SAND2008-3891P

FIB/SEM Nanotomography: 3-Dimensional Microstructural Characterization of Explosives

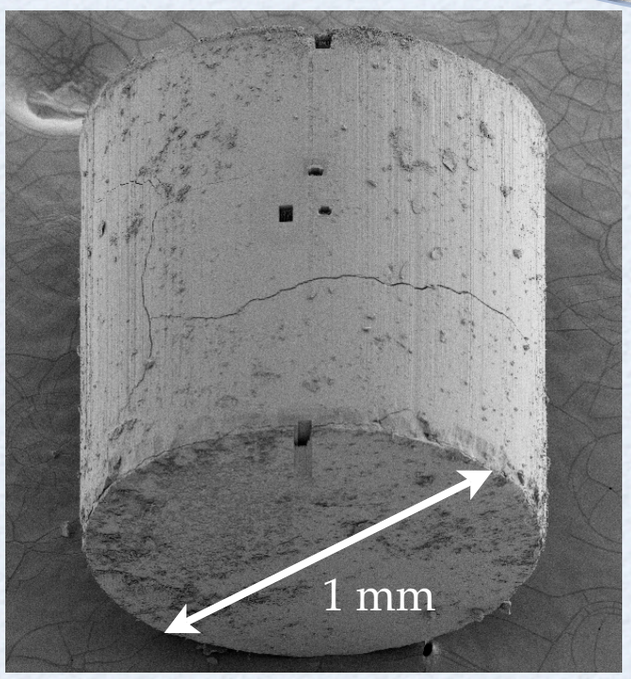
Ryan R. Wixom, A.S. Tappan, E.J. Welle, G.T. Long,
J.R. Michael, A.L. Brundage

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Traditional, spatially averaged metrics may not be appropriate for characterization of microenergetics or understanding initiation

