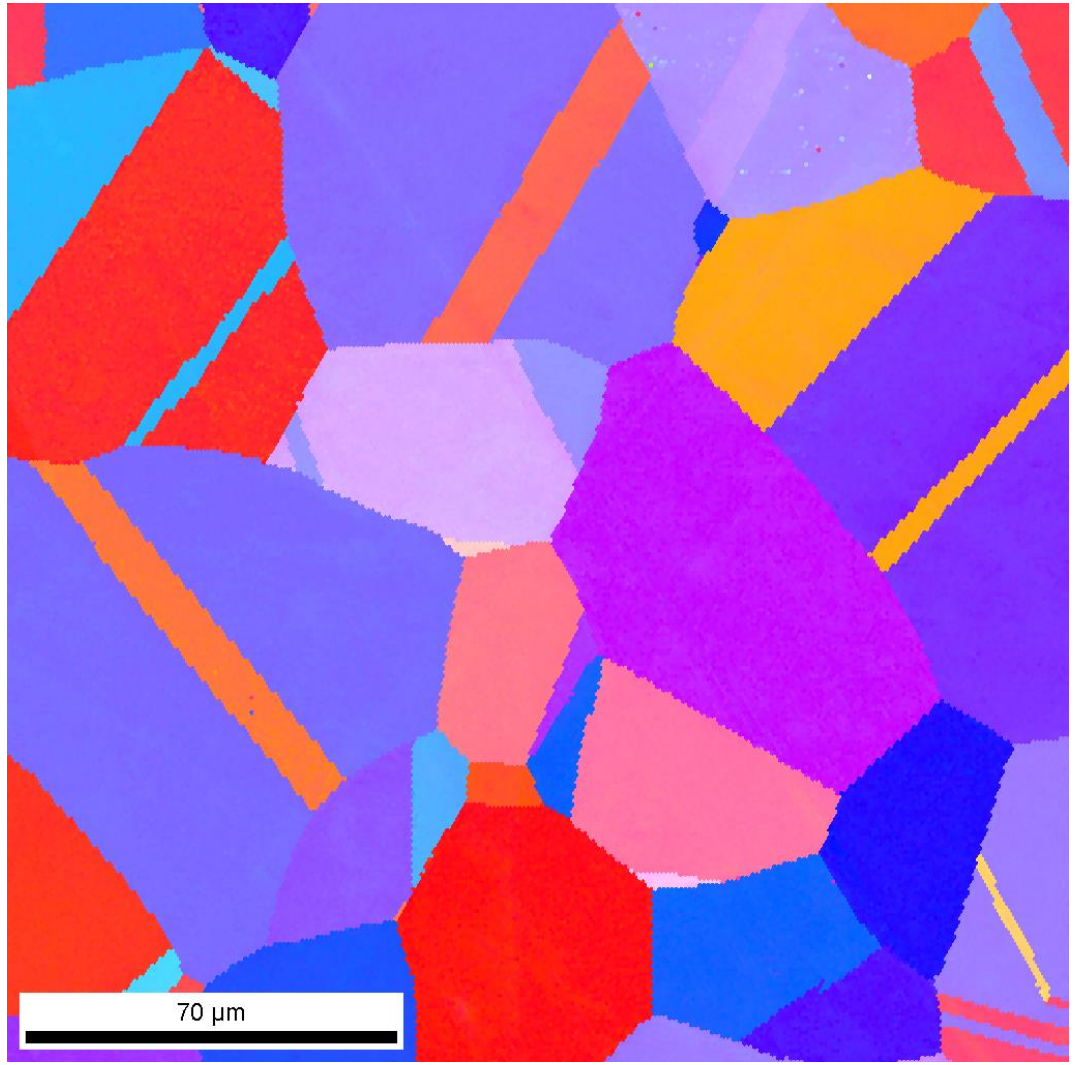
Due to the tilting the beam is elongated on the sample surface.

The treated area is > 100 mm^2,
and the quality is homogeneous within 10%.





Backscattered electron image after Ar ion polishing

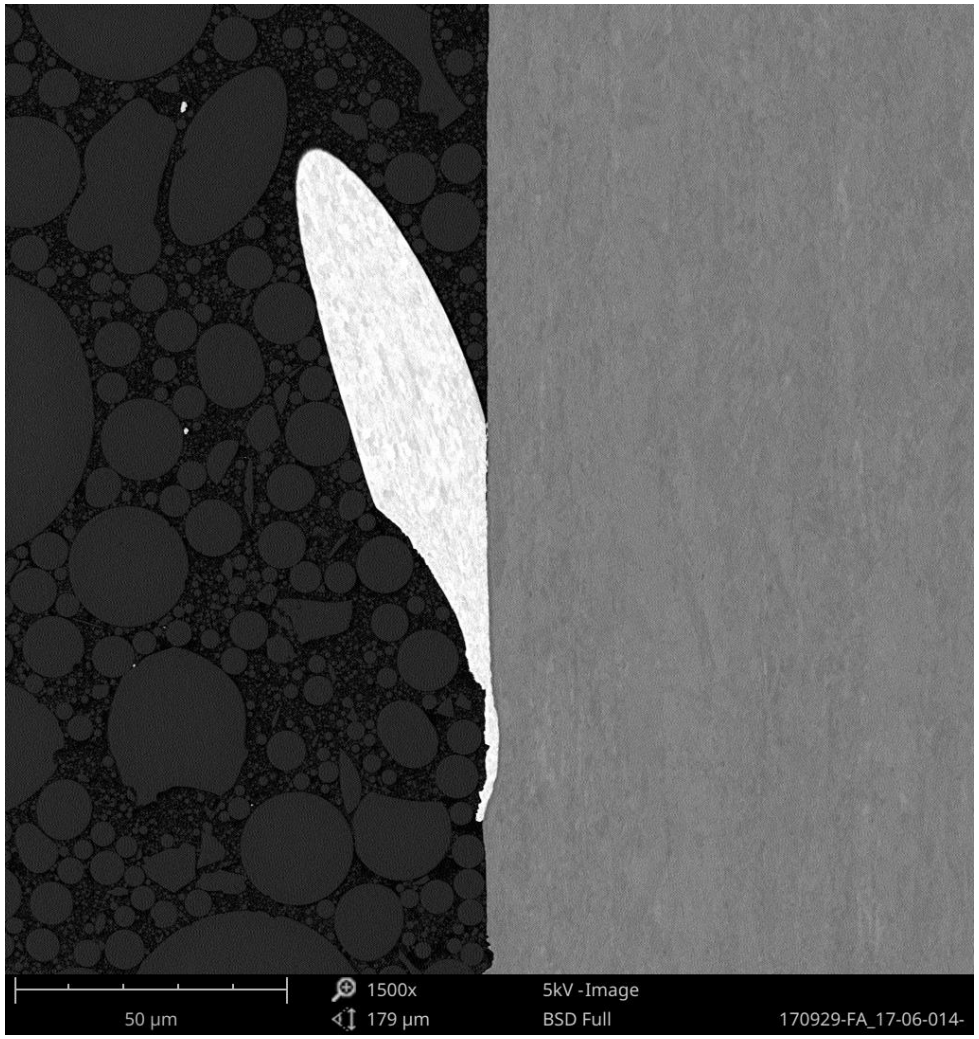


EBSD OM after Ar ion polishing (FEI Quanta 3D, EDAX)

Nickel wire embedded in titanium, surface polishing @ 6°, 10 kV, 14 minutes

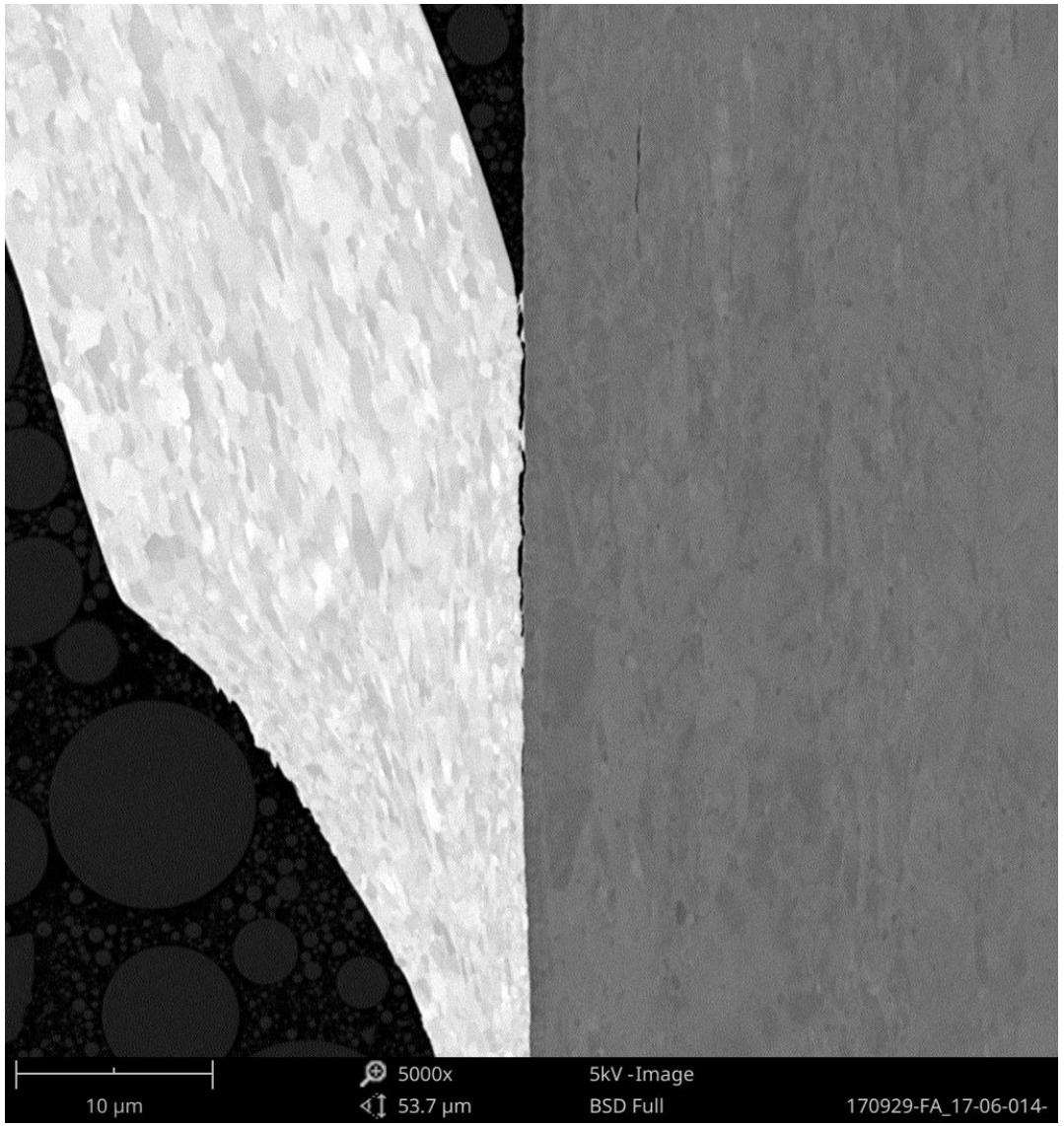
LED, surface polishing @ 6°, 10 kV, 14 minutes

after mechanical treatment

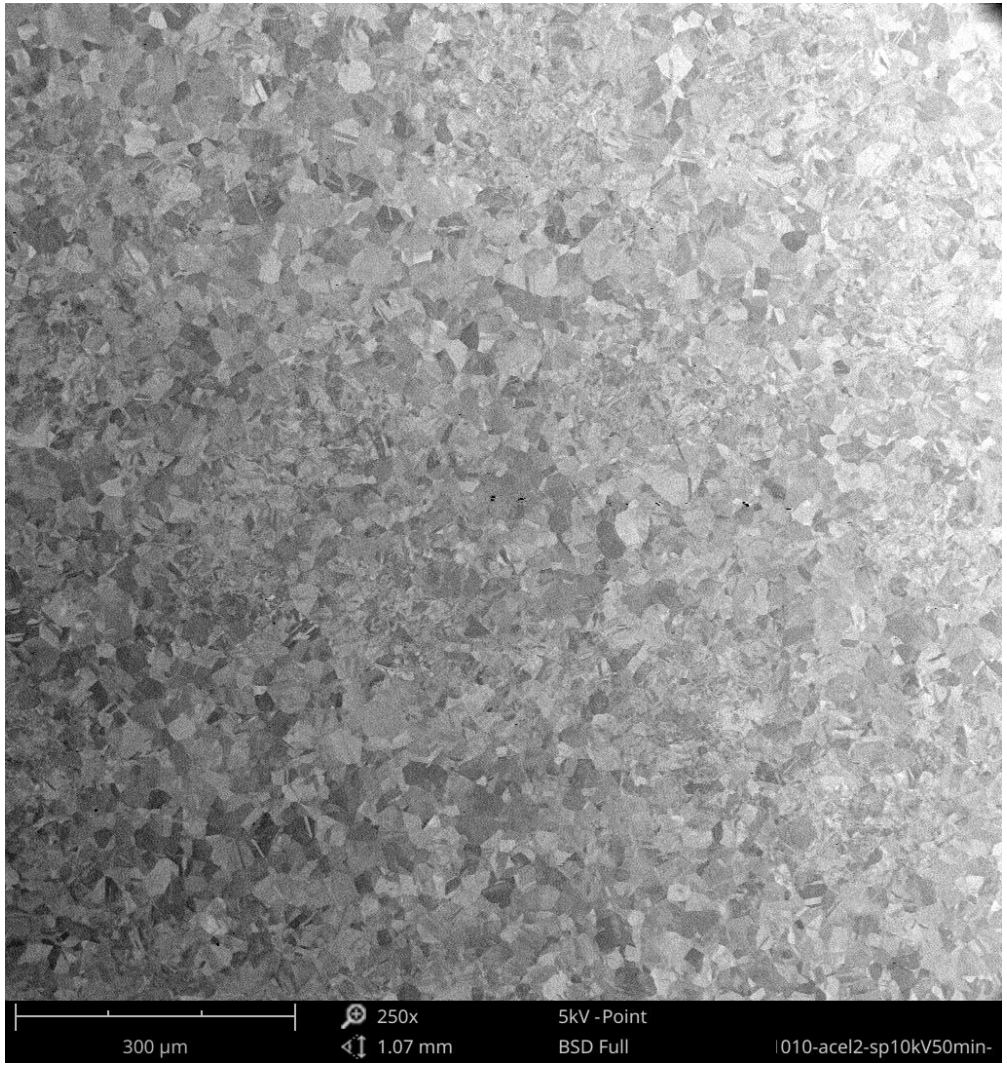


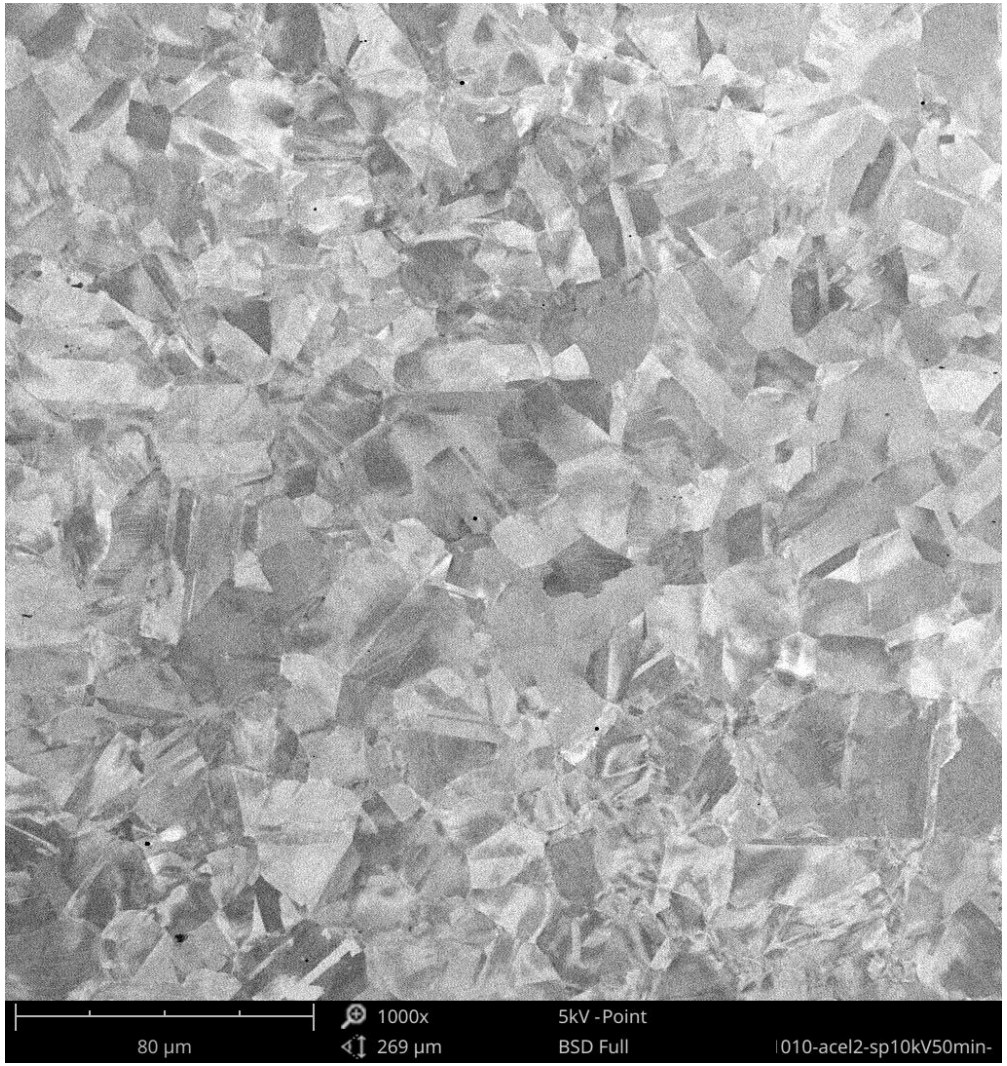
after mechanical and Ar ion treatment

Part of IC, surface polishing @ 5°, 10 kV, 10 minutes

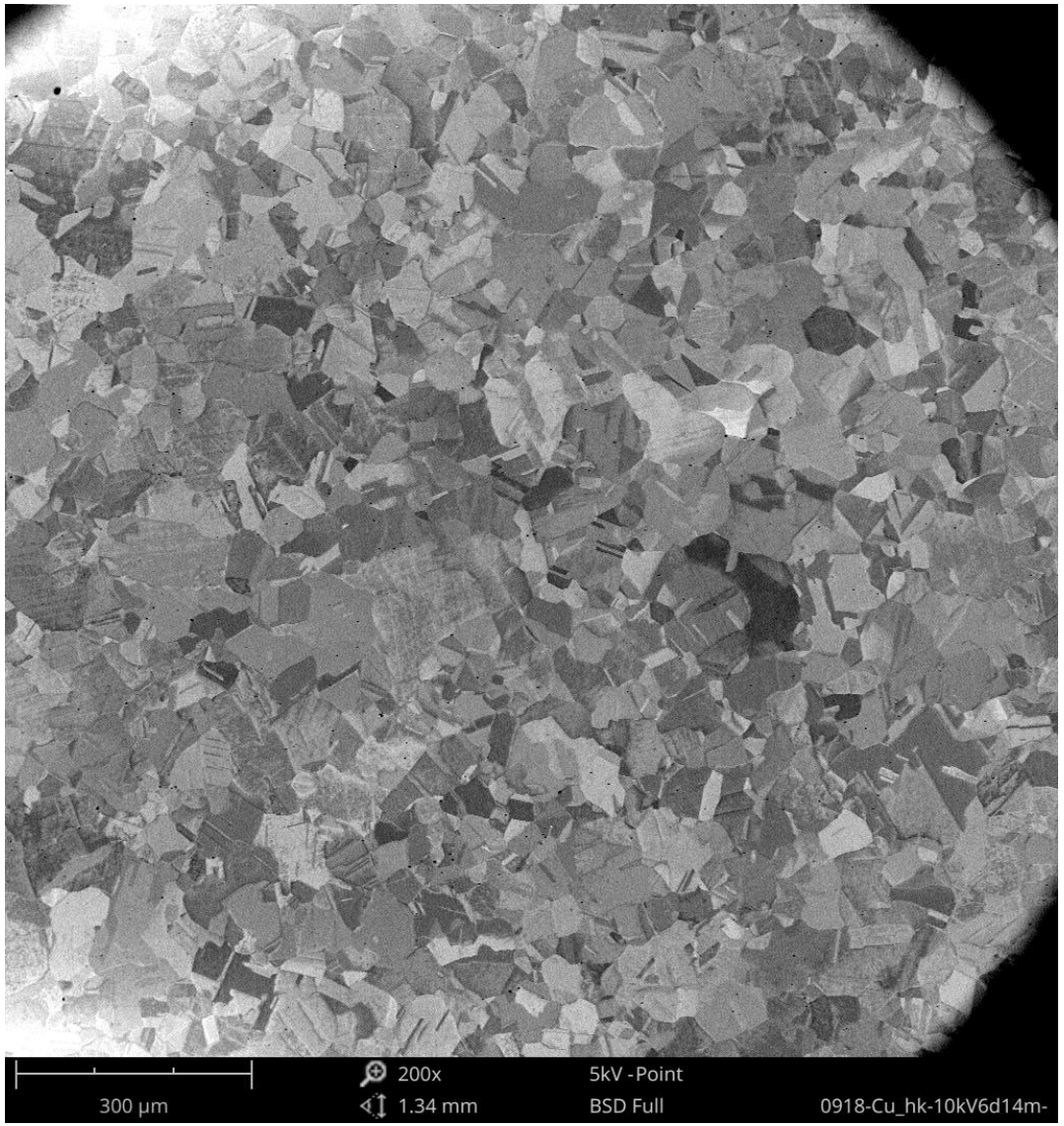


Part of IC, surface polishing @ 5°, 10 kV, 10 minutes

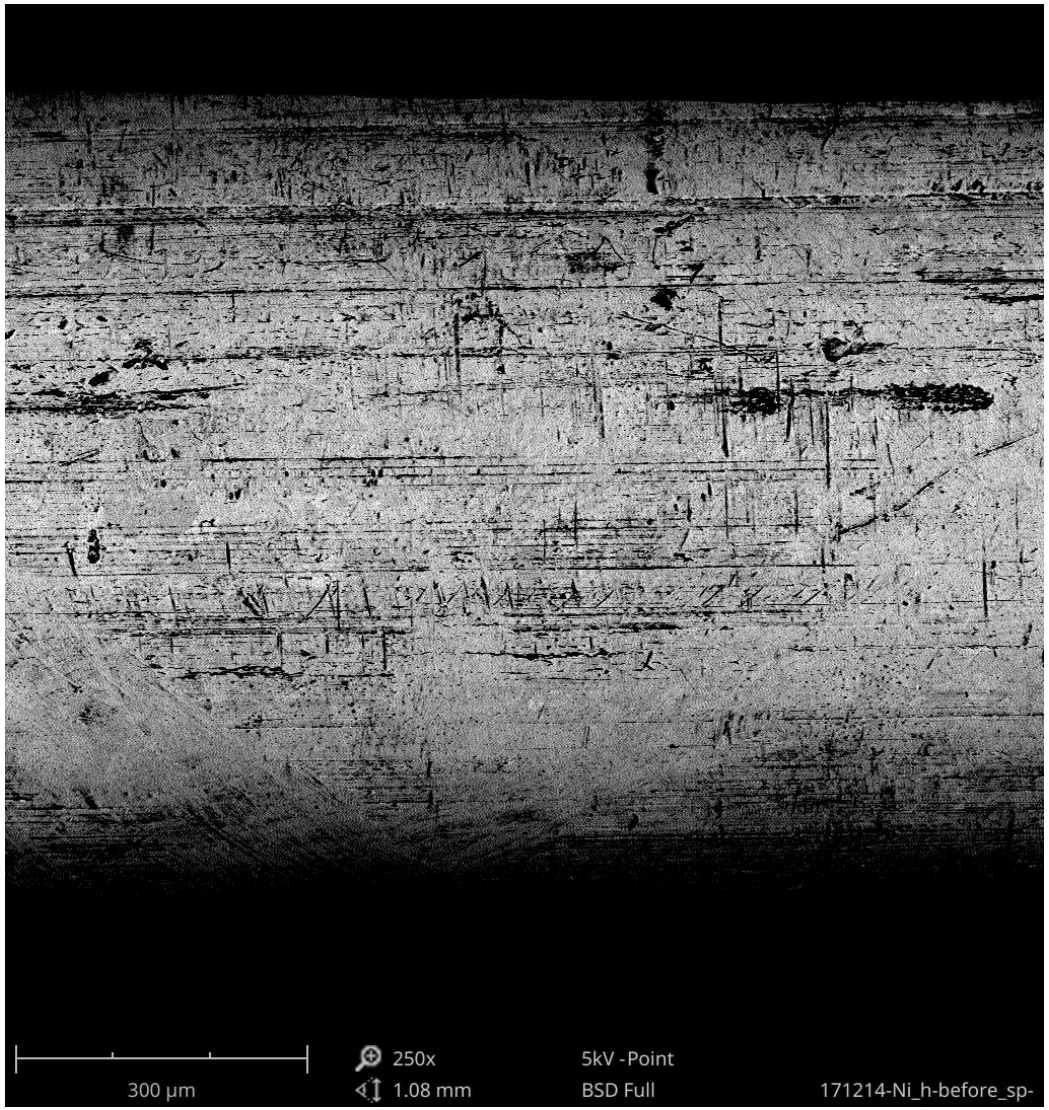


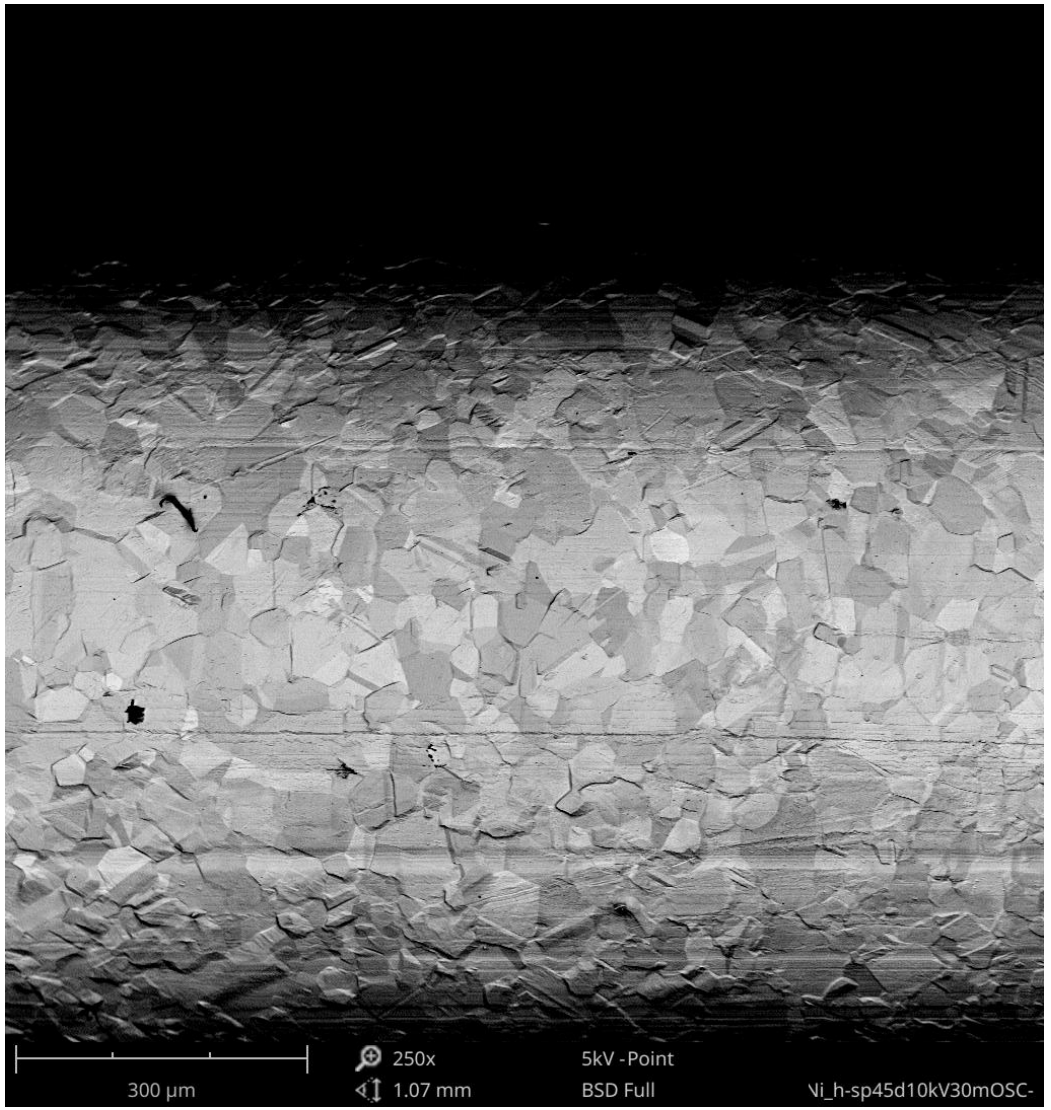


Steel, surface polishing @ 6°, 10 kV, 50 minutes



Annealed copper, surface polishing @ 6°, 10 kV, 14 minutes

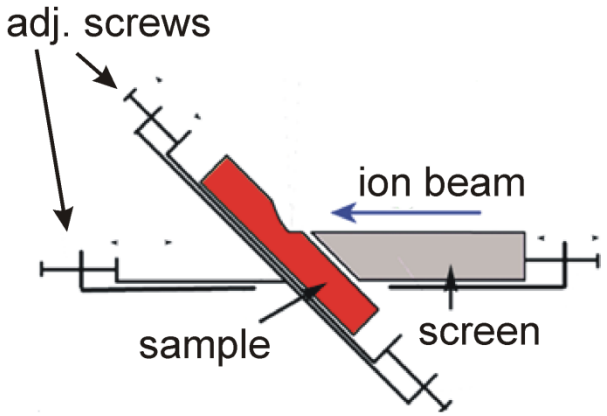


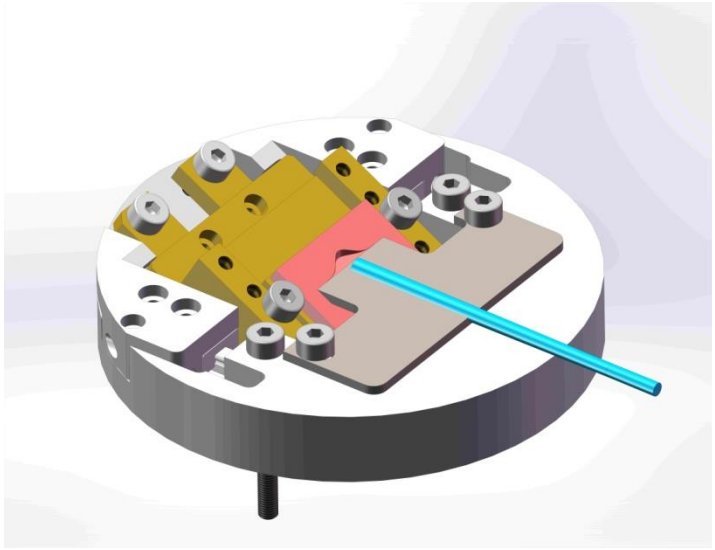


Tungsten wire before and after Ar ion milling (intentionally overtreated)

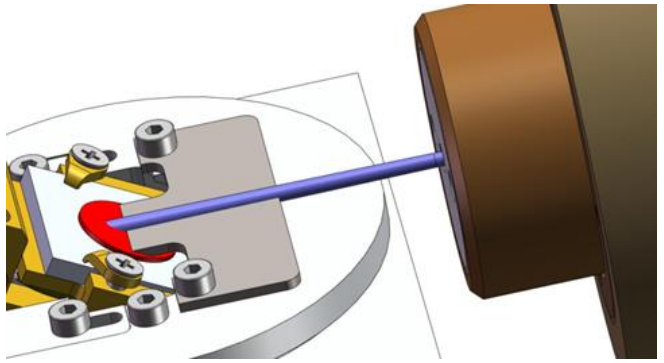
CROSS-SECTIONAL SEM SAMPLE (SLOPE CUT)

Principle

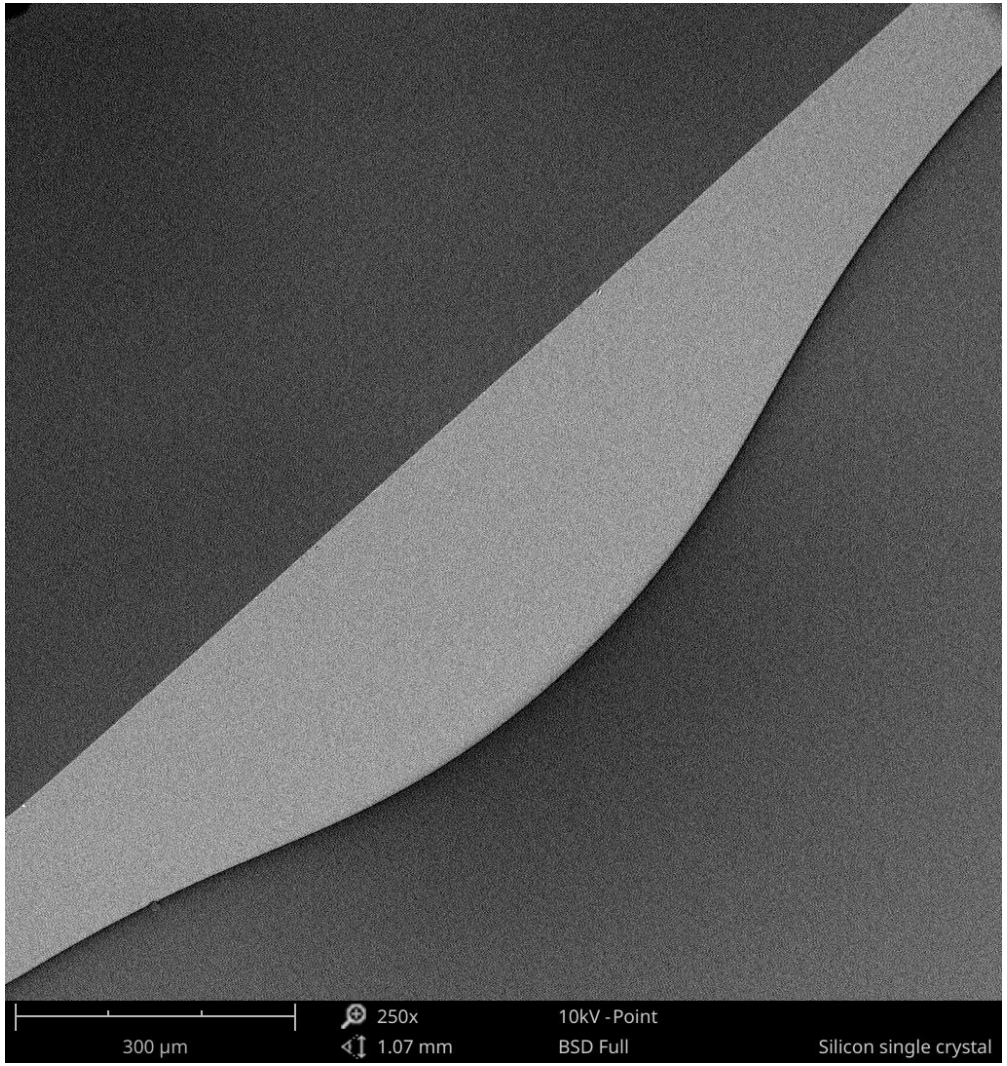


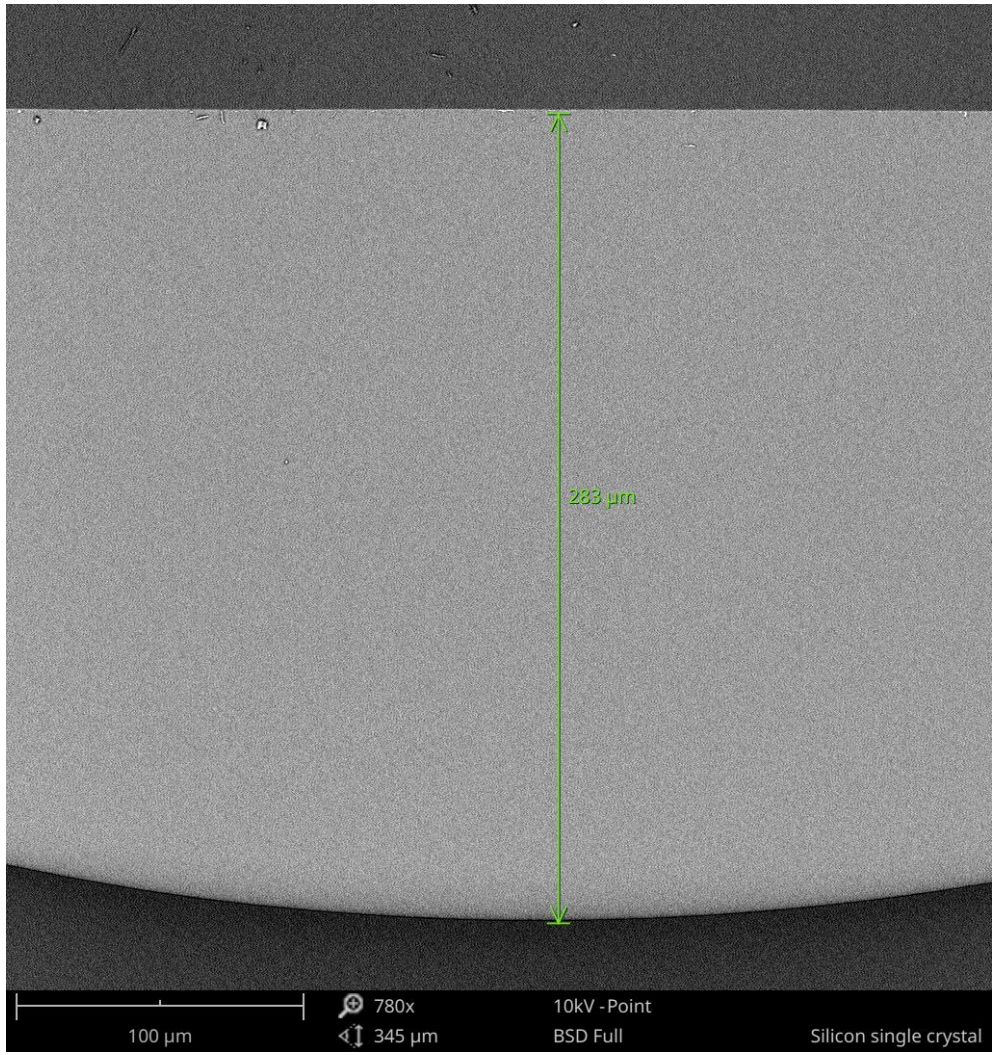


Practice

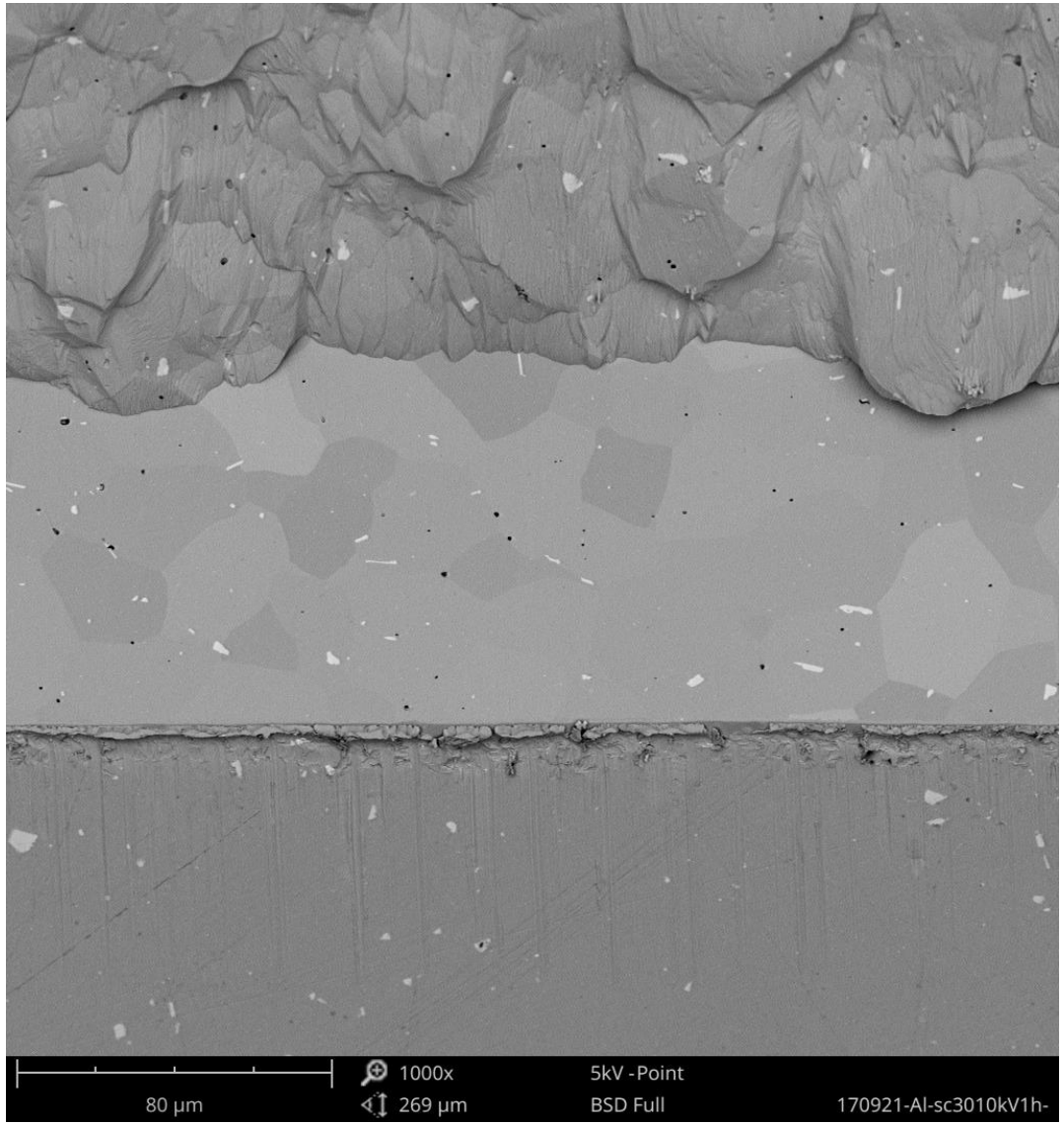


Sample holders for 30^{o}, 45^{o}, 90^{o}
Sample sizes: 20 (l) x 16 (w) x 7(th) mm

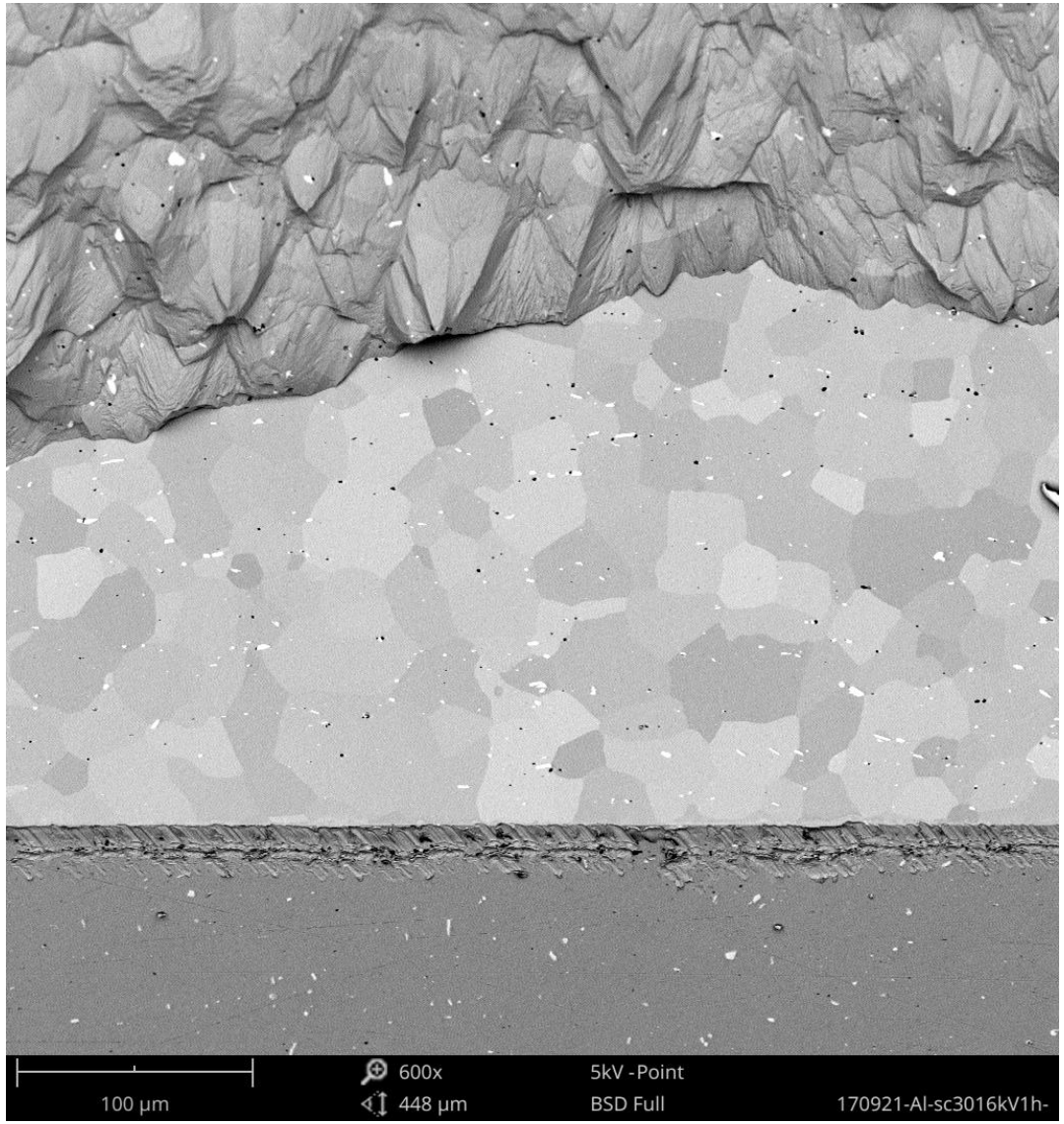




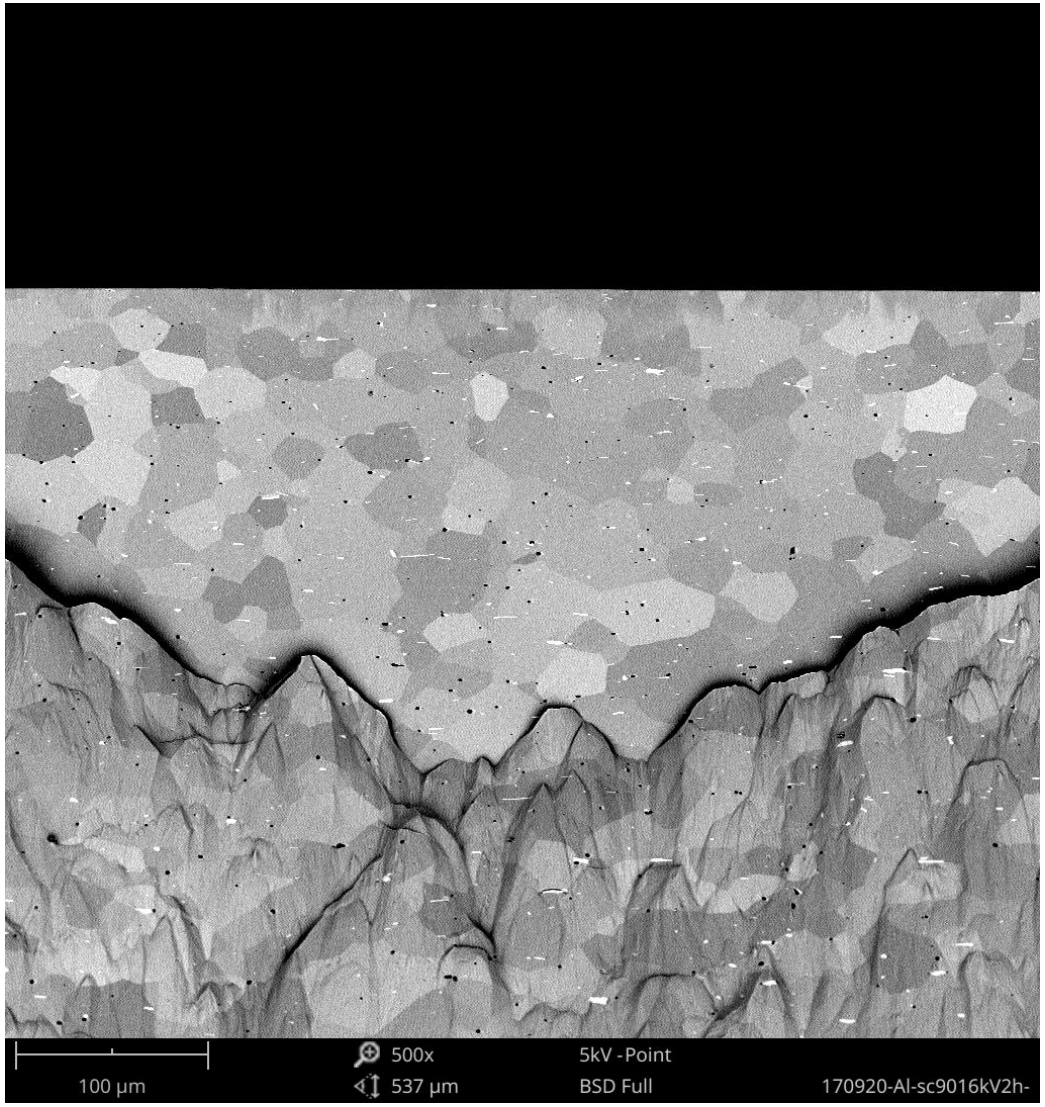
Silicon single crystal, slope cut @ 30°, 10 kV, 2 hours