Vapor deposited PETN

Pressed HNS



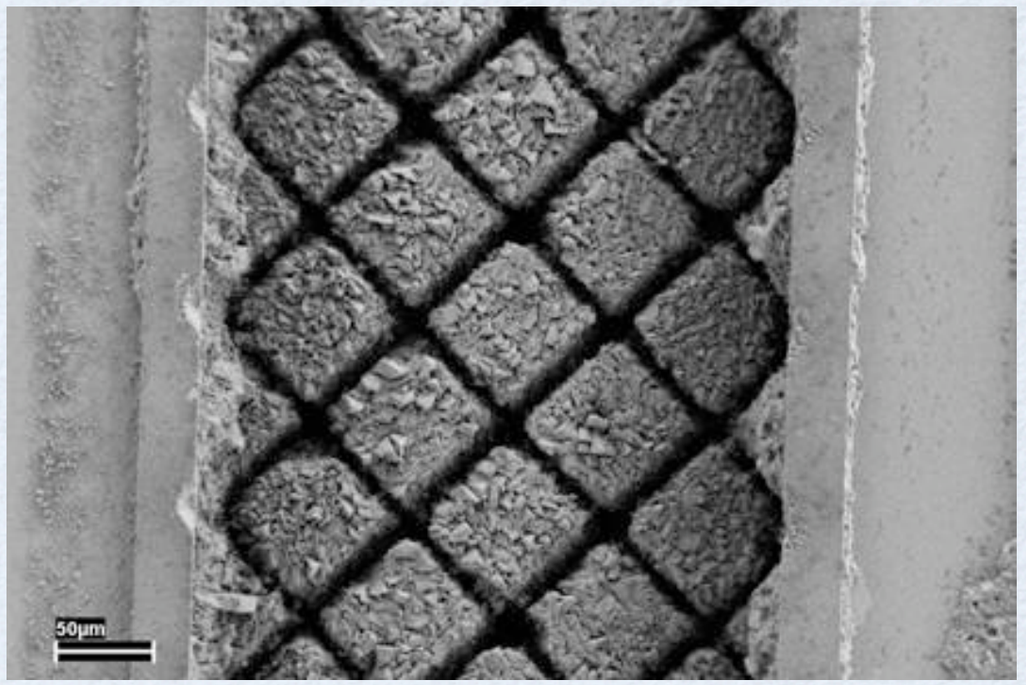
Structure

↓

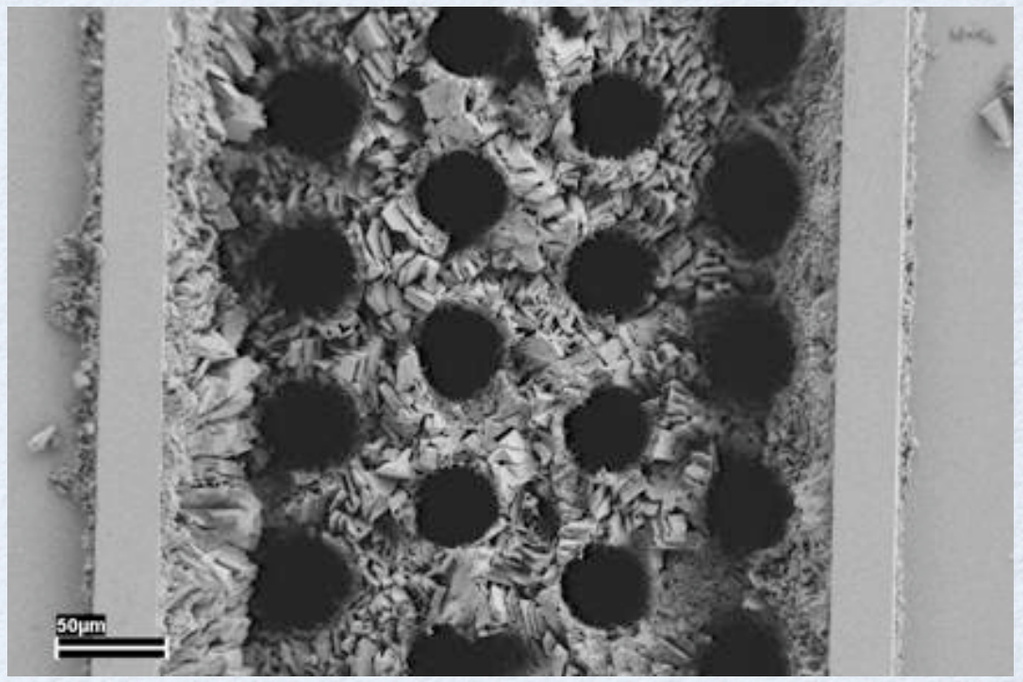