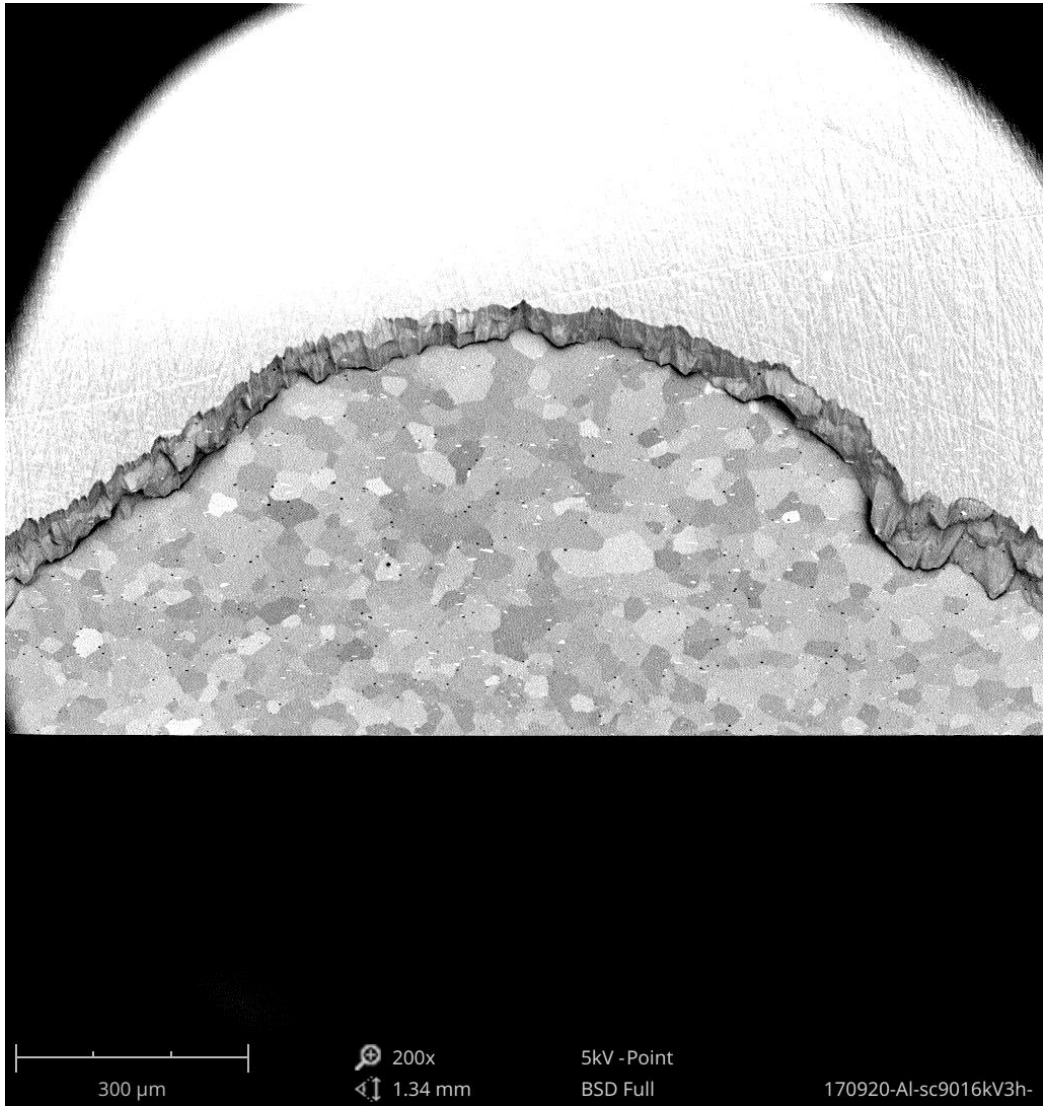
Aluminum, slope cut @ 30°, 10 kV, 1 hour



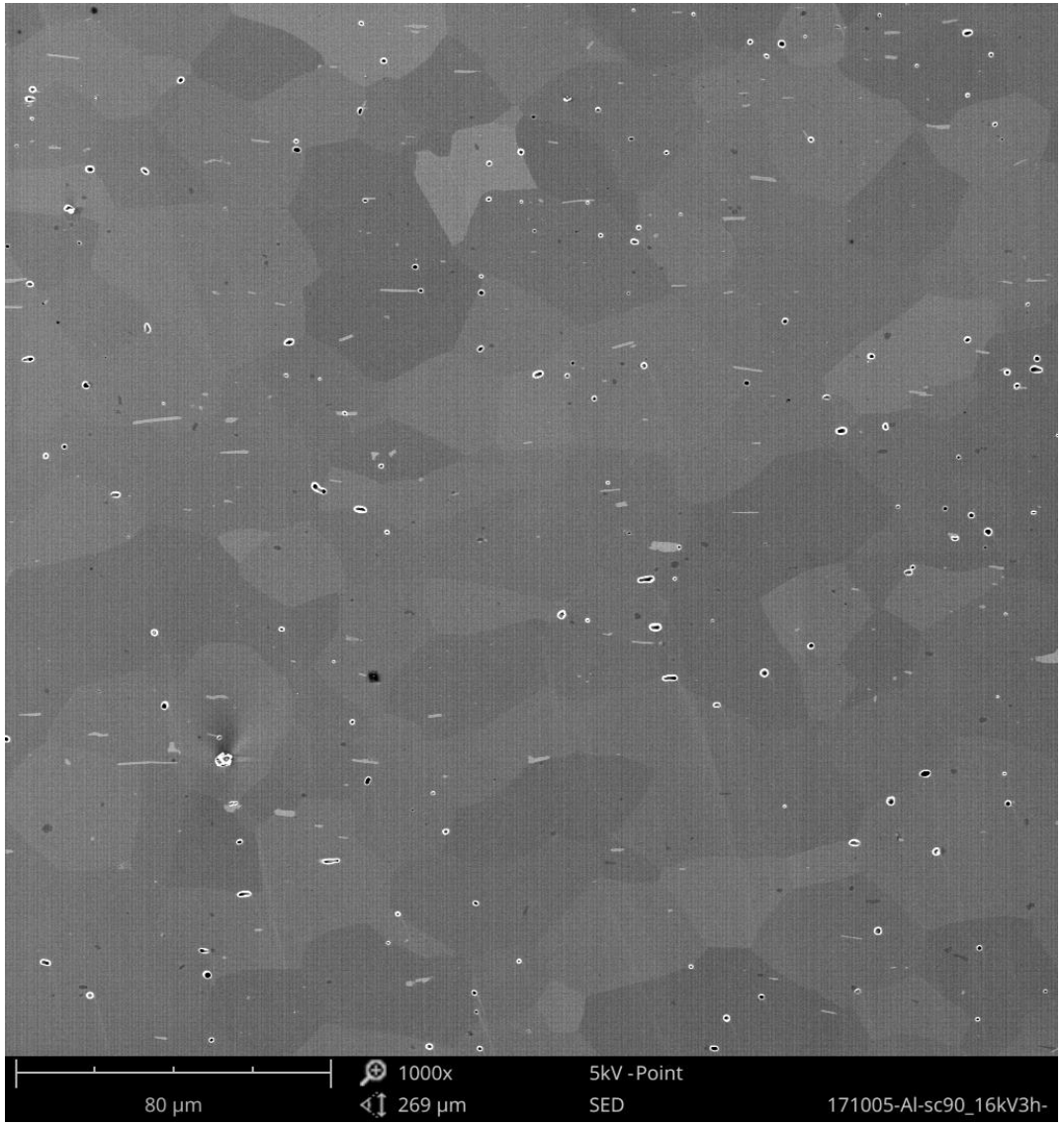
Aluminum, slope cut @ 30°, 16 kV, 1 hour

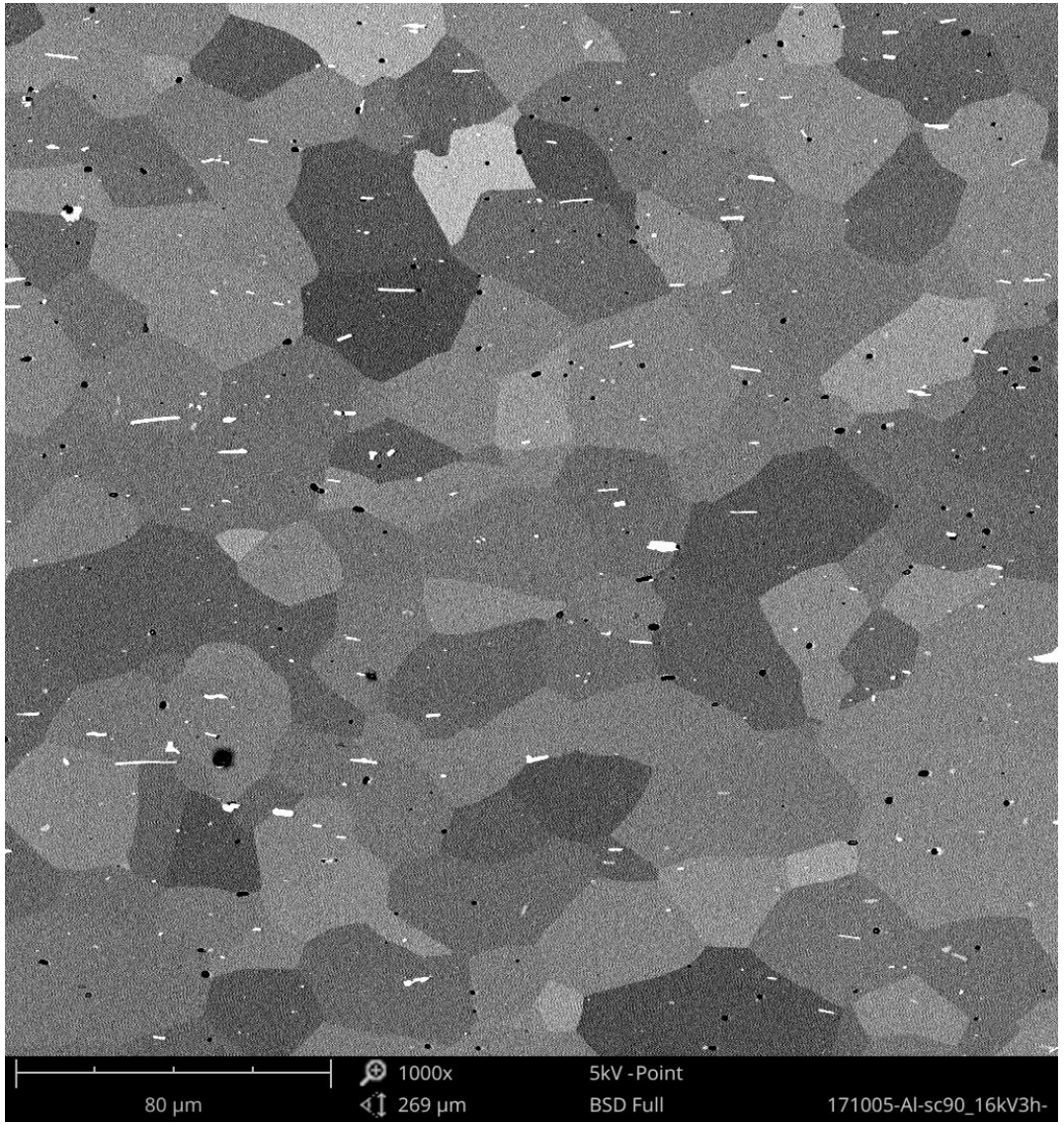


Aluminum, slope cut @ 90°, 16 kV, 2 hours
depth: 251 µm.

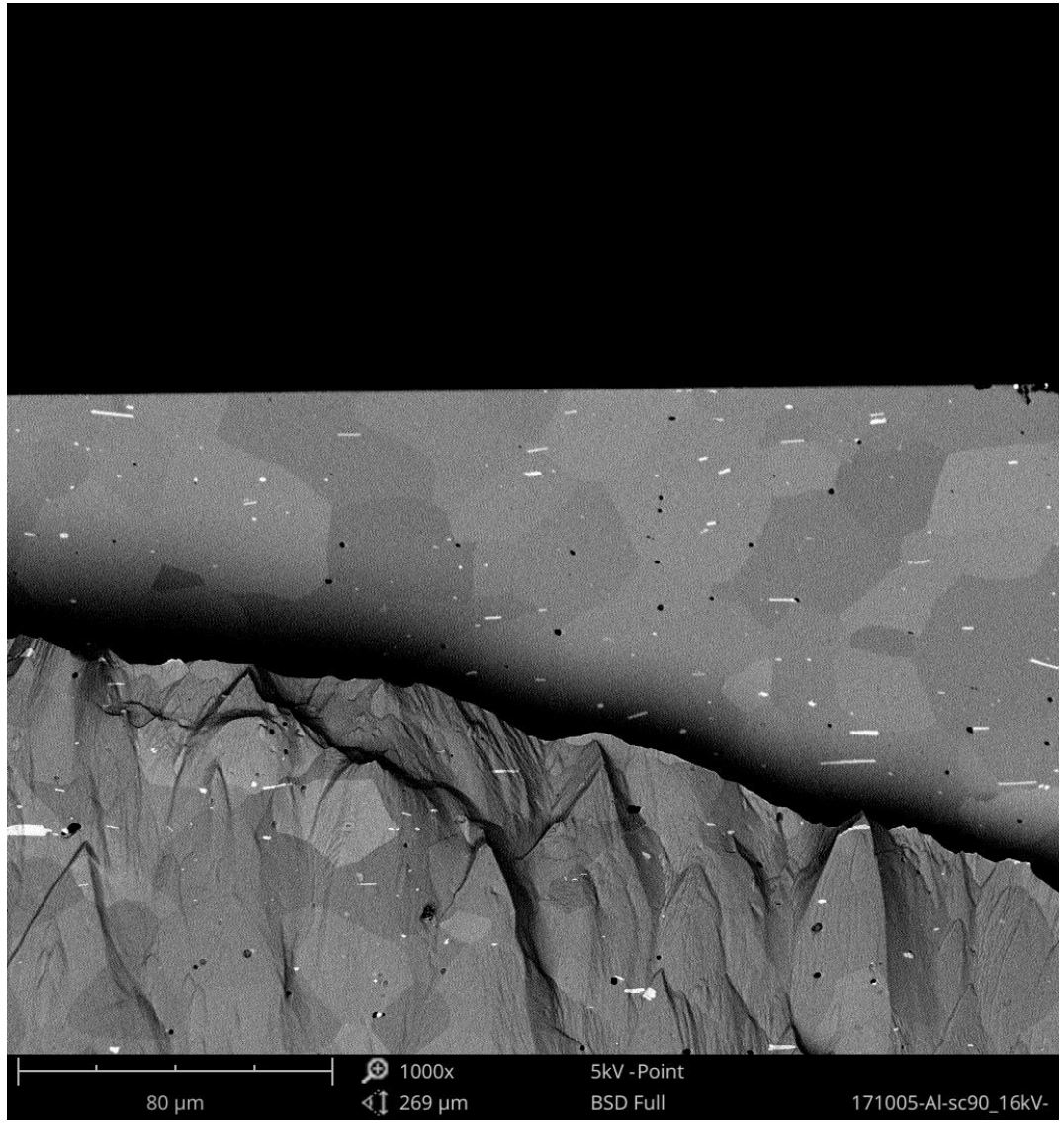


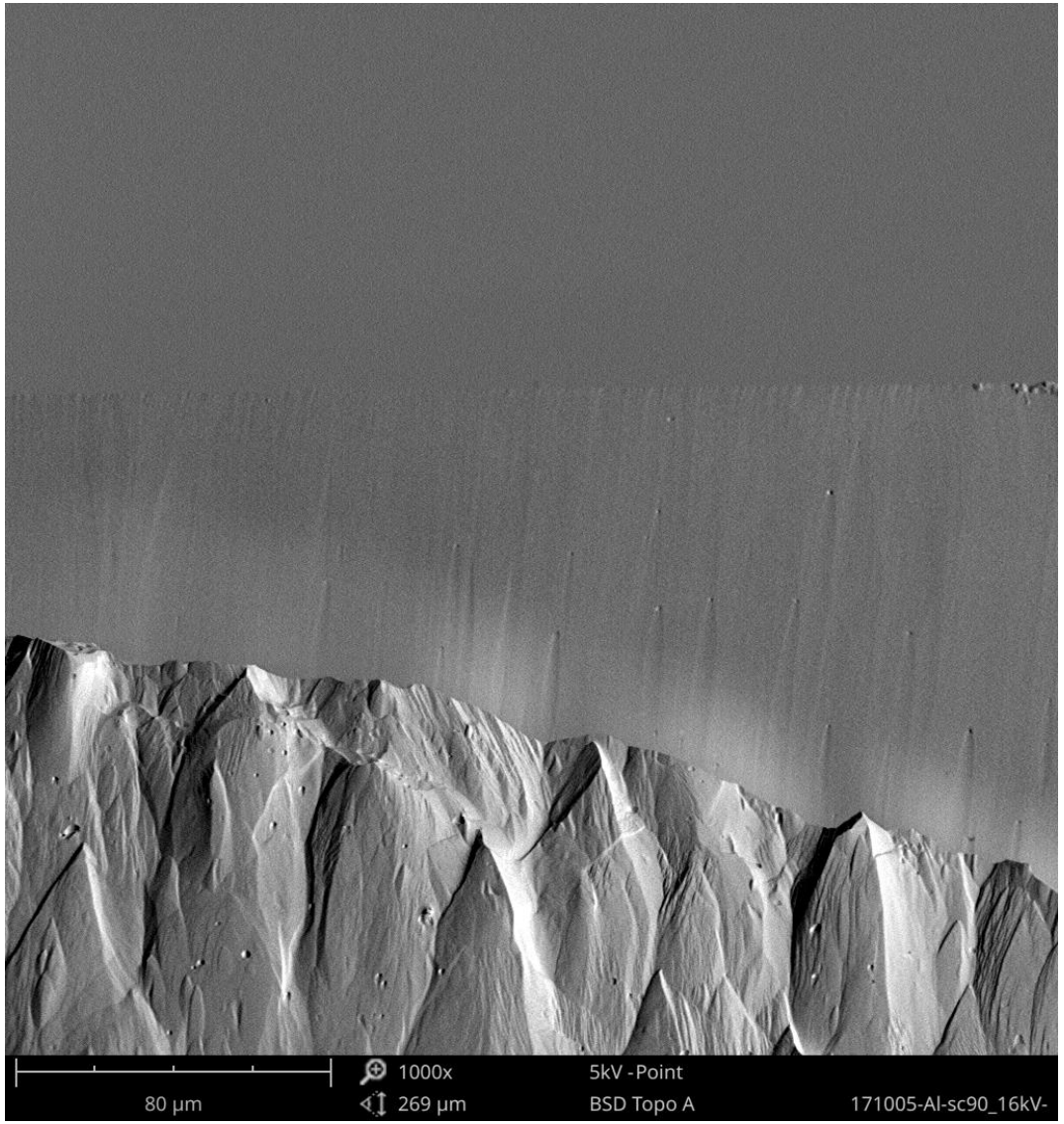
Aluminum, slope cut @ 90°, 16 kV, 3 hours
depth: 530 µm.



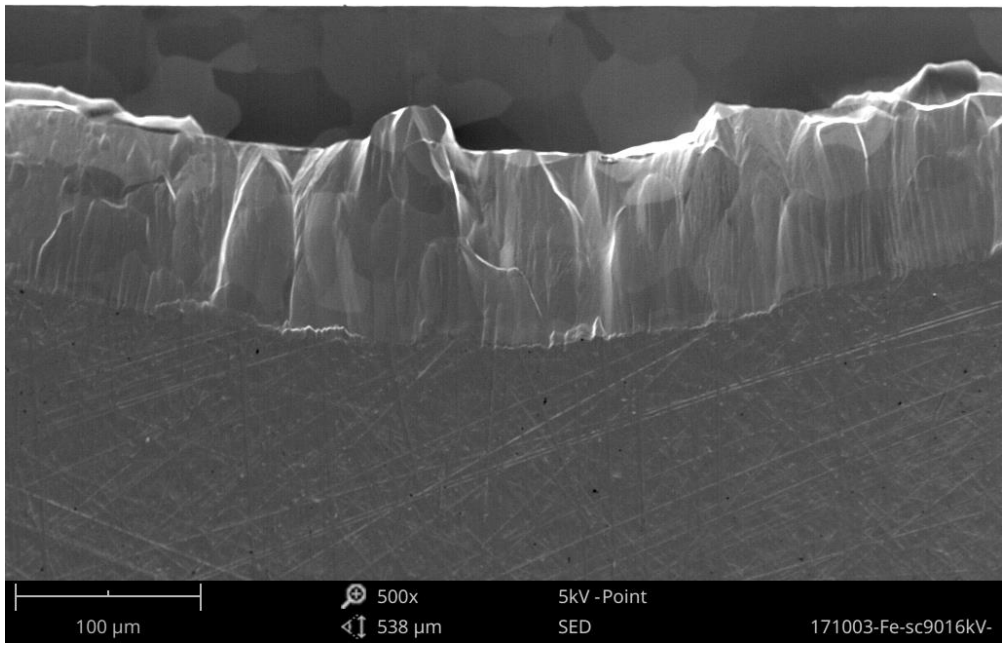


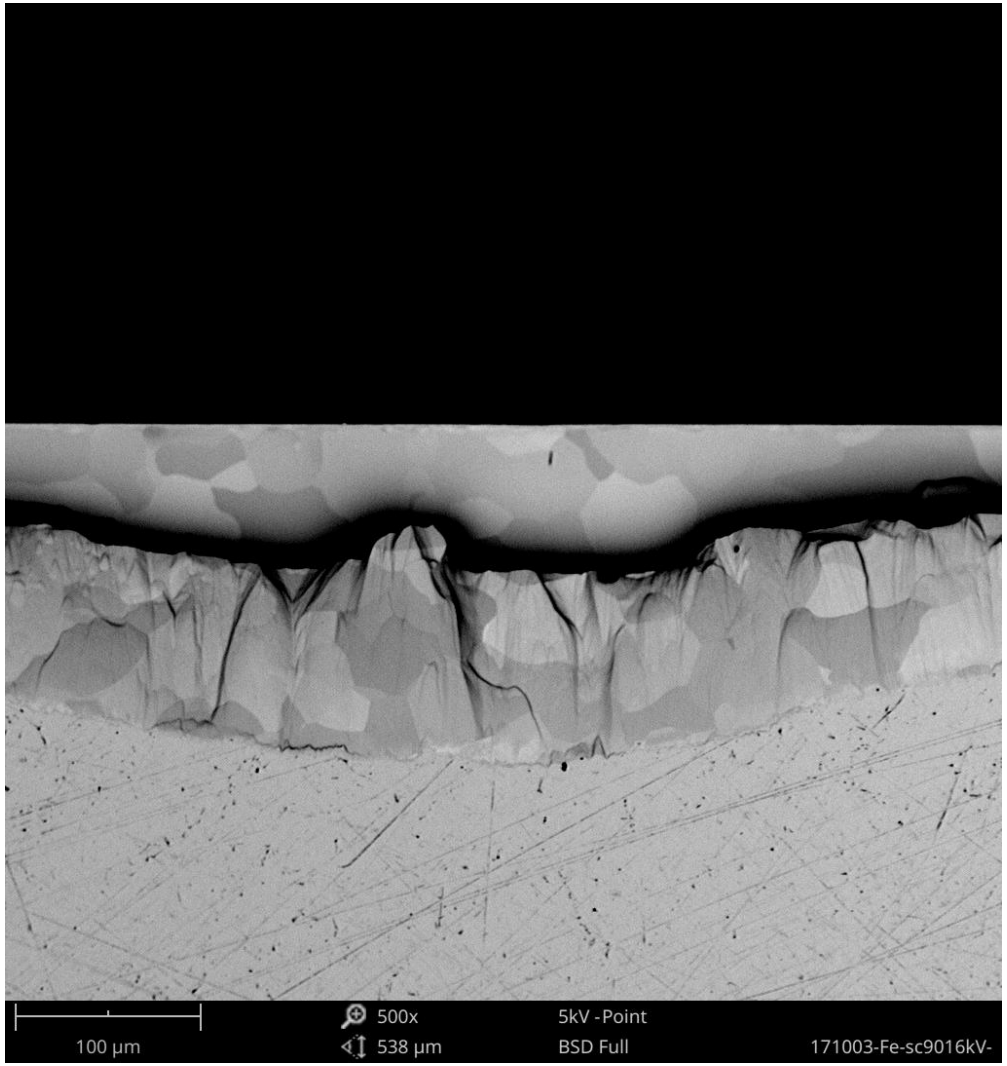
Aluminum, slope cut @ 90°, 16 kV, 3 hours



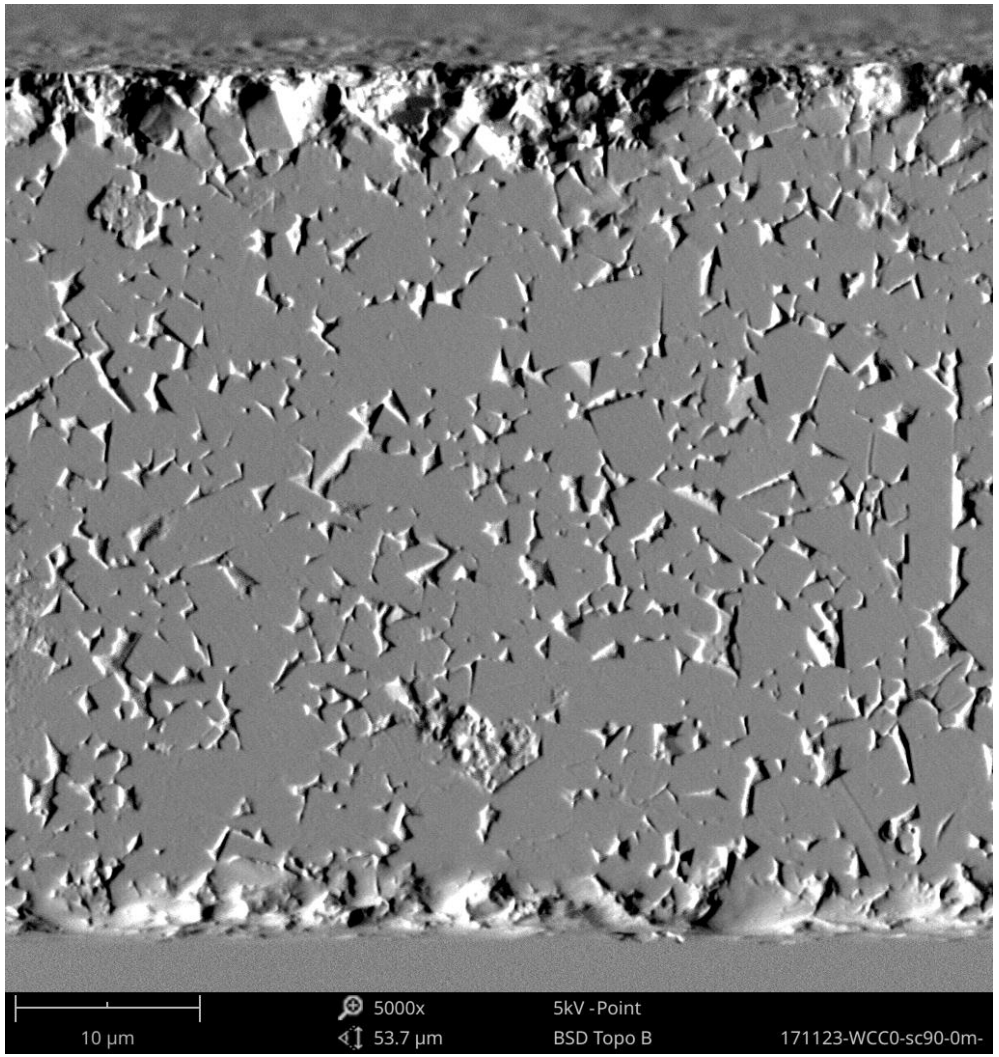


Aluminum, slope cut @ 90°, 16 kV, 2 hours

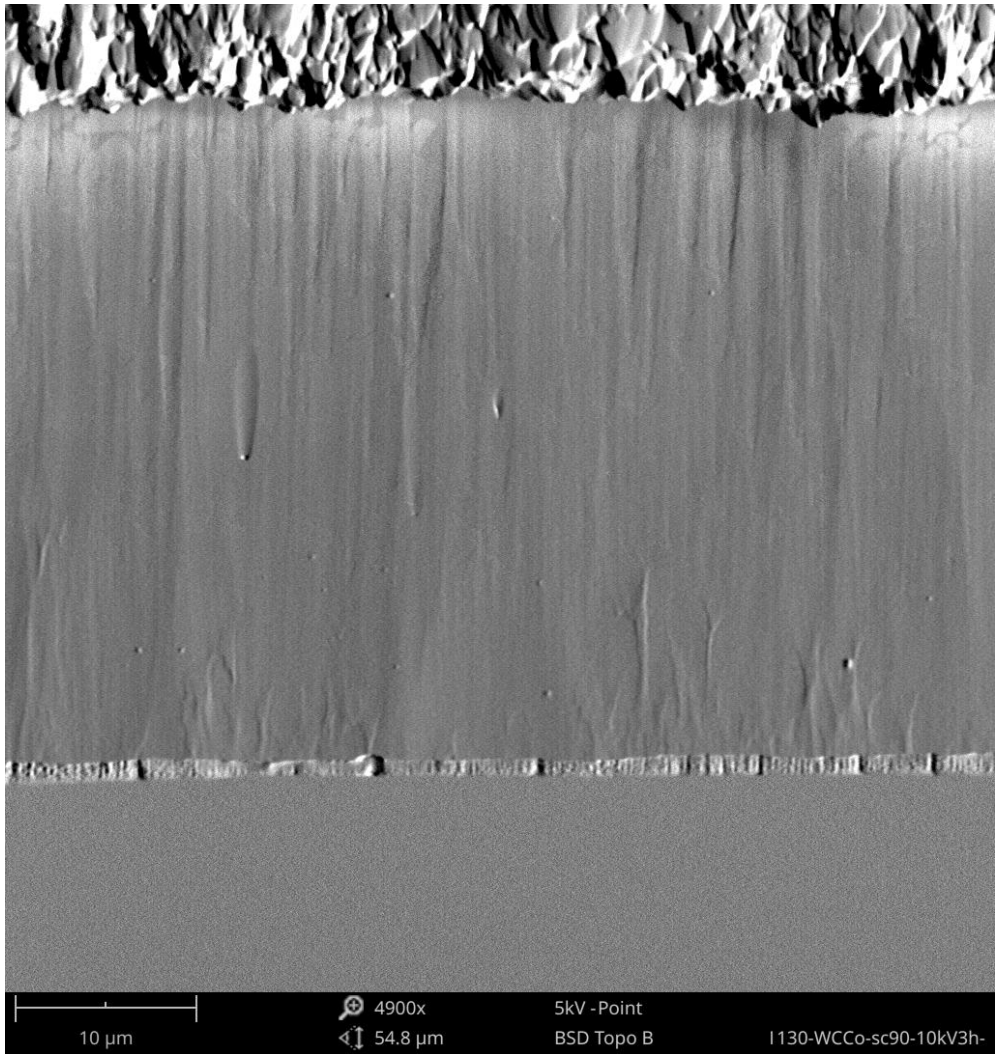




Iron, slope cut @ 90°, 16 kV, 1 hour

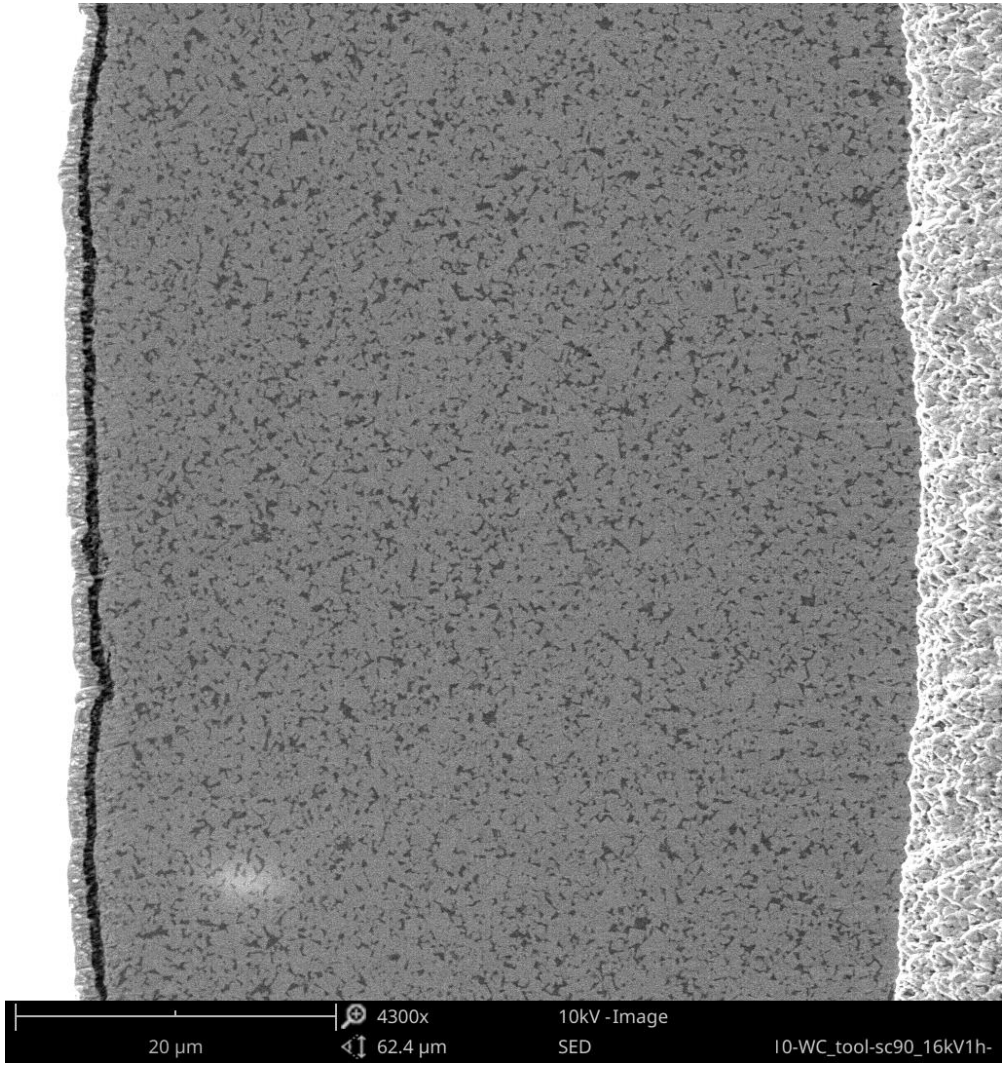


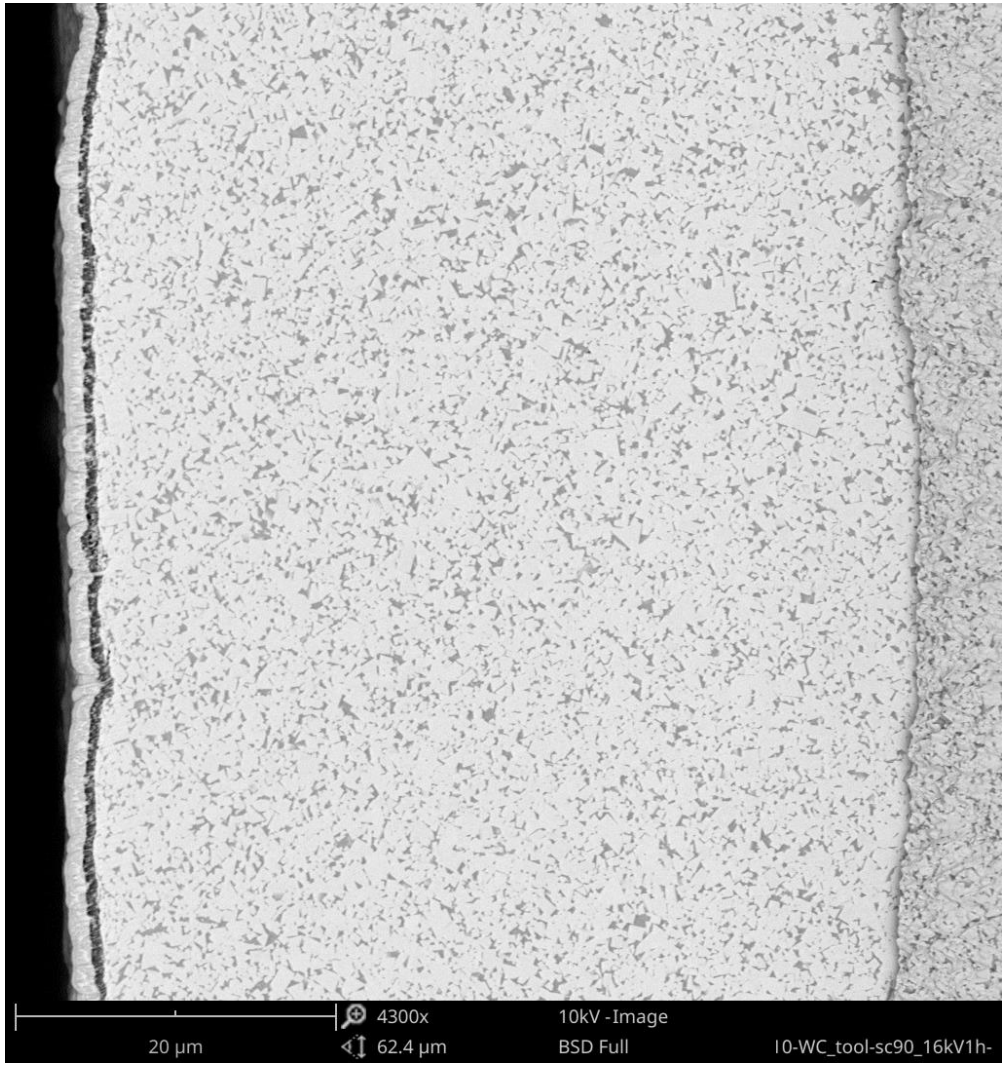
After mechanical polishing



After Ar ion slope cut

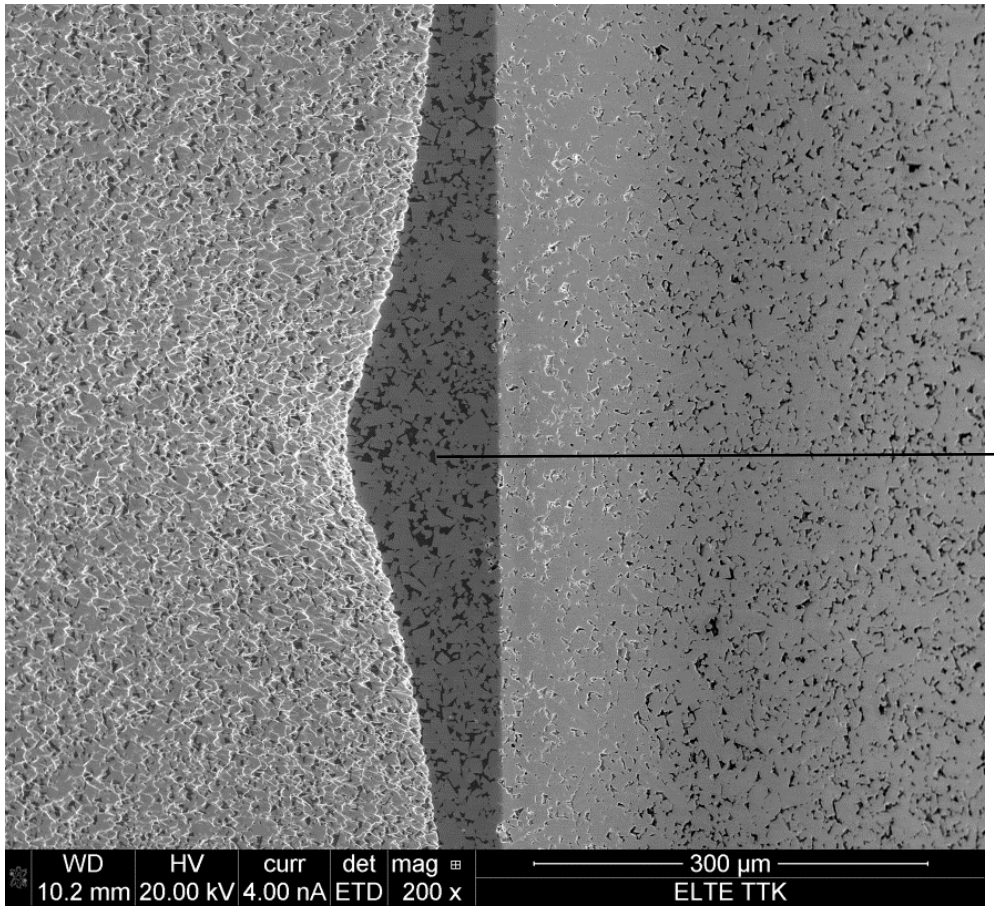
WC-Co, slope cut @ 90°, 10 kV, 120 minutes



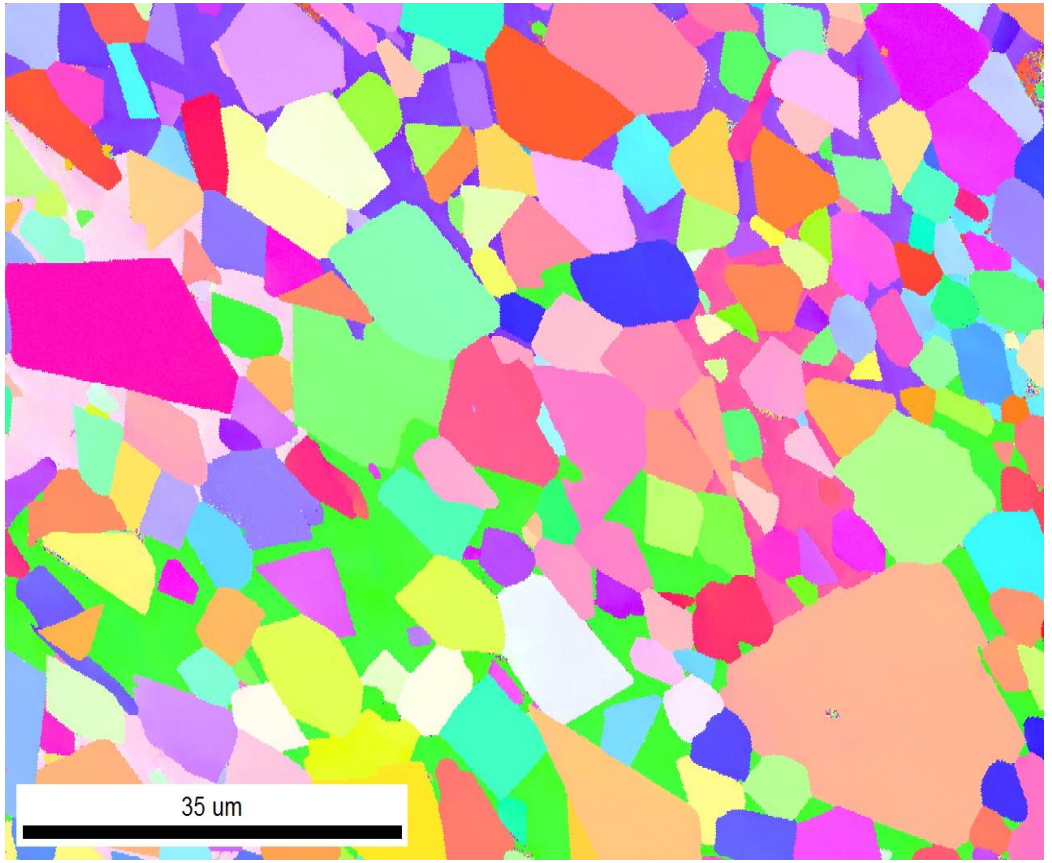


Tungsten-carbide, slope cut @ 90° 10 kV 1 hour

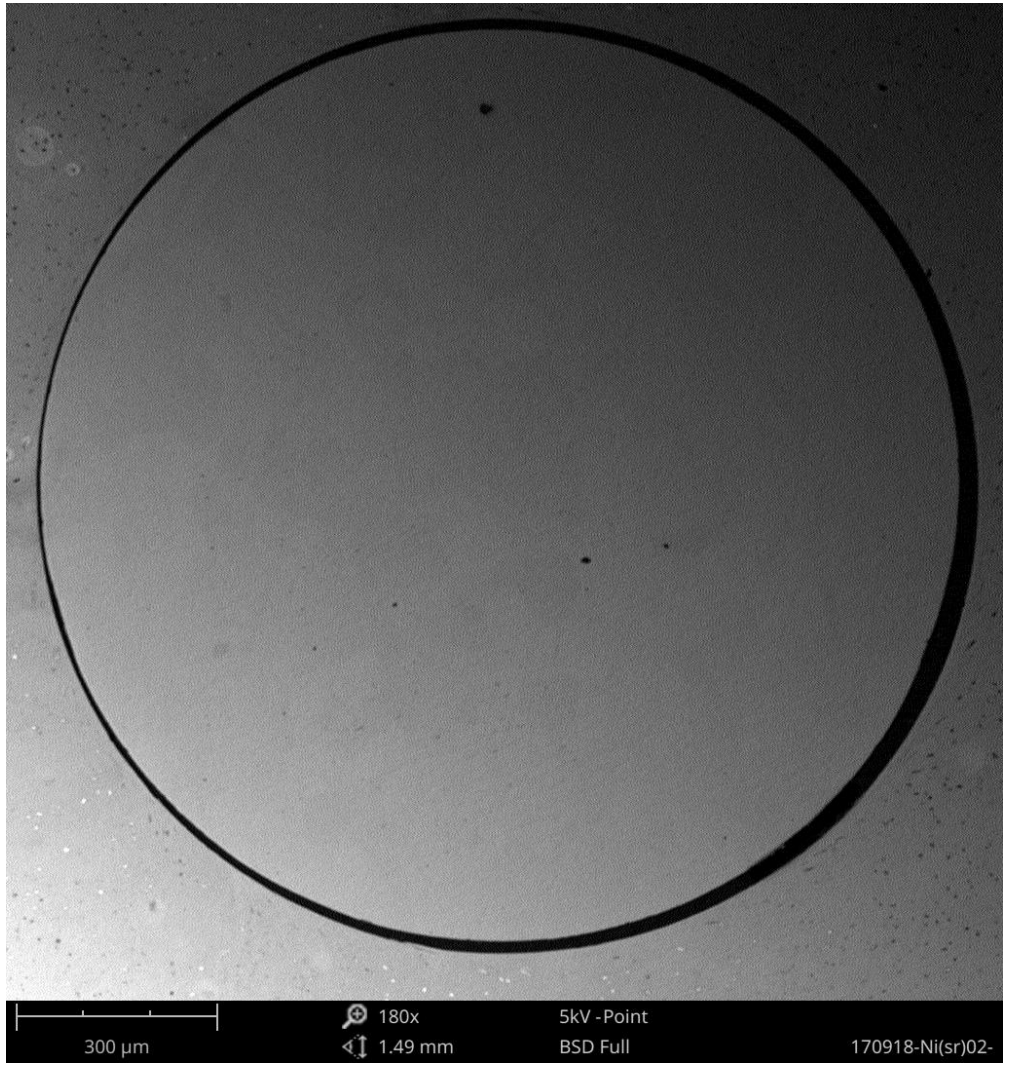
INHOMOGENEOUS MATERIAL – WC-Co



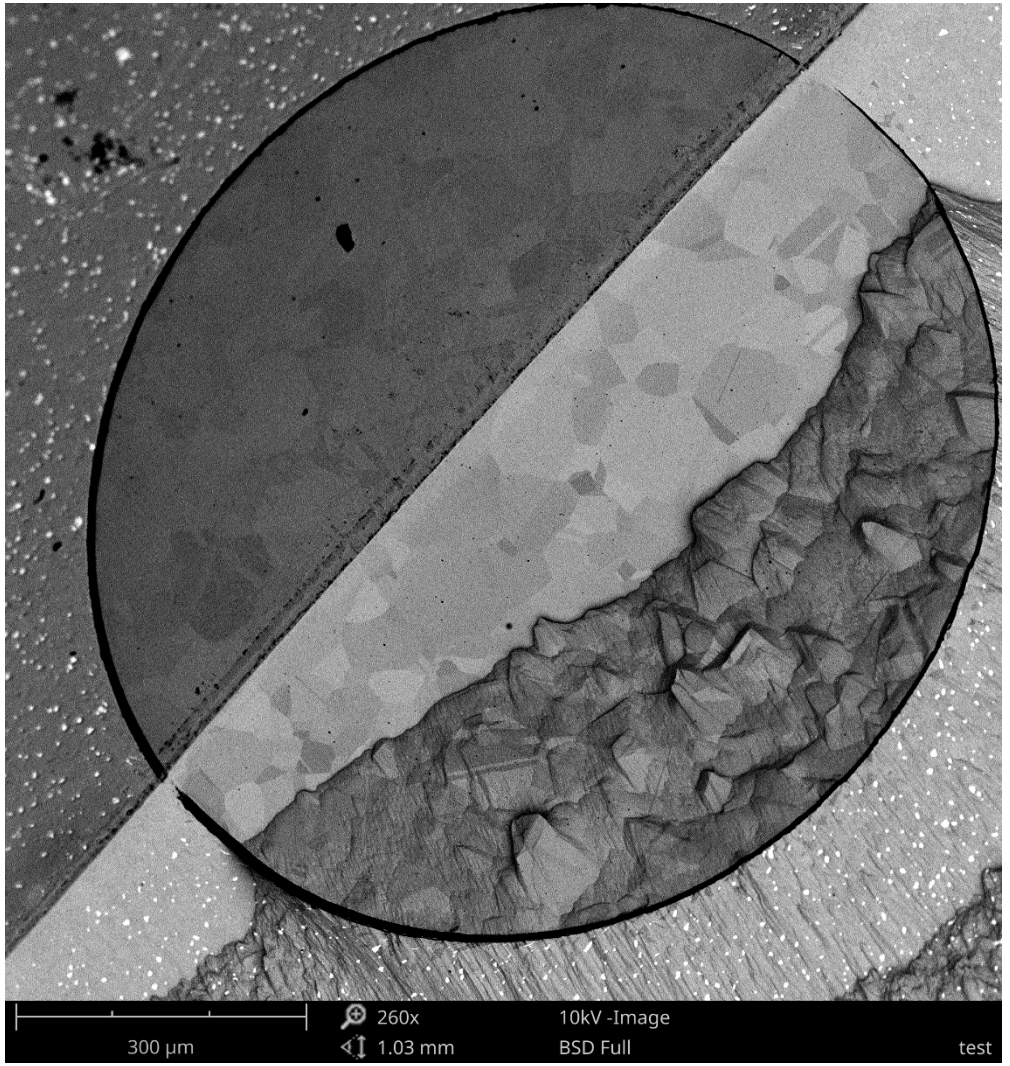
Slope cut of 30°, prepared by the high energy gun.
(measured by FEI Quanta 3D)



EBSD measurement after slope cut.
(measured by FEI Quanta 3D)