Properties

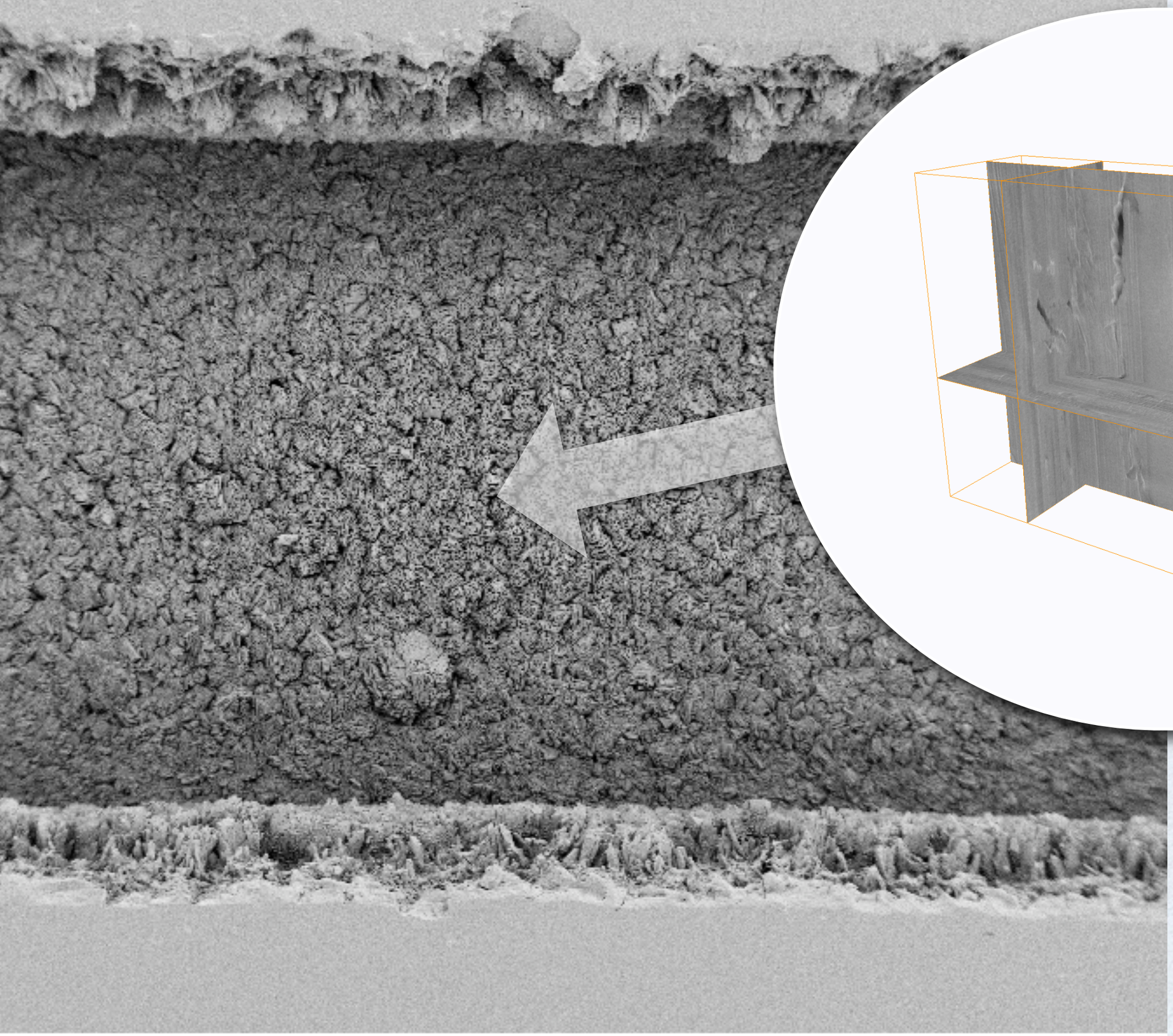
↓

Performance

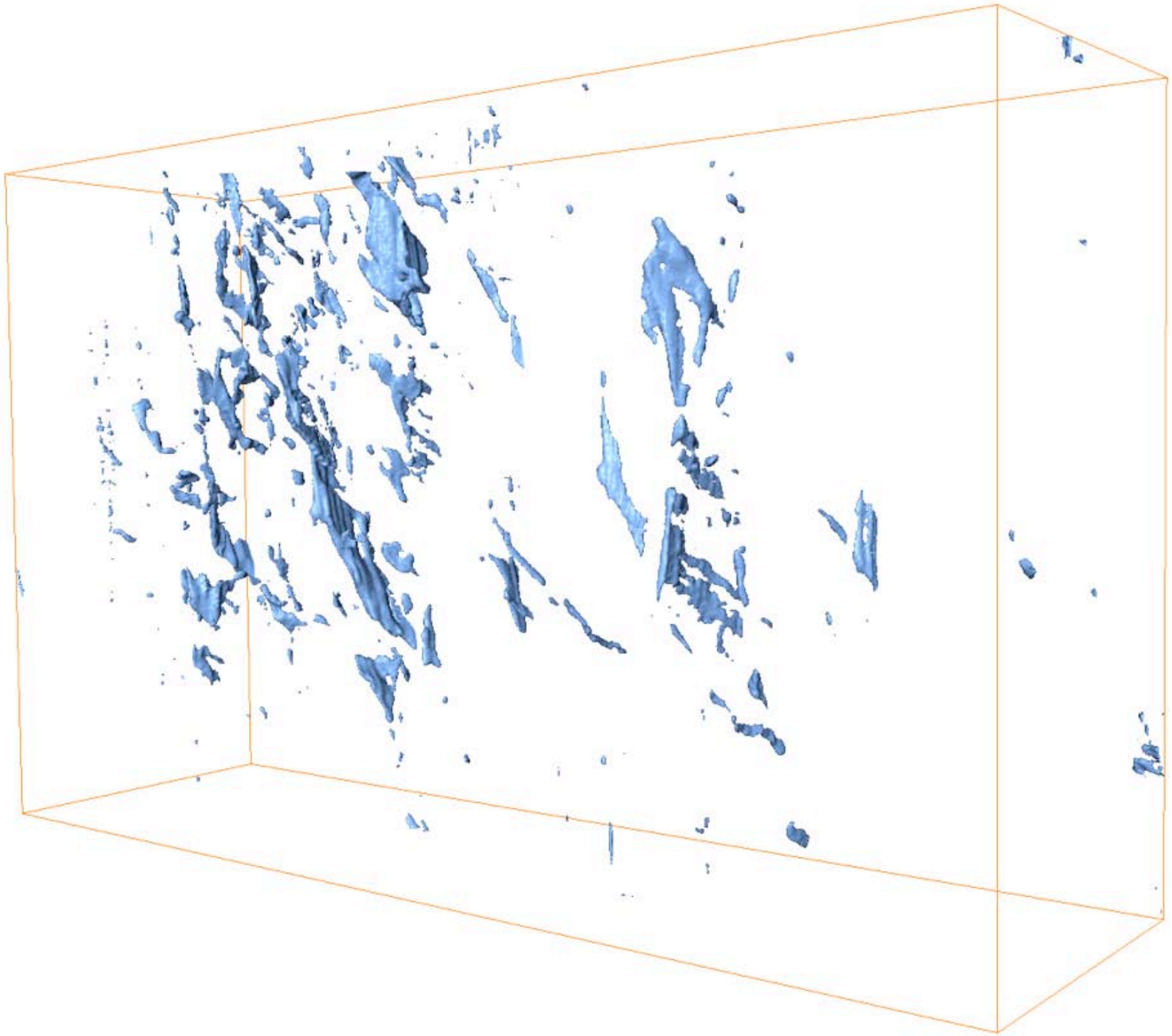


Engineered Porosity