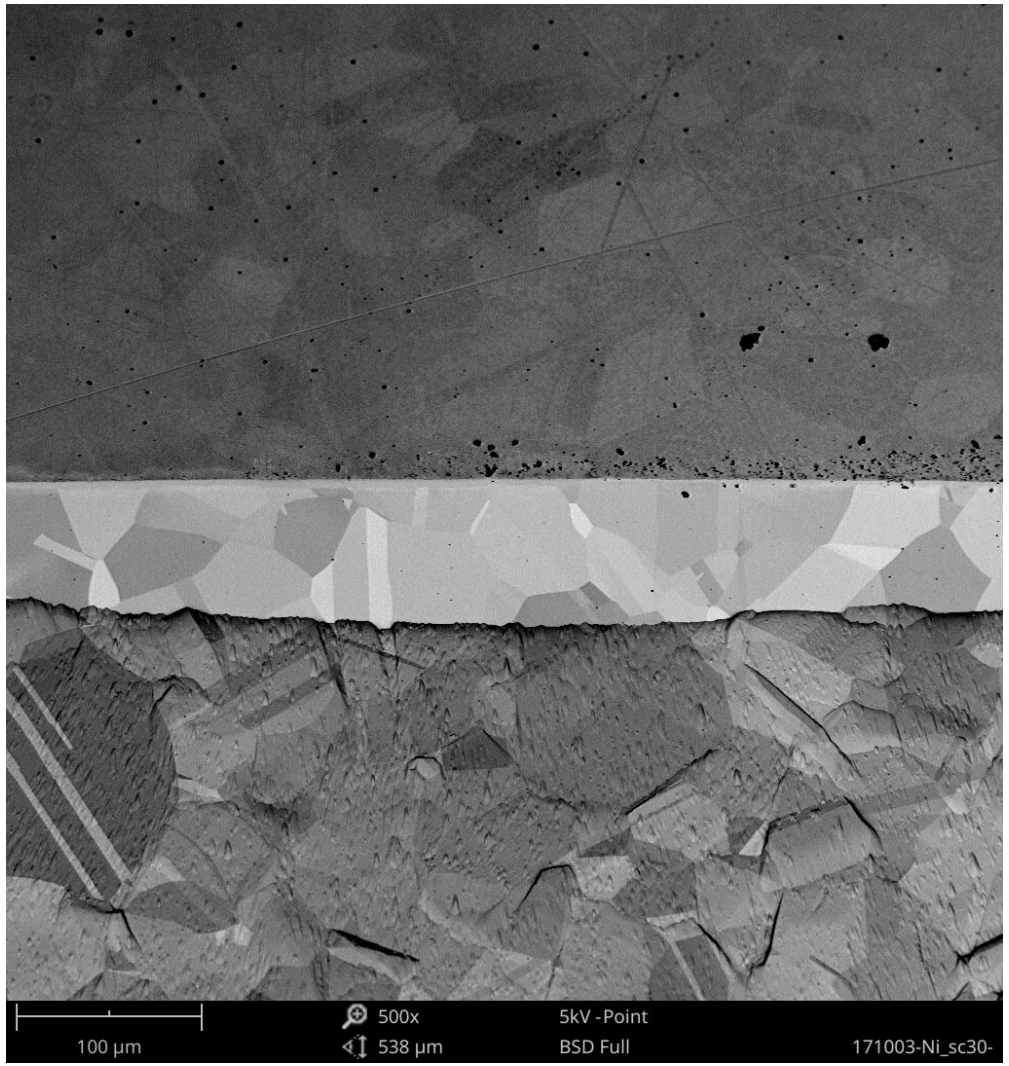


After only mechanical polishing

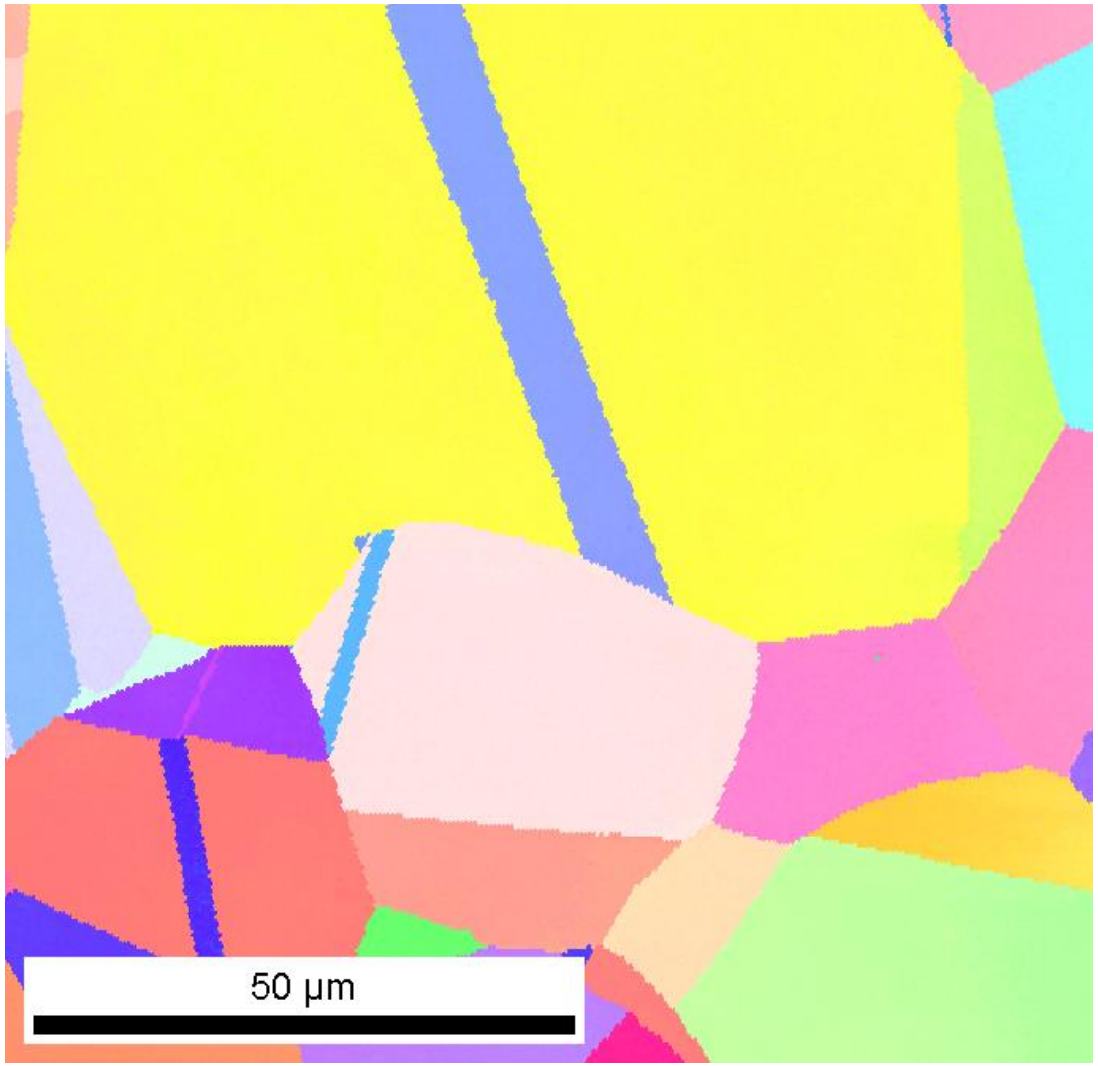


After mechanical and Ar ion polishing

Nickel wire in brass, slope cut @ 30°, 16 kV, 1 hour

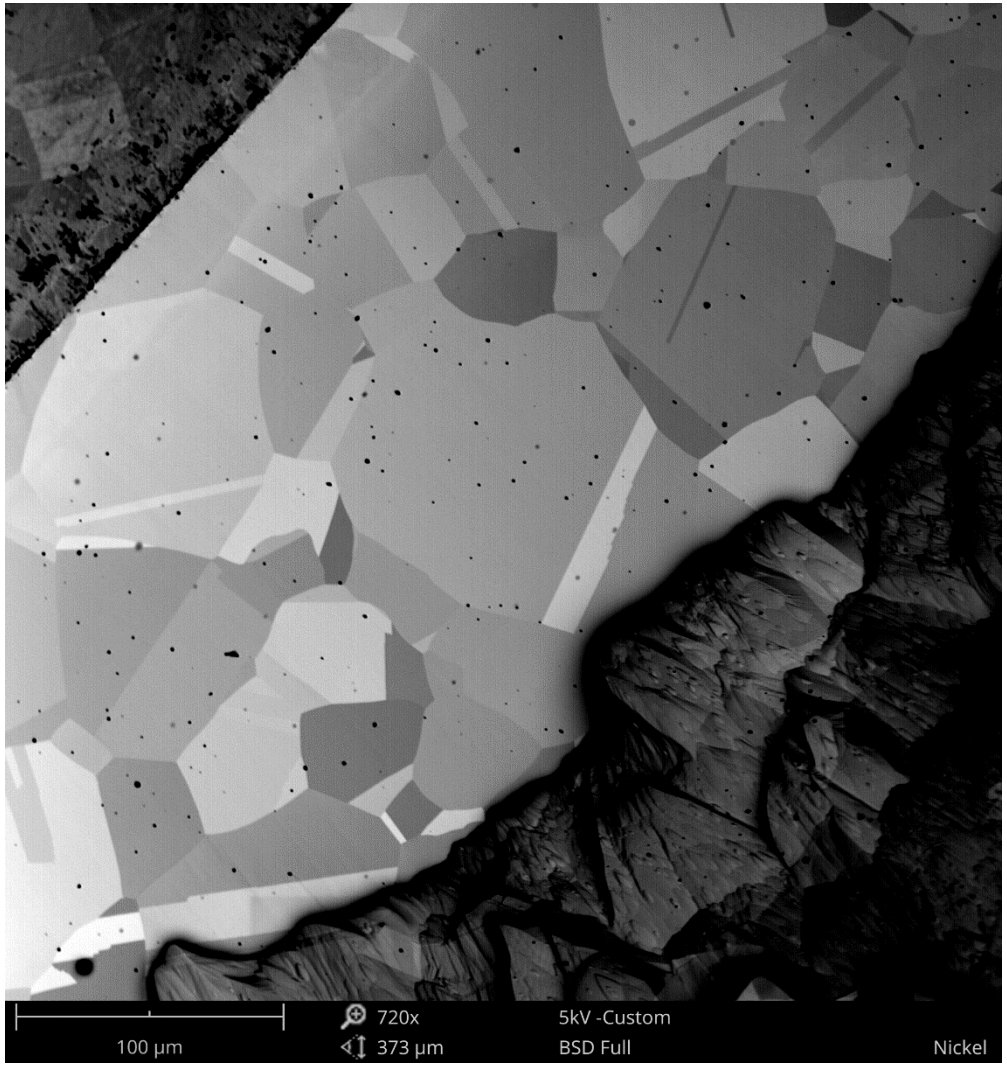


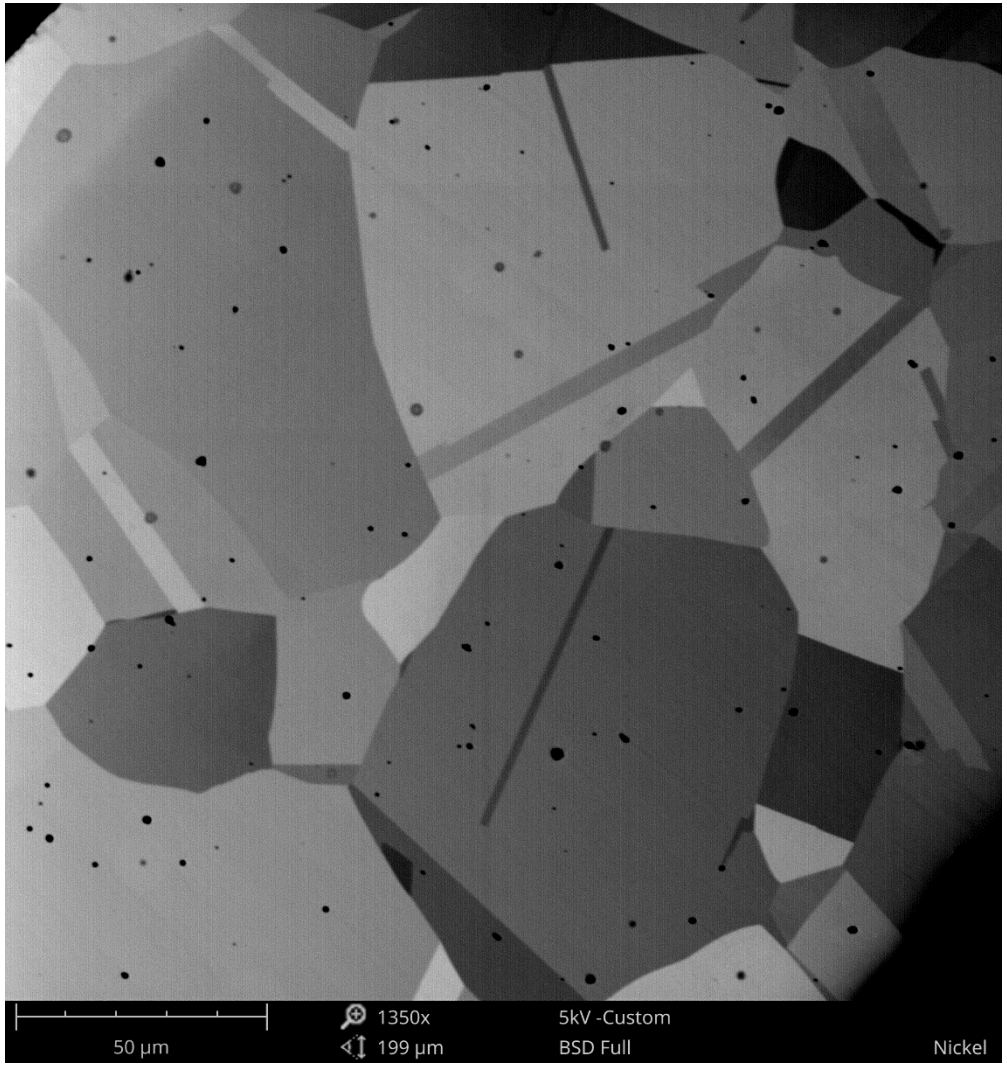
Backscattered electron image after Ar ion slope cut



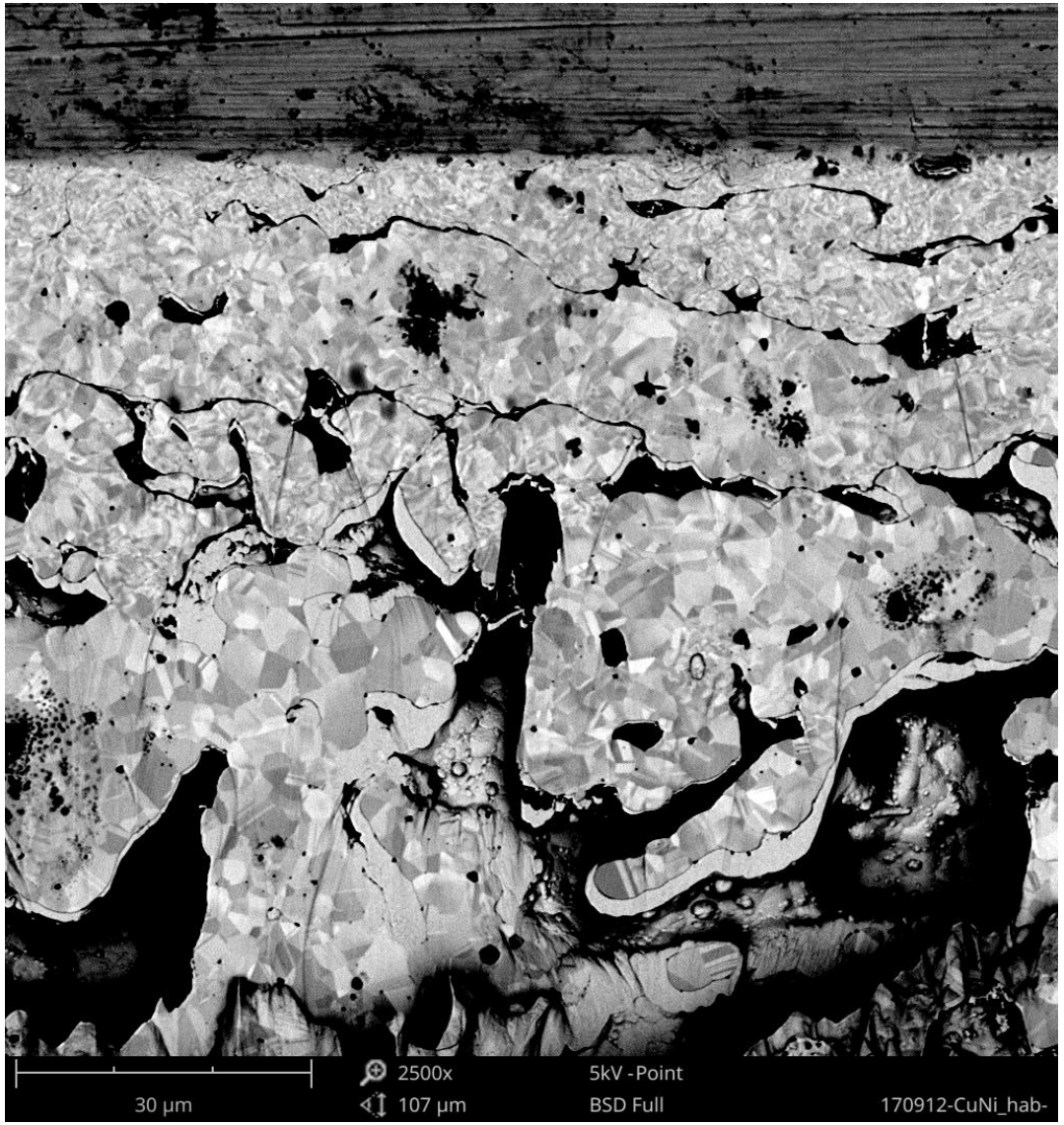
EBSD OM after Ar ion slope cut (FEI Quanta 3D, EDAX)

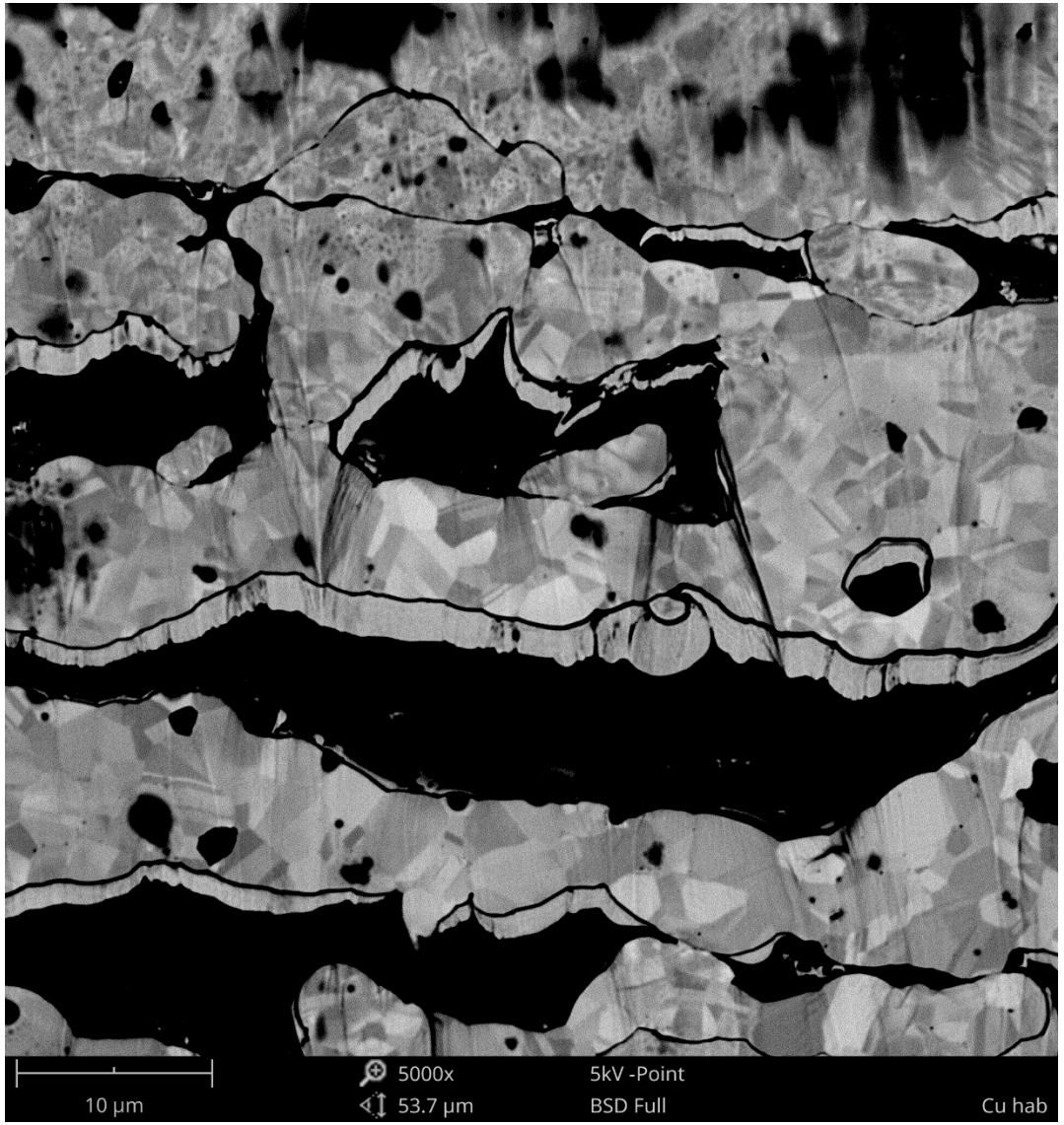
Nickel wire embedded in brass, slope cut @ 30° 10 kV 1 hour



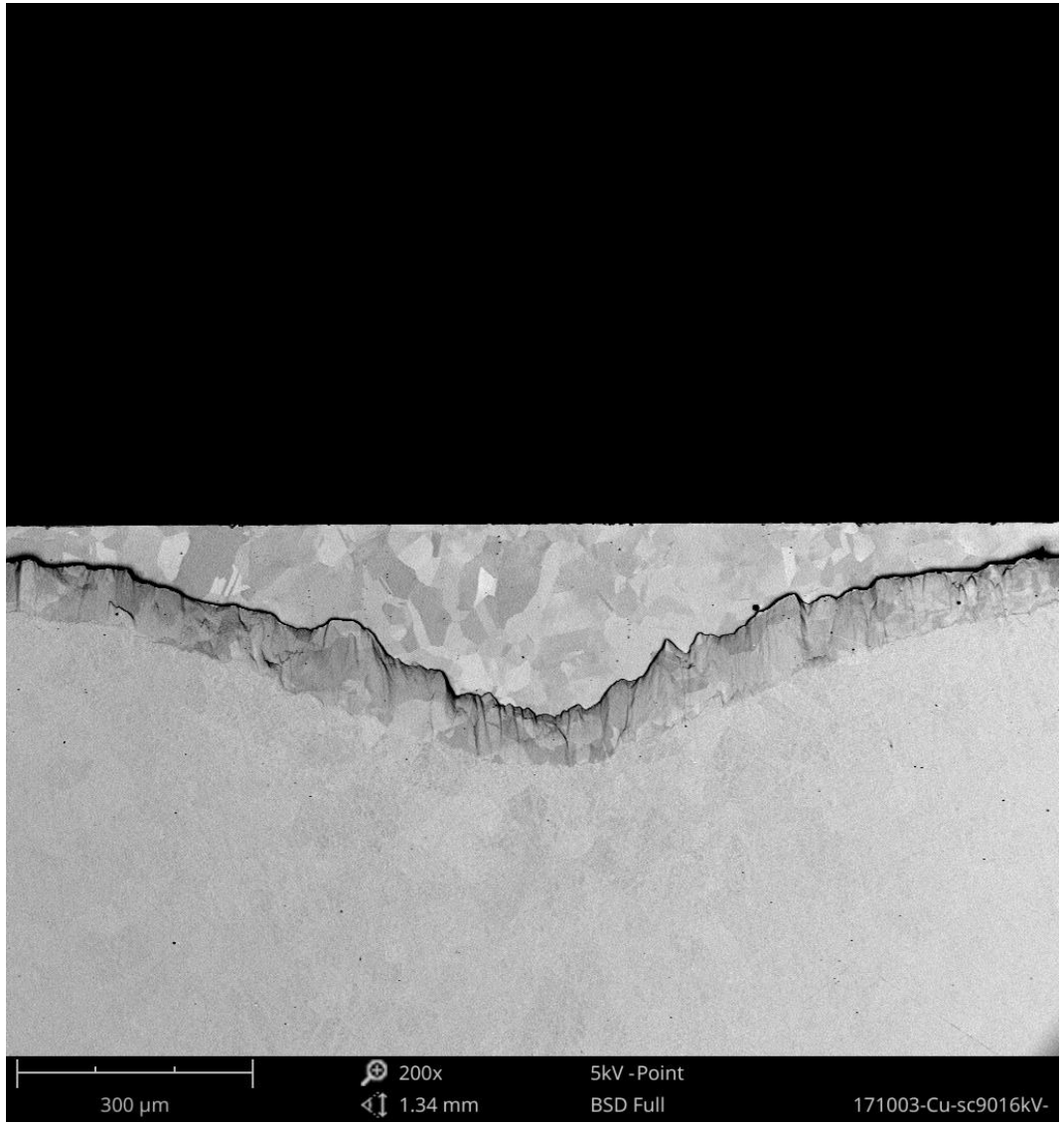


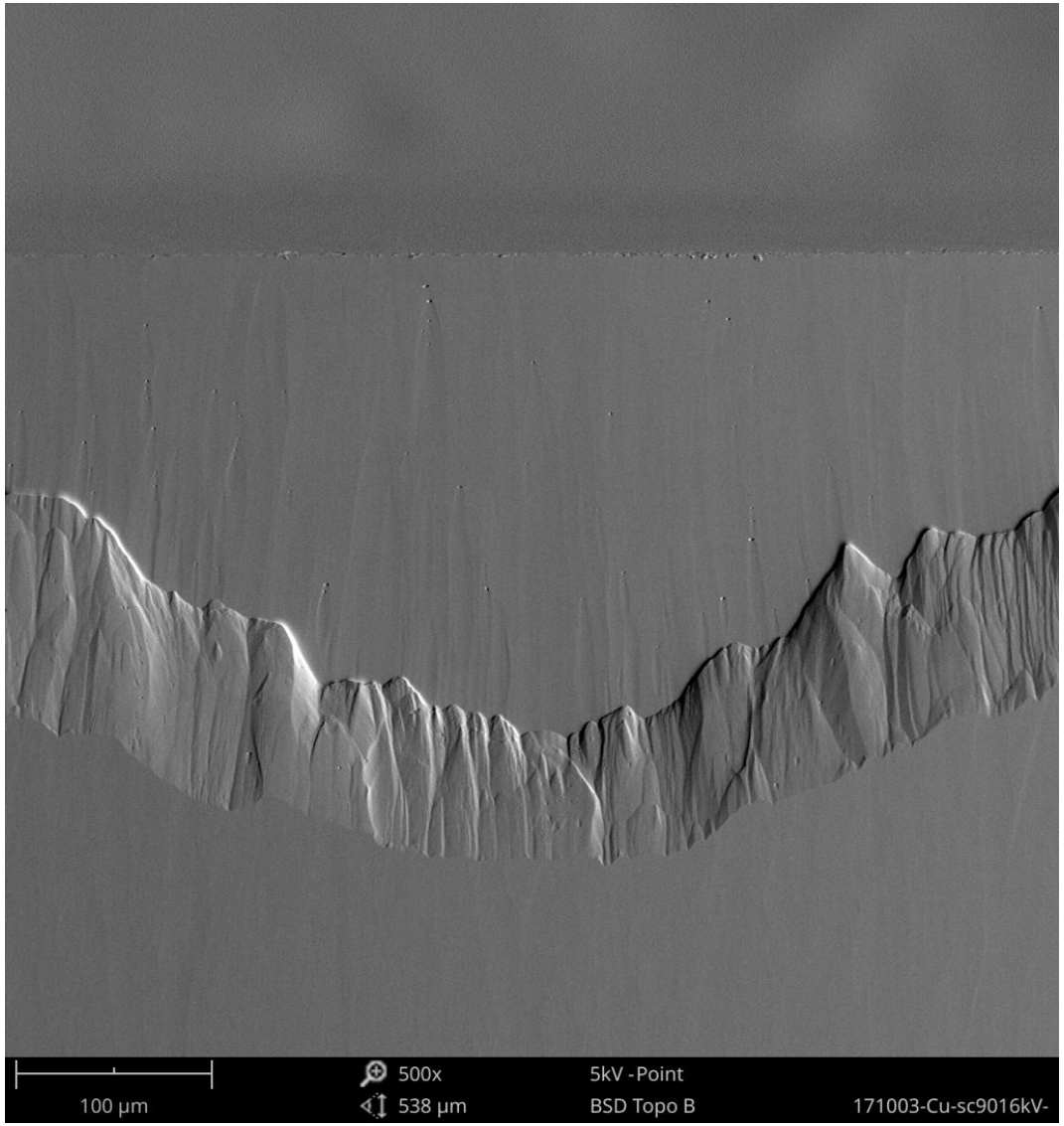
Nickel wire in brass, slope cut @ 30°, 16 kV, 1 hour



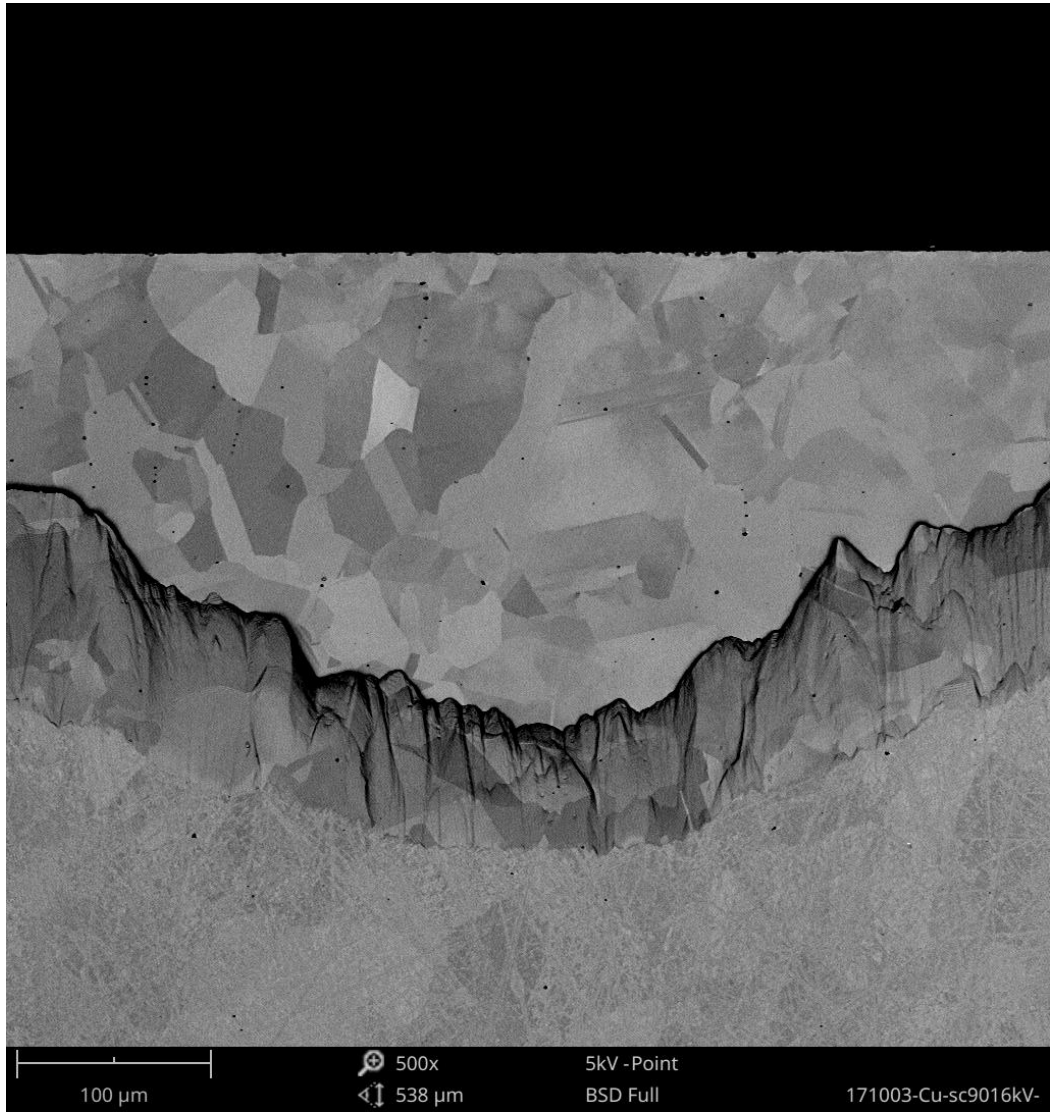


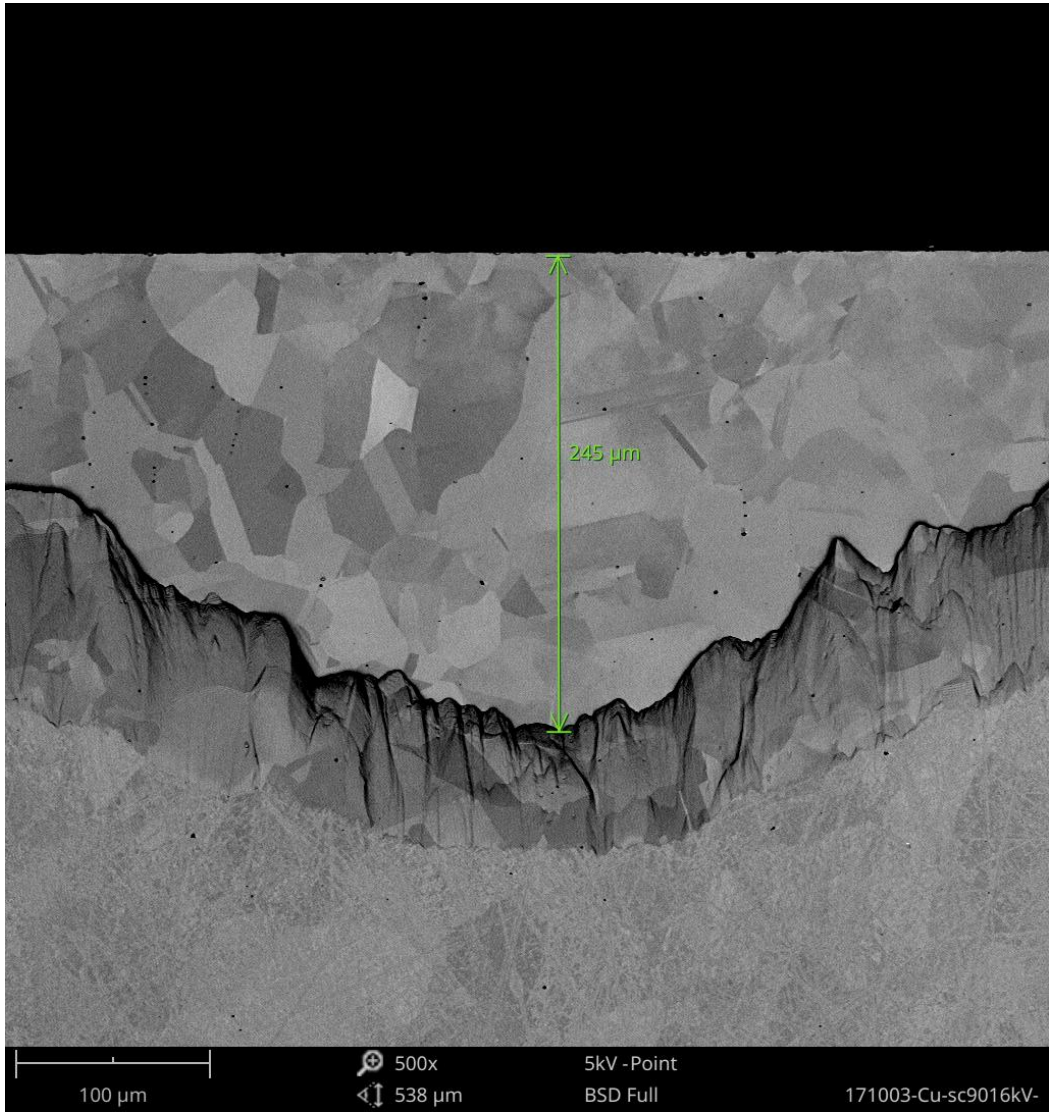
Nickel-copper alloy metal-foam, slope cut @ 30°, 10 kV, 1 hour



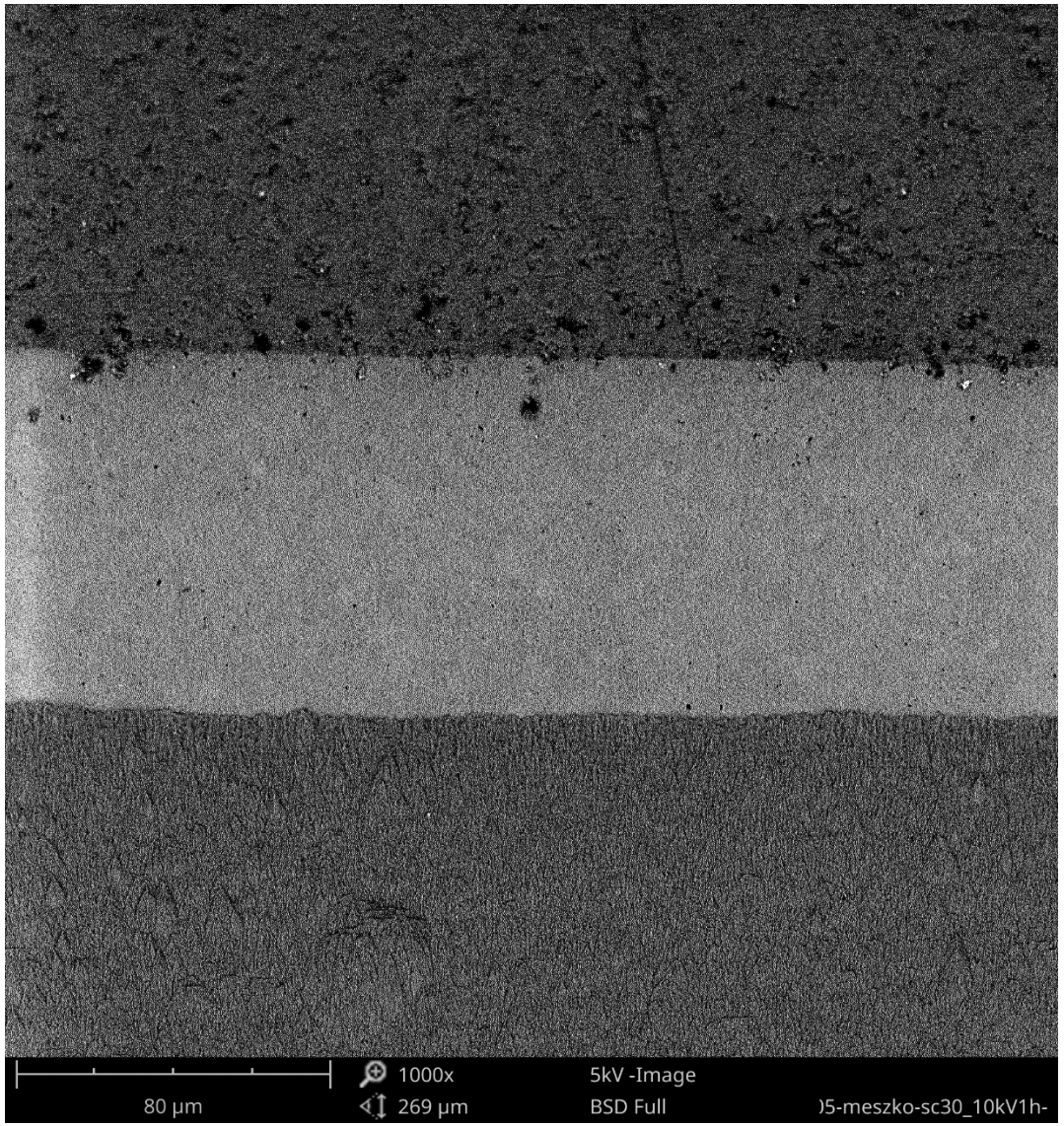


Copper, slope cut @ 90°, 16 kV, 1 hour

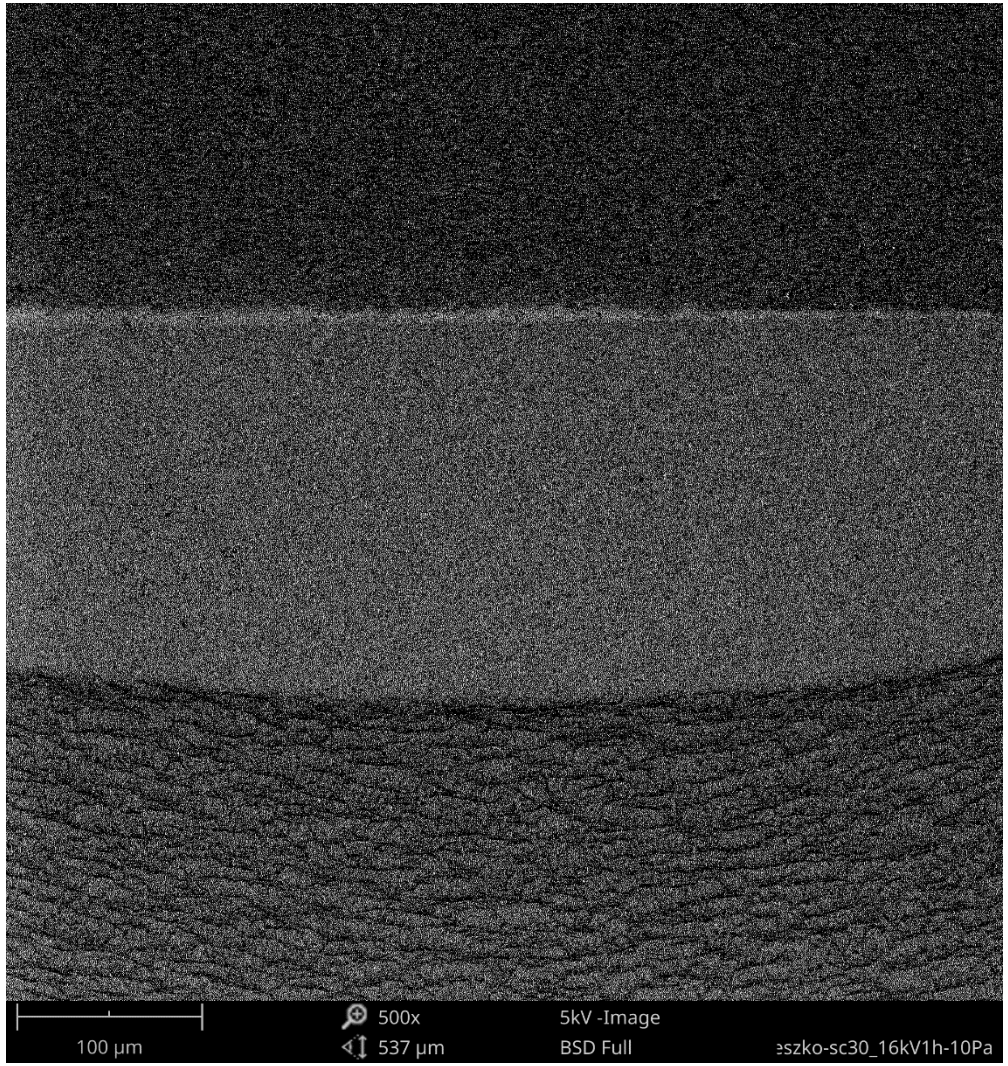


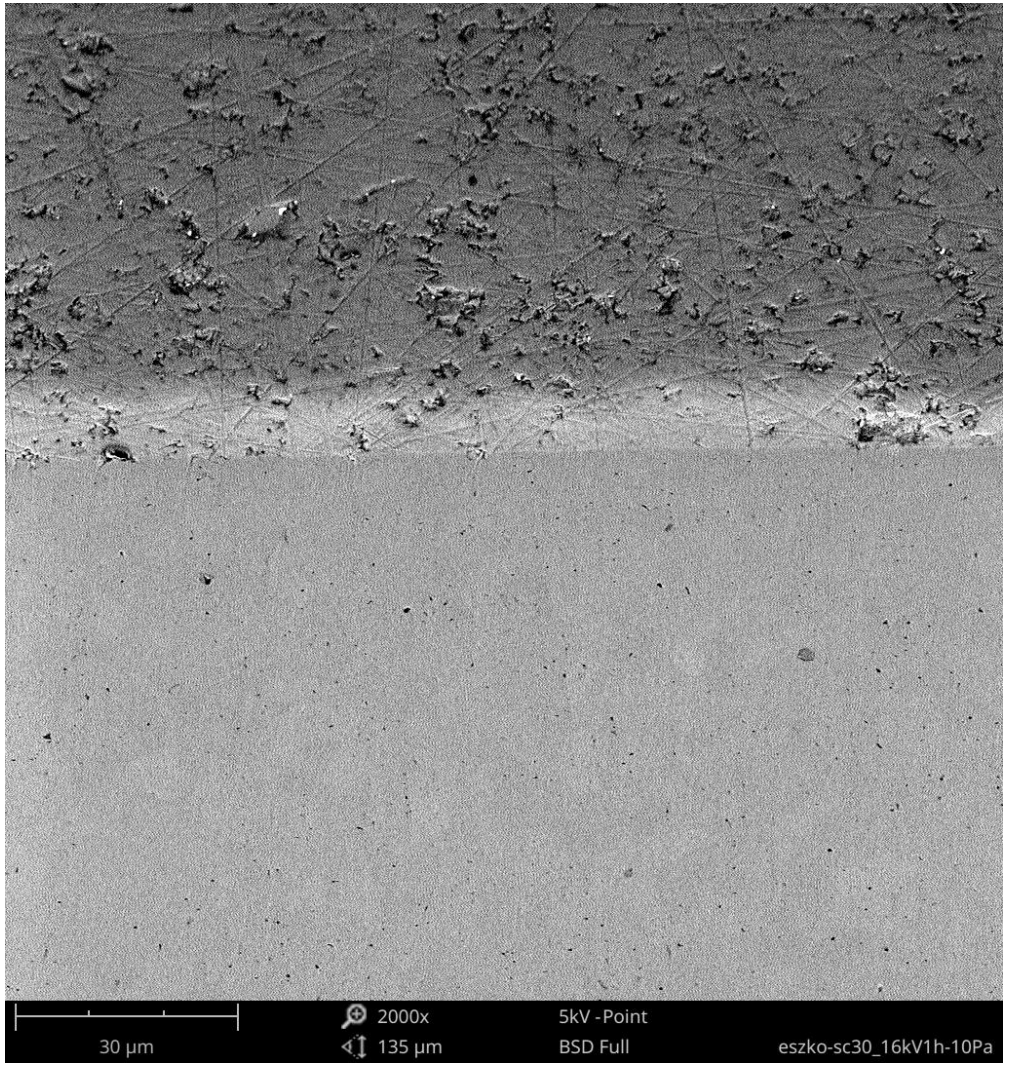


Copper, slope cut @ 90°, 16 kV, 1 hour. Depth: 245 µm.