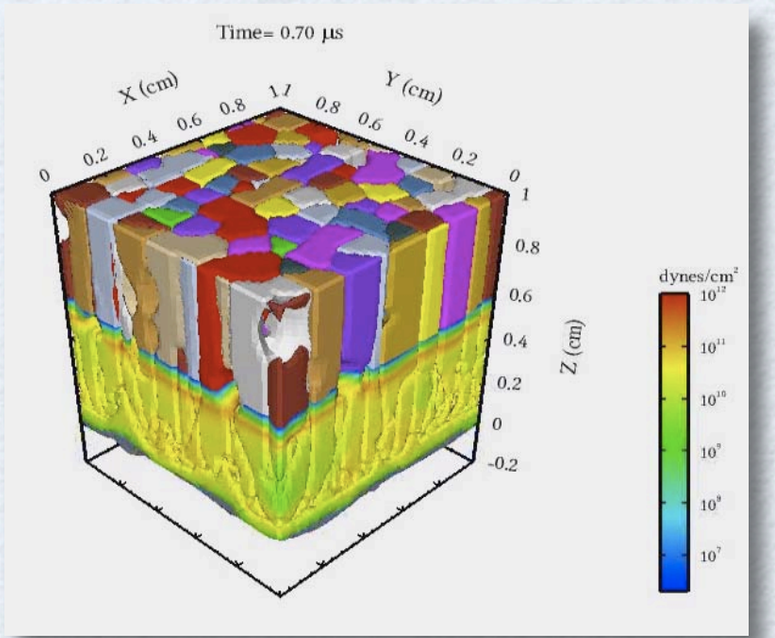




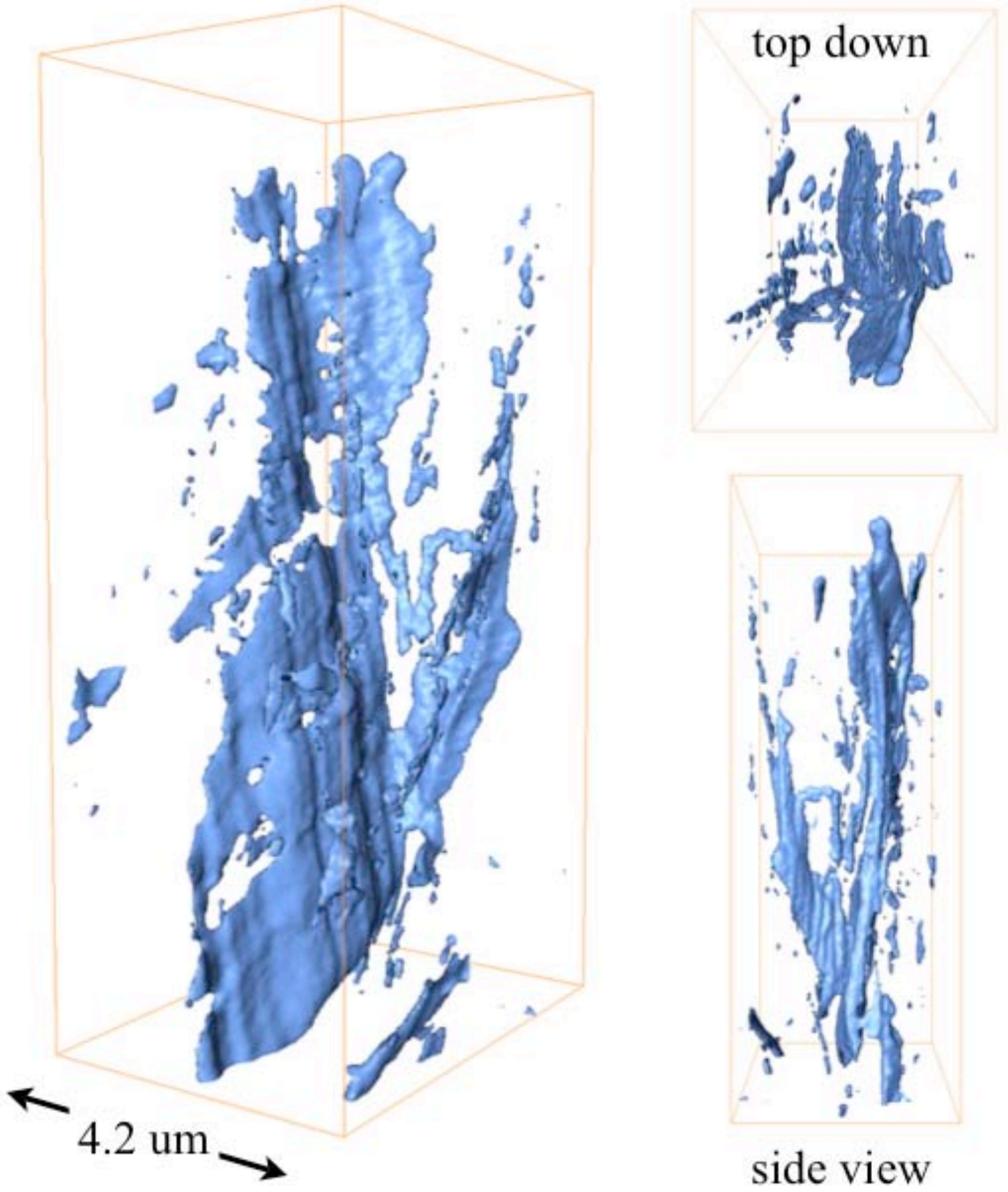
FIB / SEM
nanotomography
inside a
microchannel