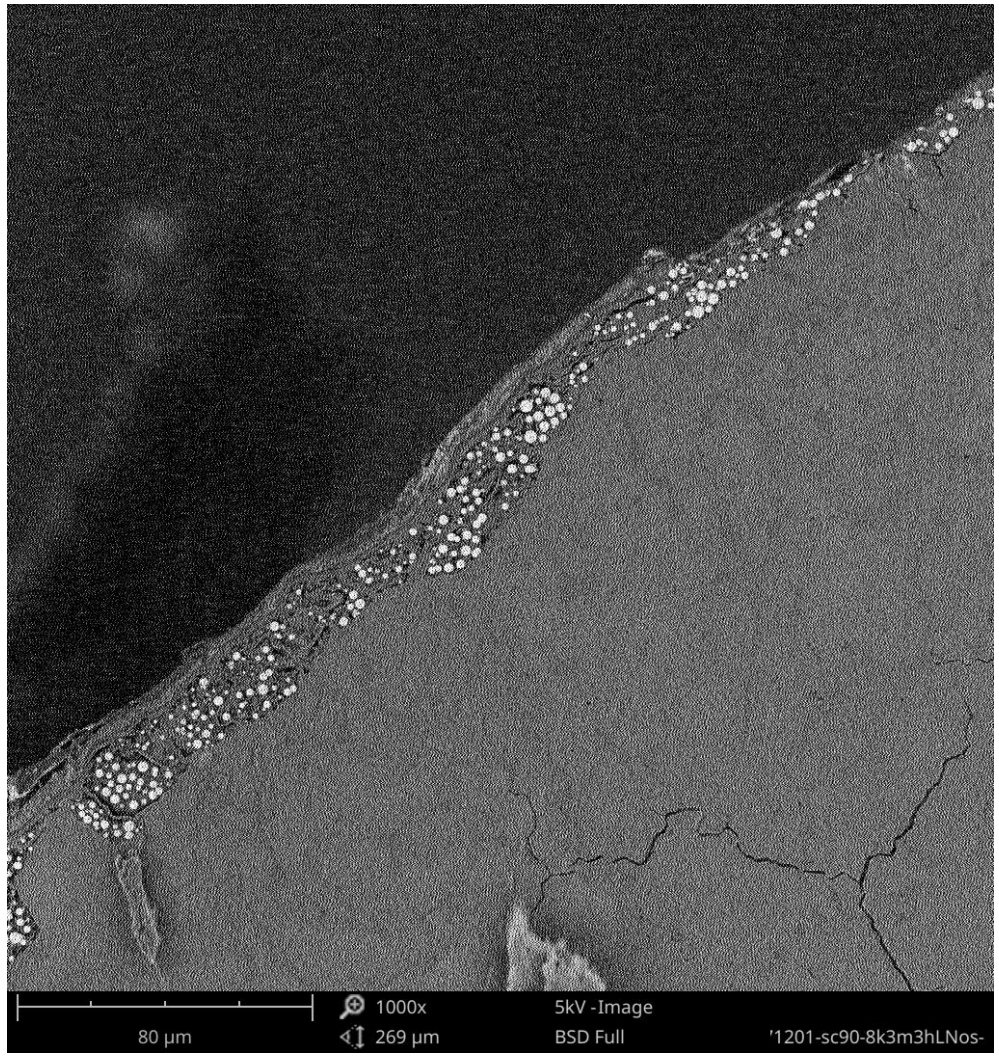


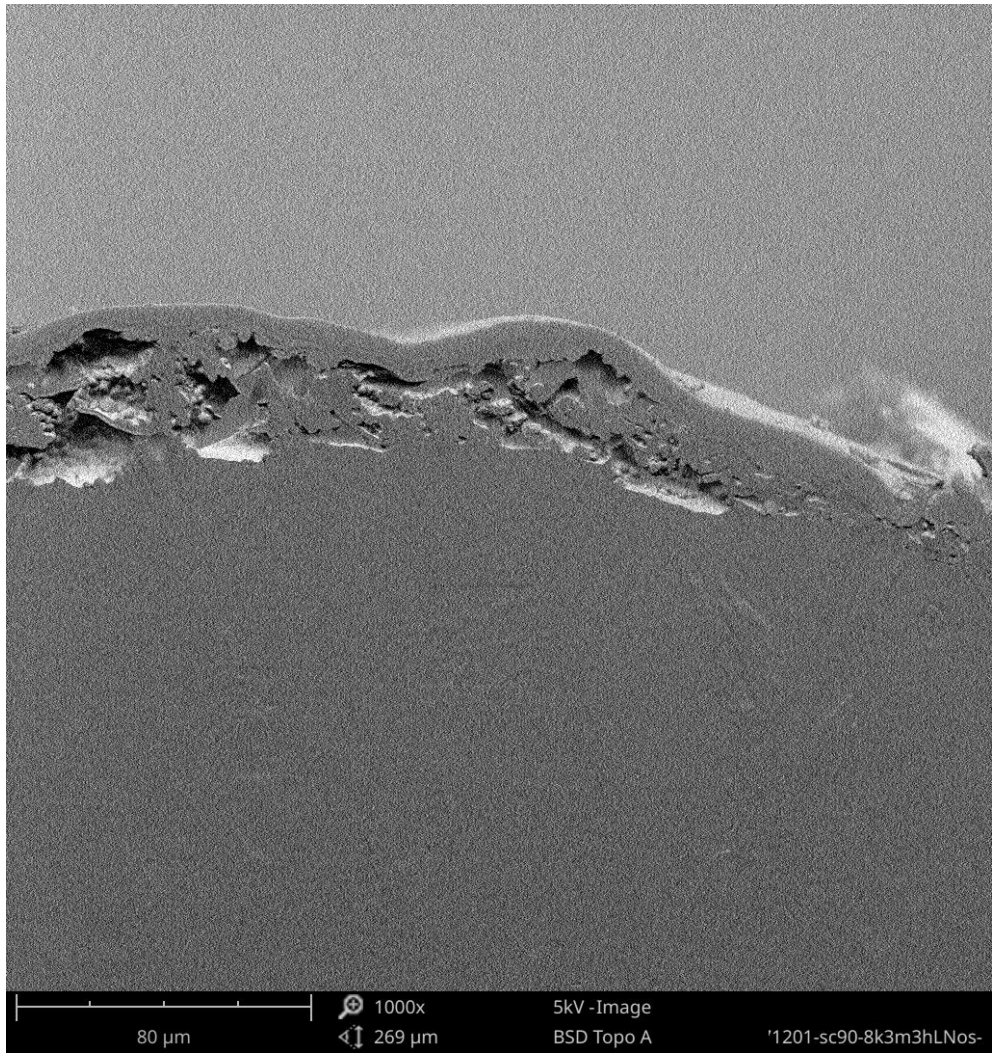
Limestone, slope cut @ 90°, 10 kV, 1 hour



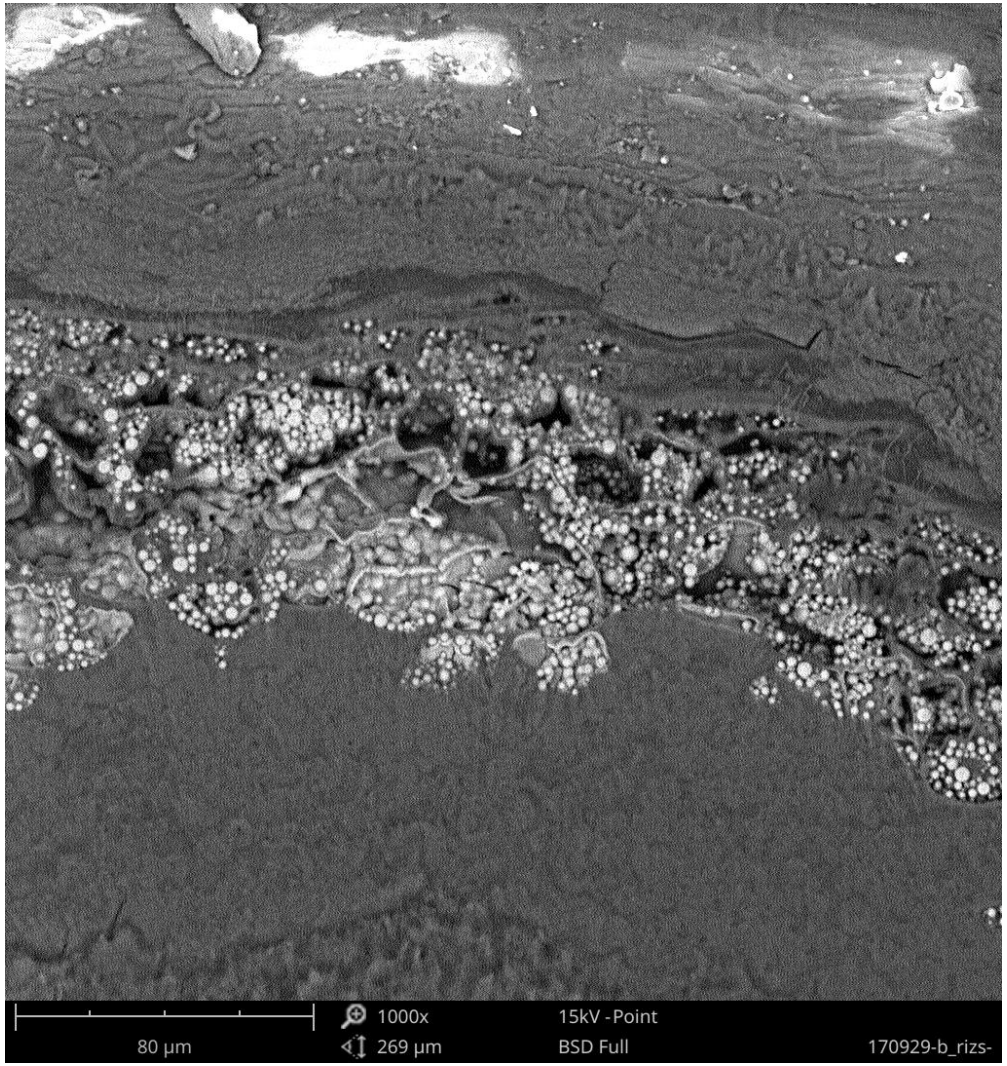


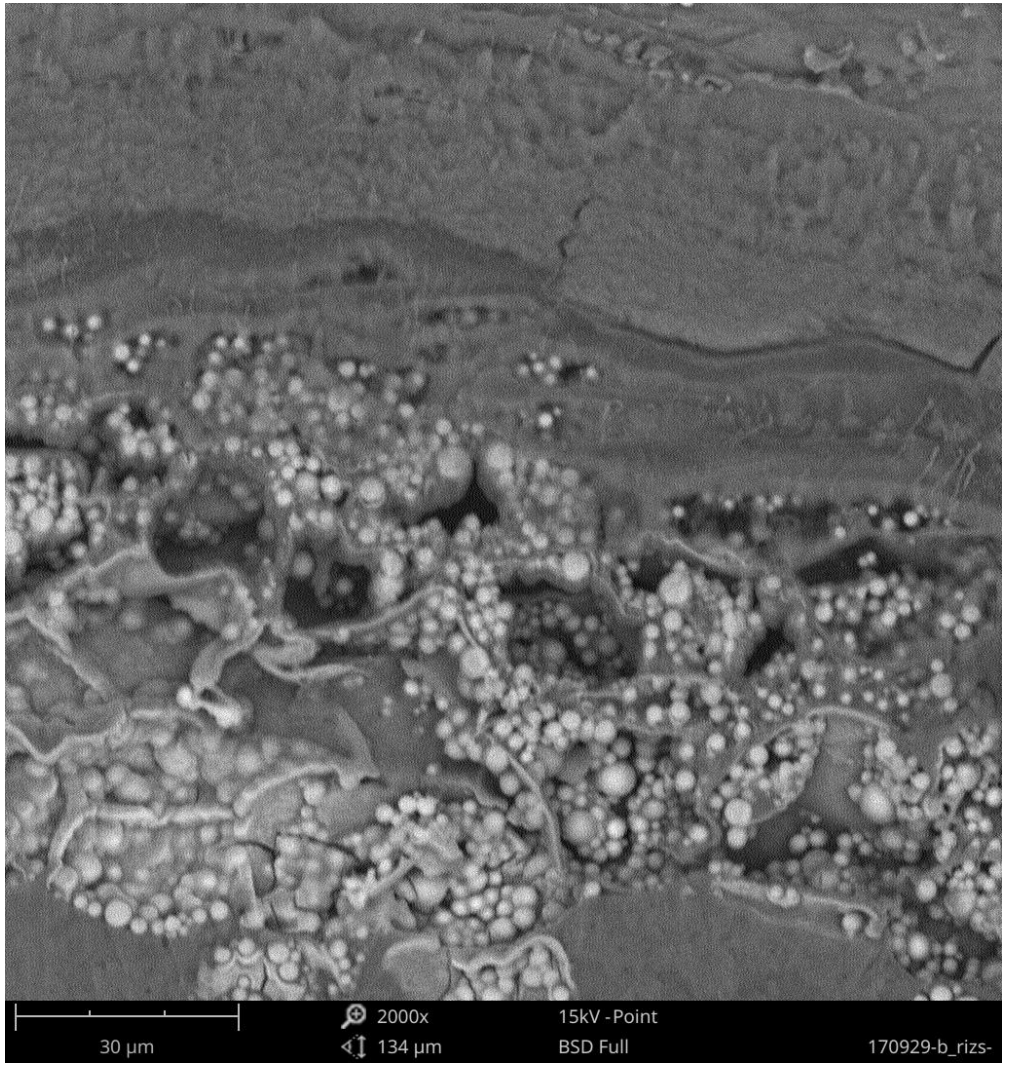
Limestone, slope cut @ 30°, 16 kV, 1 hour. Depth: 209 µm.



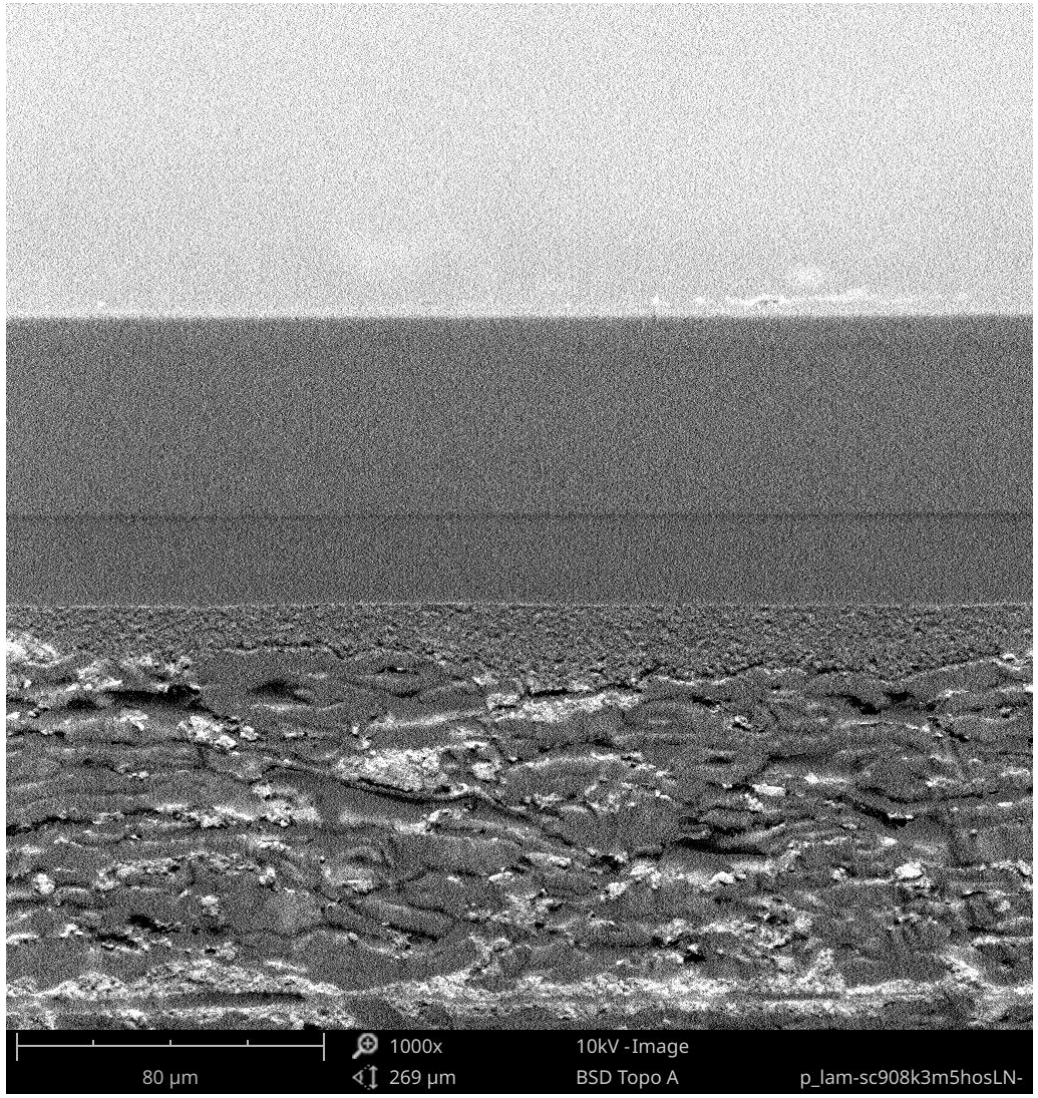


Rice grain, slope cut @ 90°, 8 kV, 120 minutes, LN_2 cooling

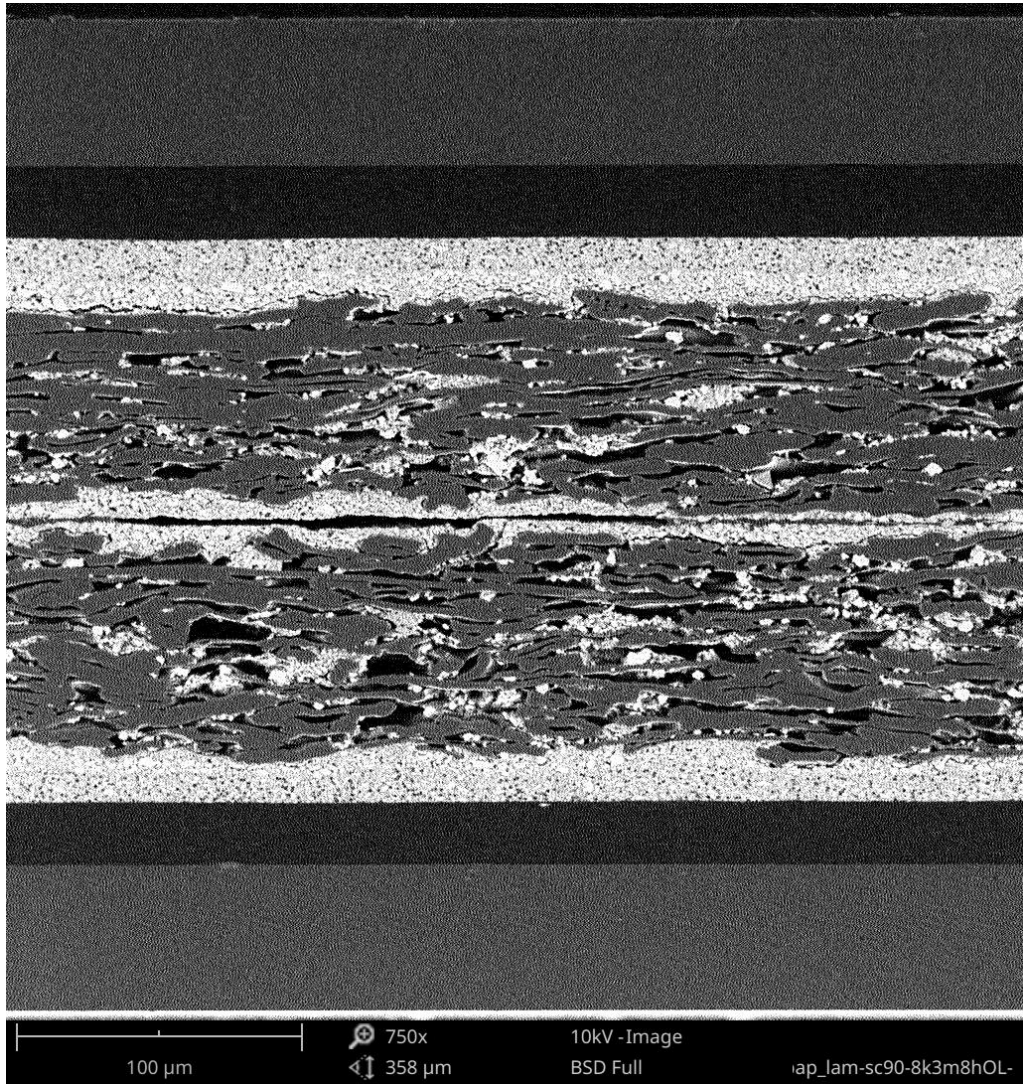




Rice, slope cut @ 30°, 10 kV, 90 minutes, LN_2 cooling

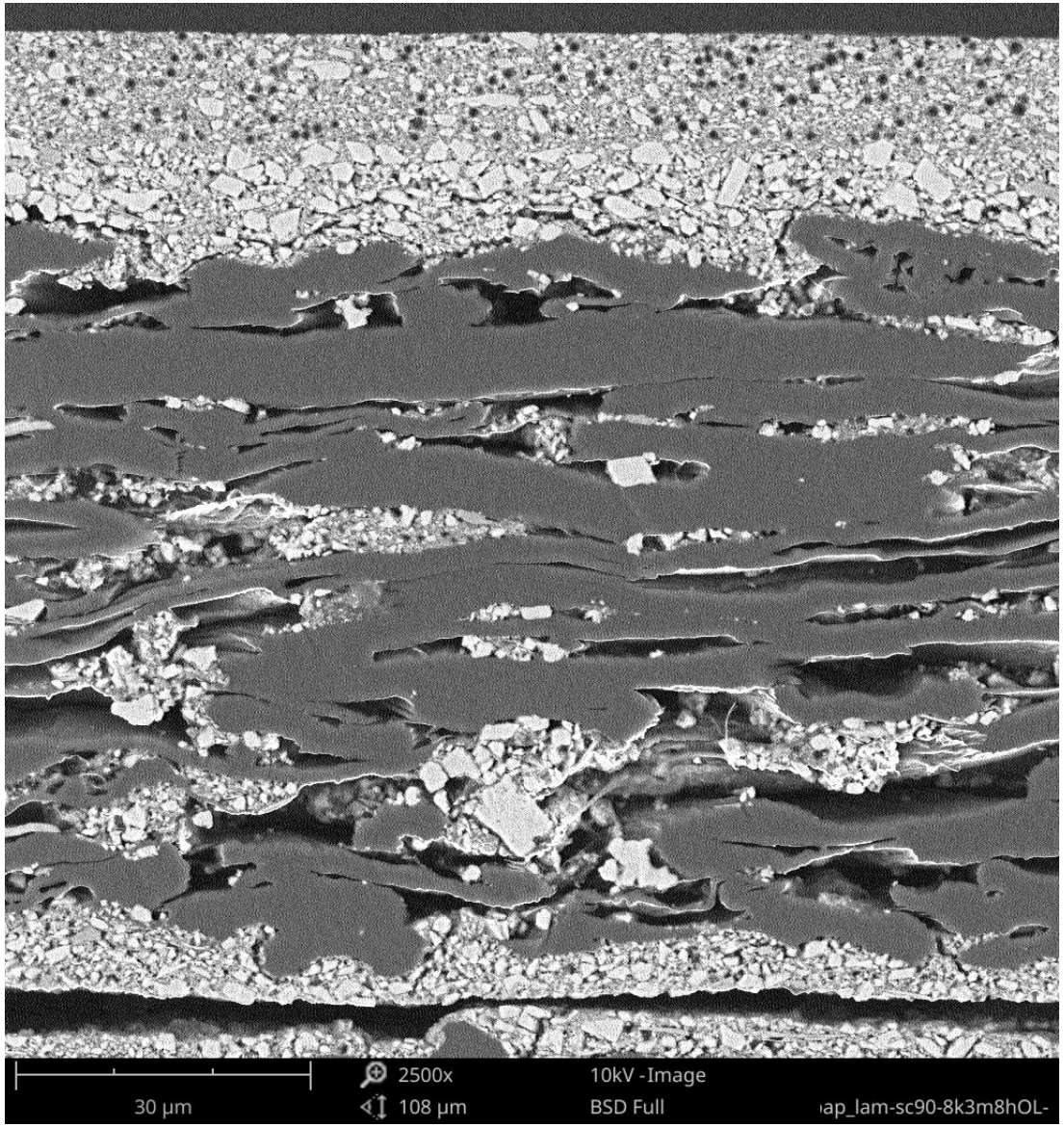


Partially cut through, 8 kV, 5 hours

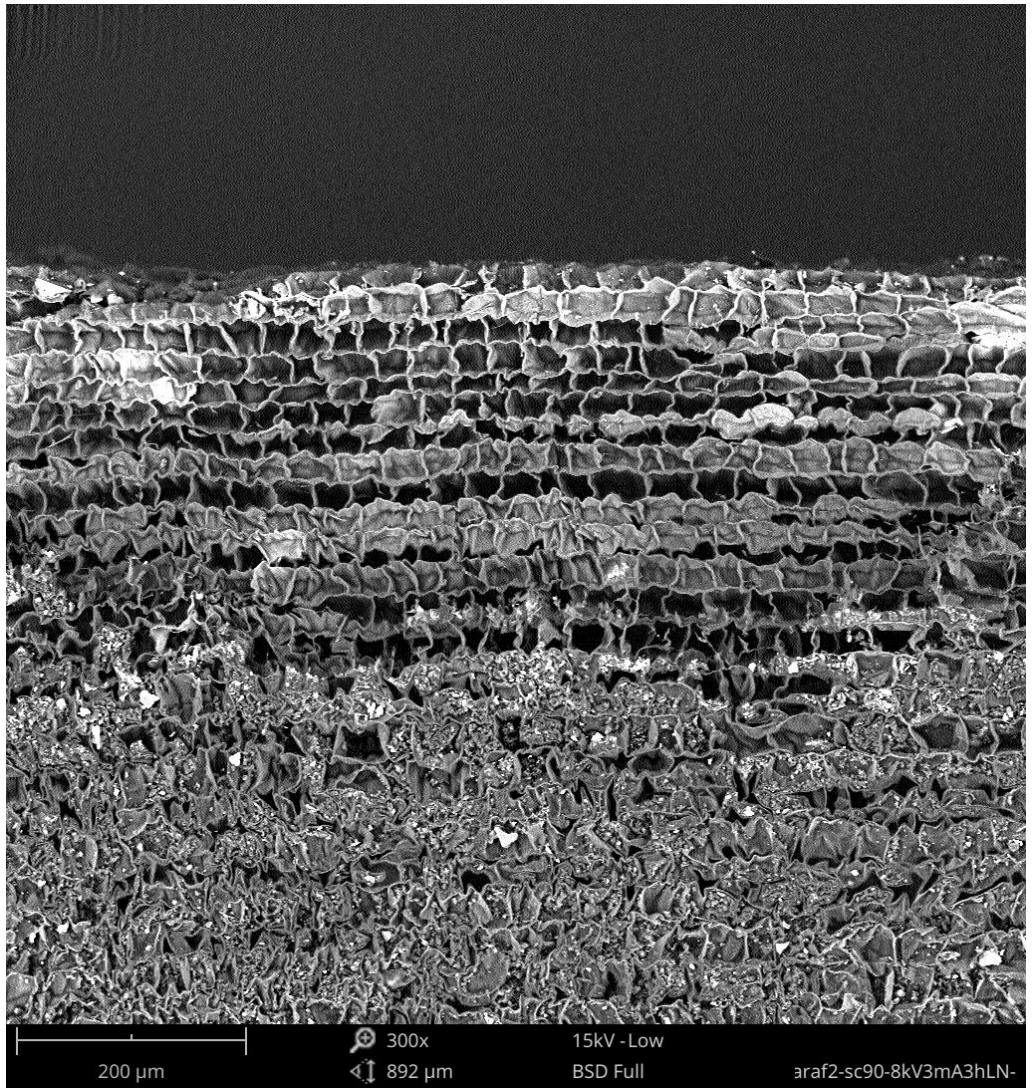


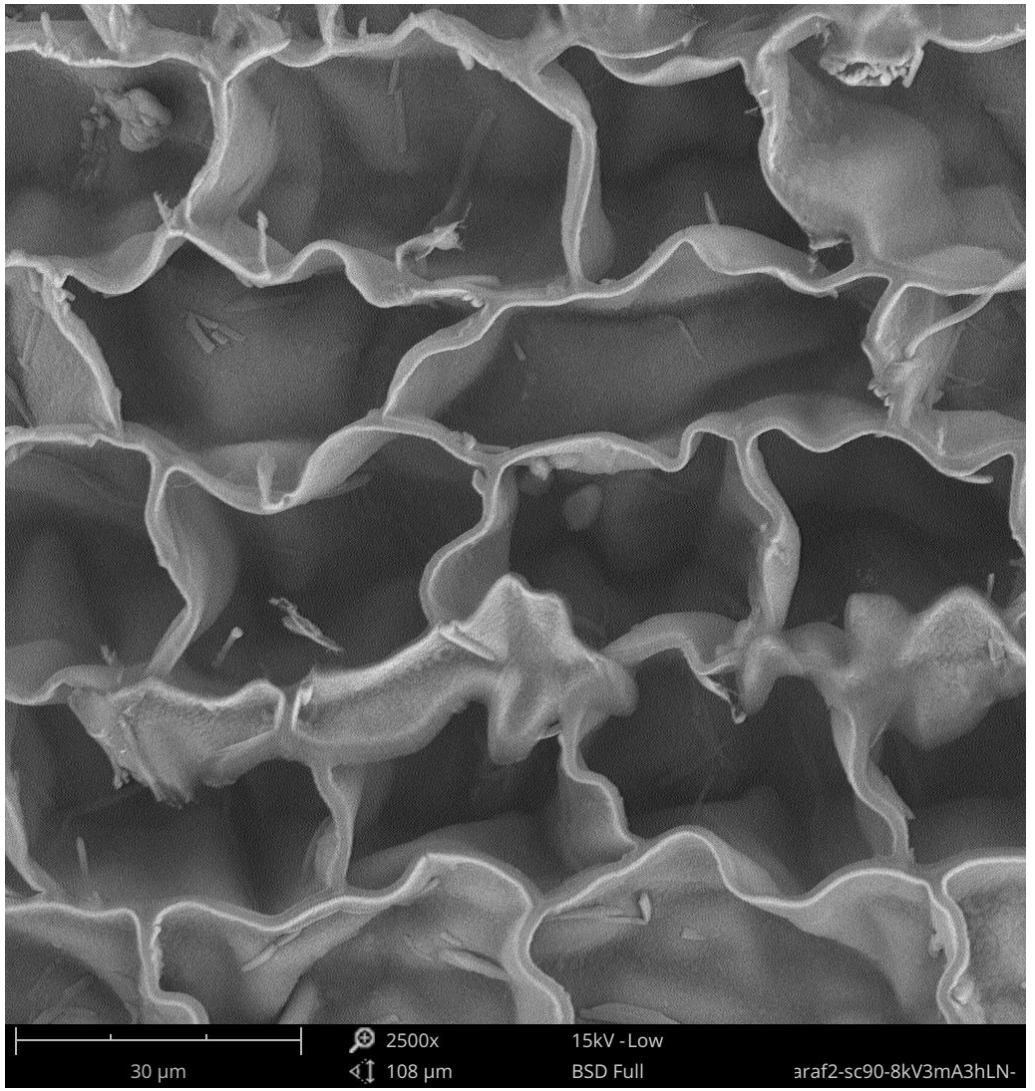
Fully cut through, 8 kV, 8 hours

Laminated paper layers, slope cut @ 90°, LN_2 cooling

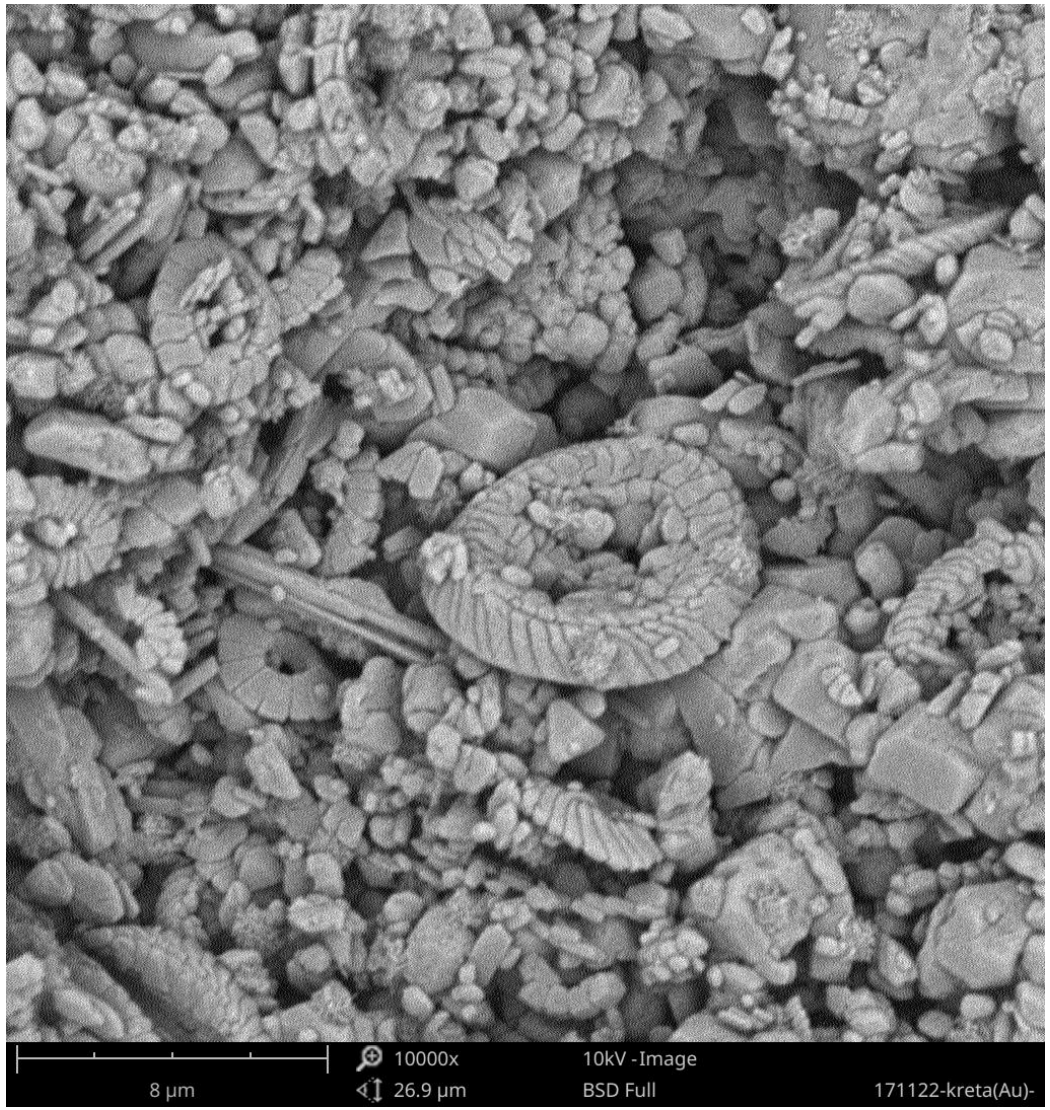


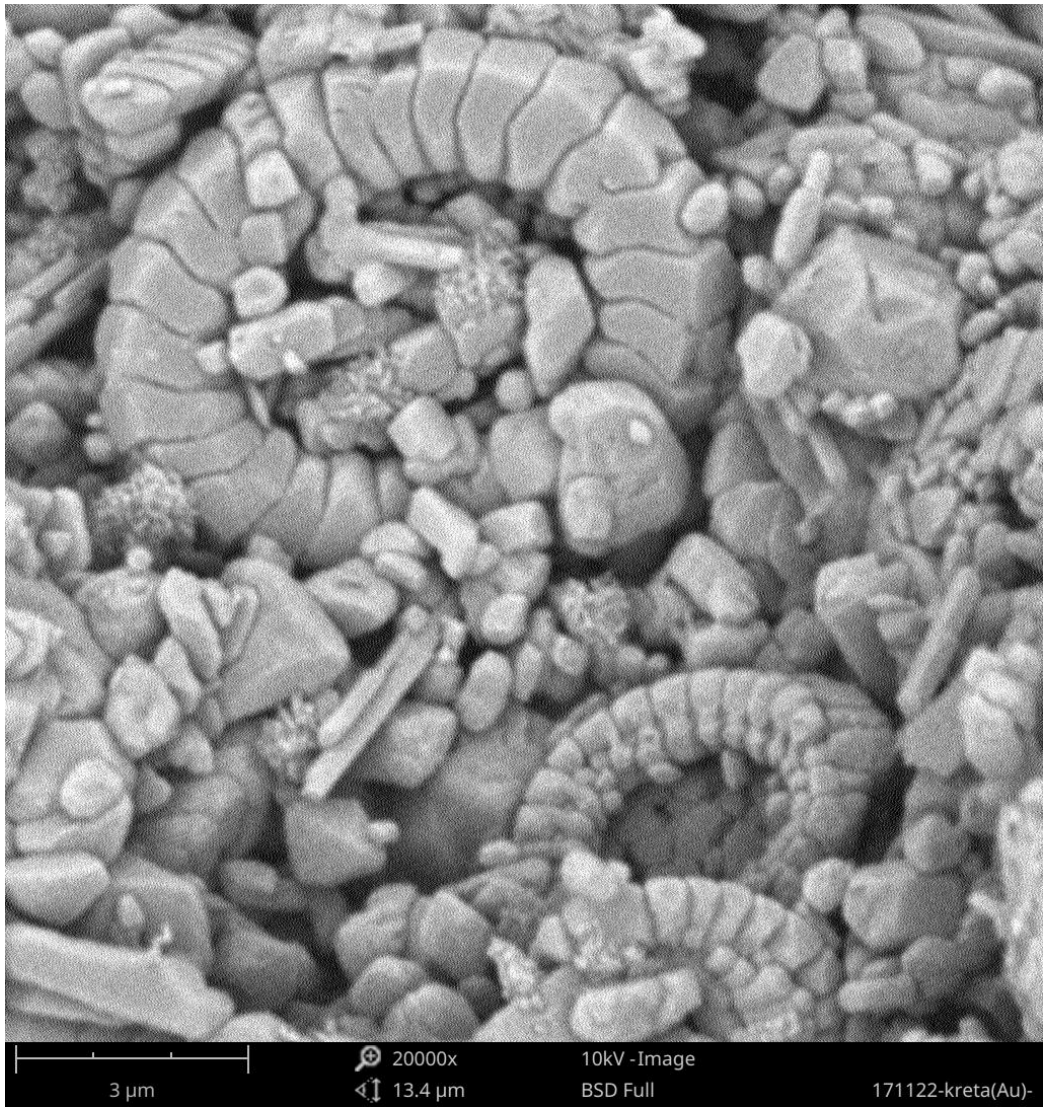
Paper layer in the laminated paper, slope cut @ 90°, 8 kV, 8 hours, LN_2 cooling



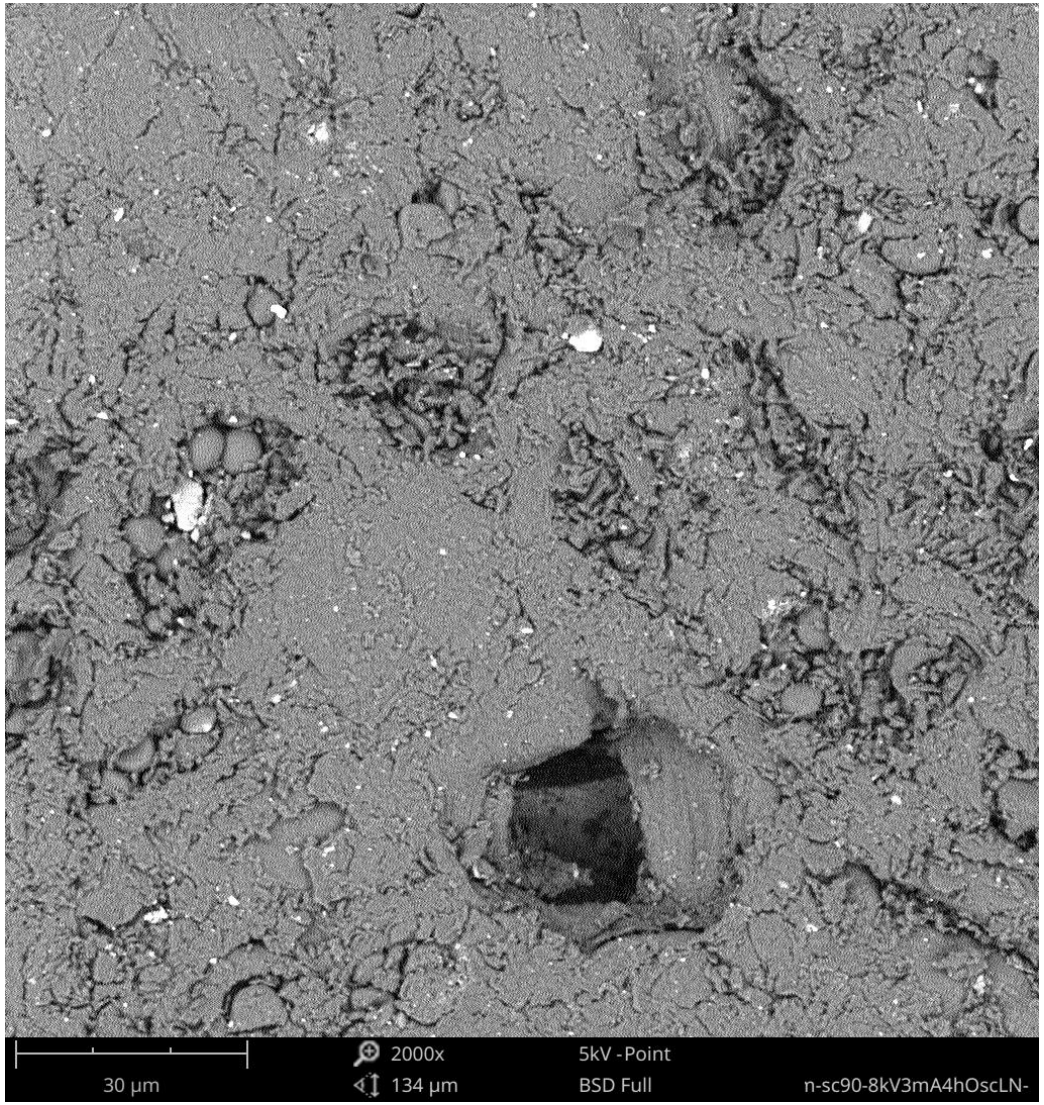


Cork (drawn from a bottle) slope cut @ 90°, 8 kV, 180 minutes, LN_2 cooling

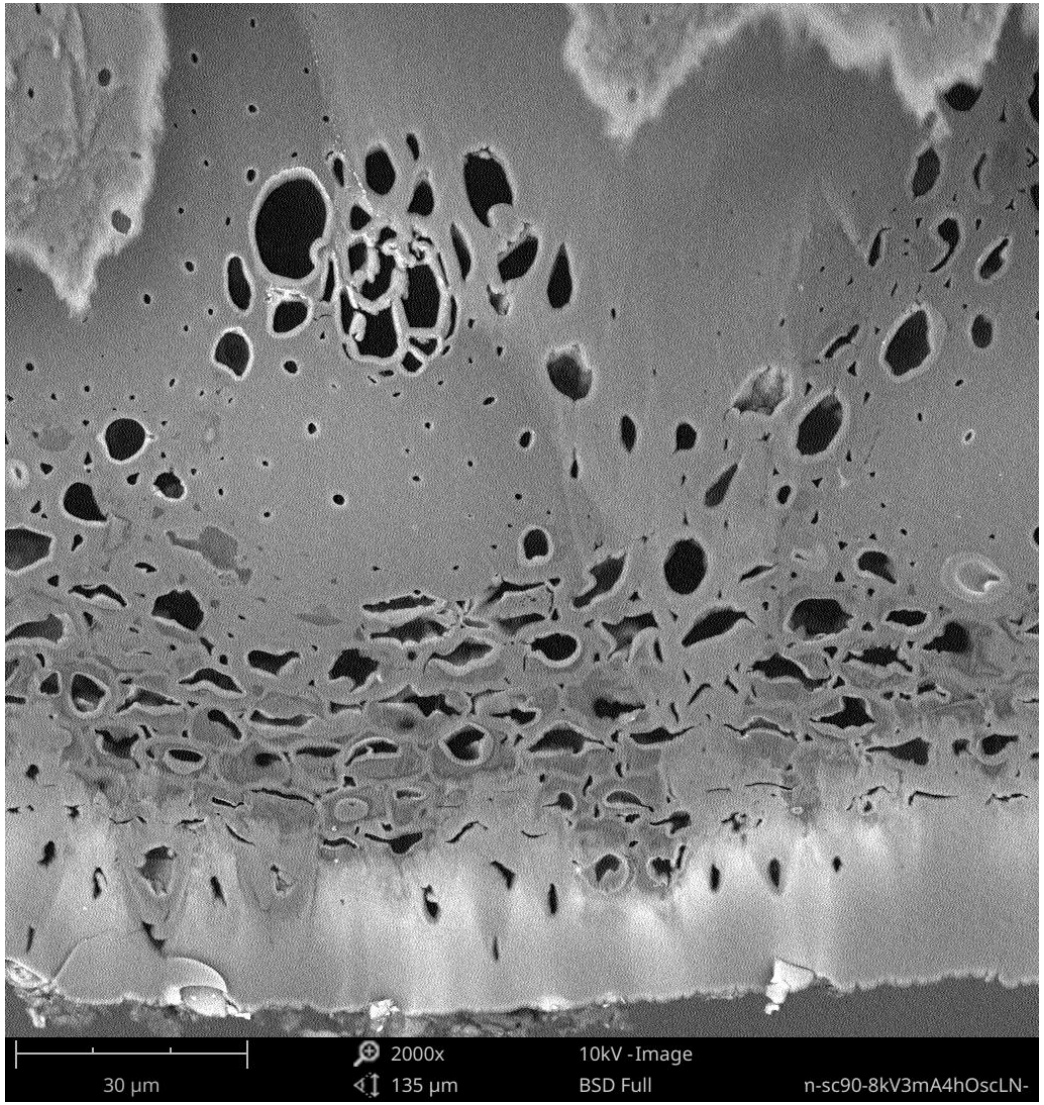




Chalk-stone (without mechanical treatment)

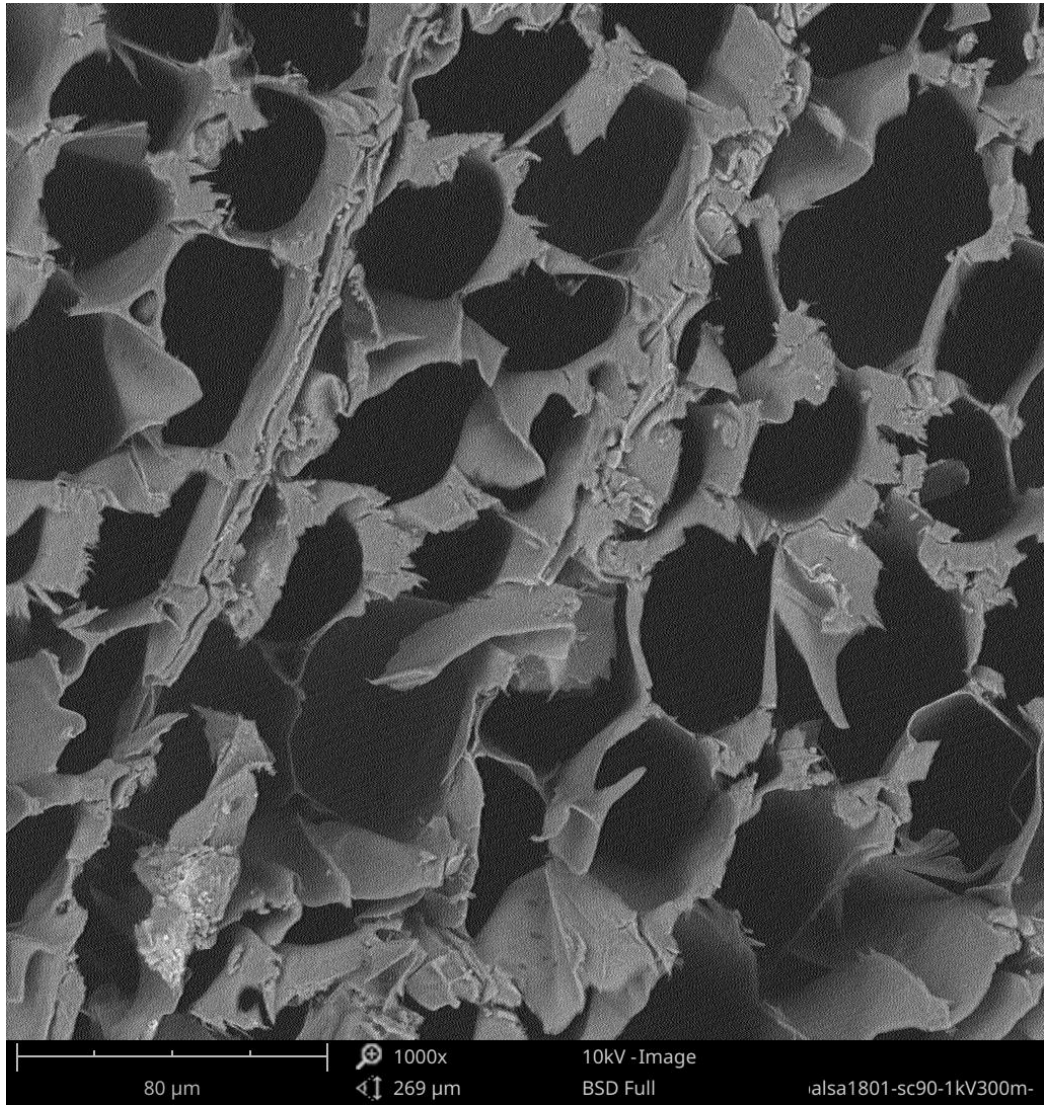


After mechanical polishing

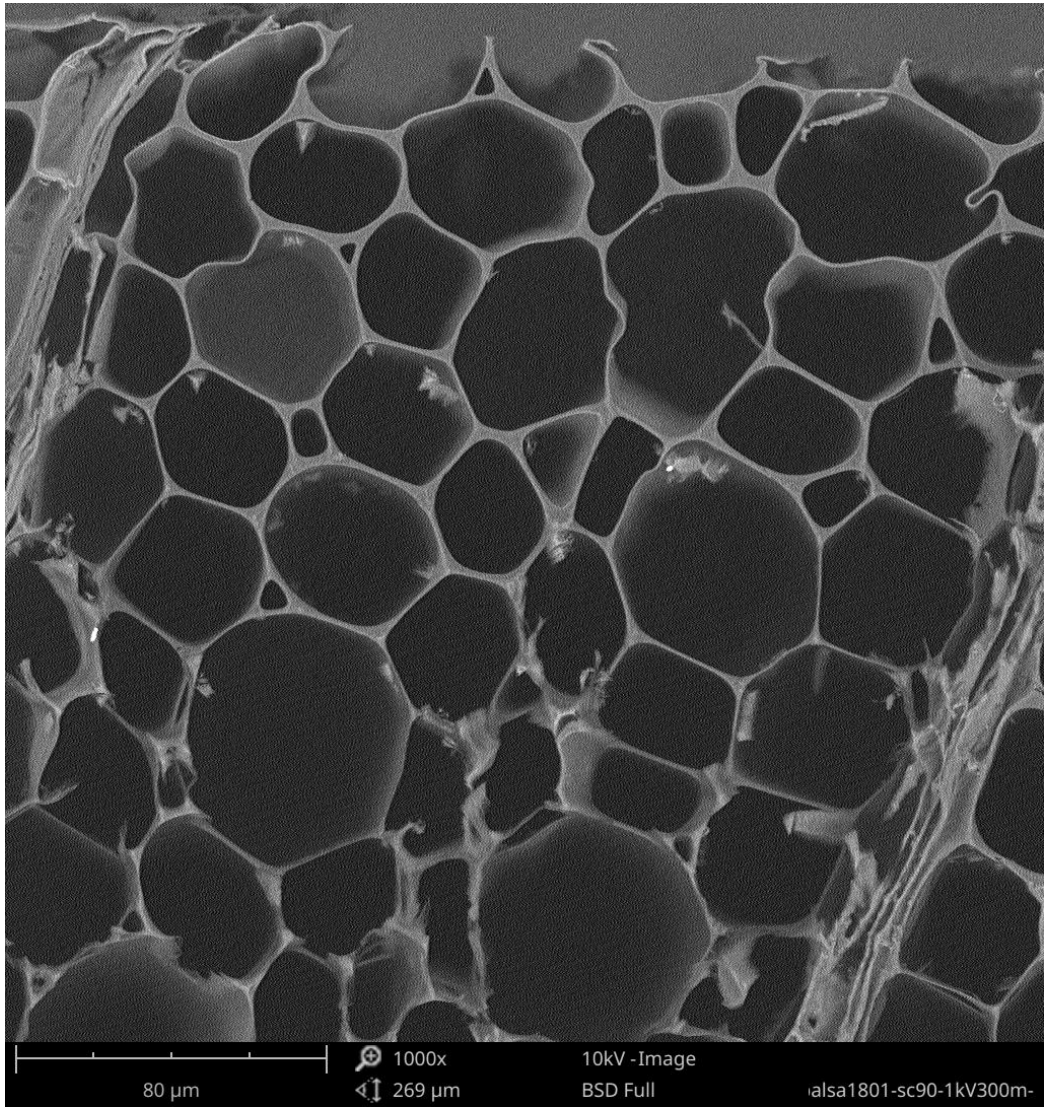


After Ar ion slope cut

Bamboo slope cut @ 90°, 8 kV, LN_2 cooling, 4 hours



After mechanical cutting



After Ar ion slope cut

Balsa wood slope cut @ 90°, 1 kV, LN_2 cooling, 5 hours