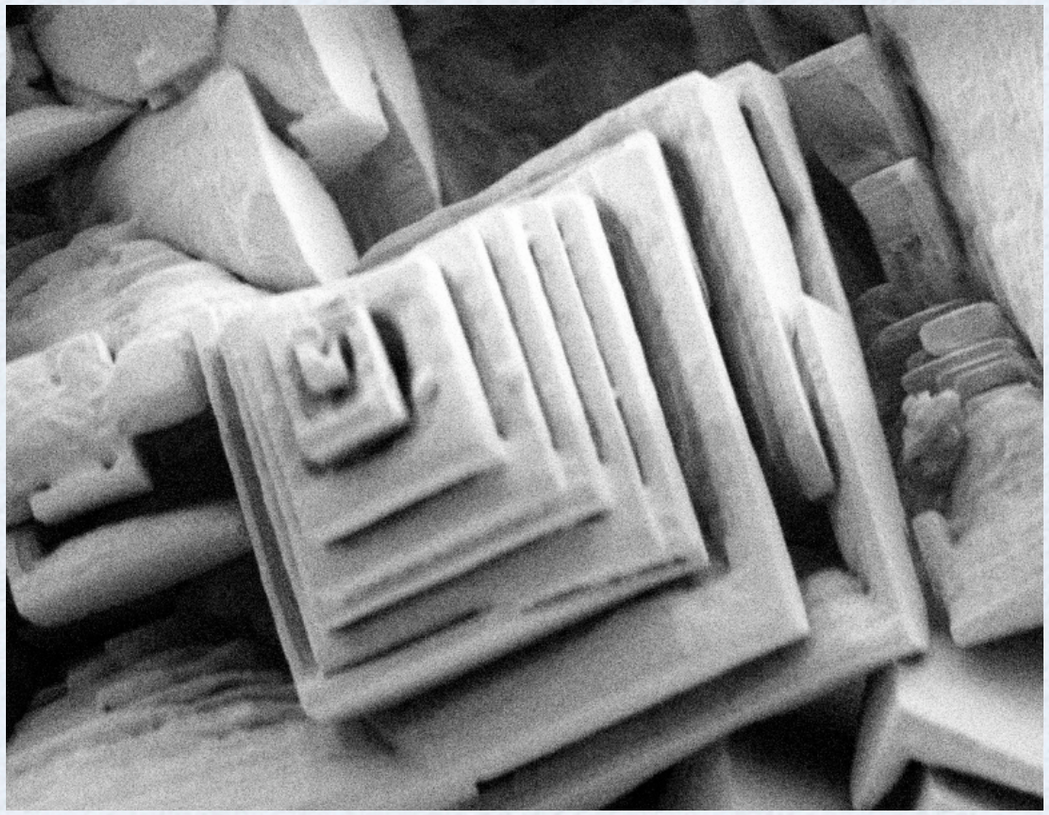


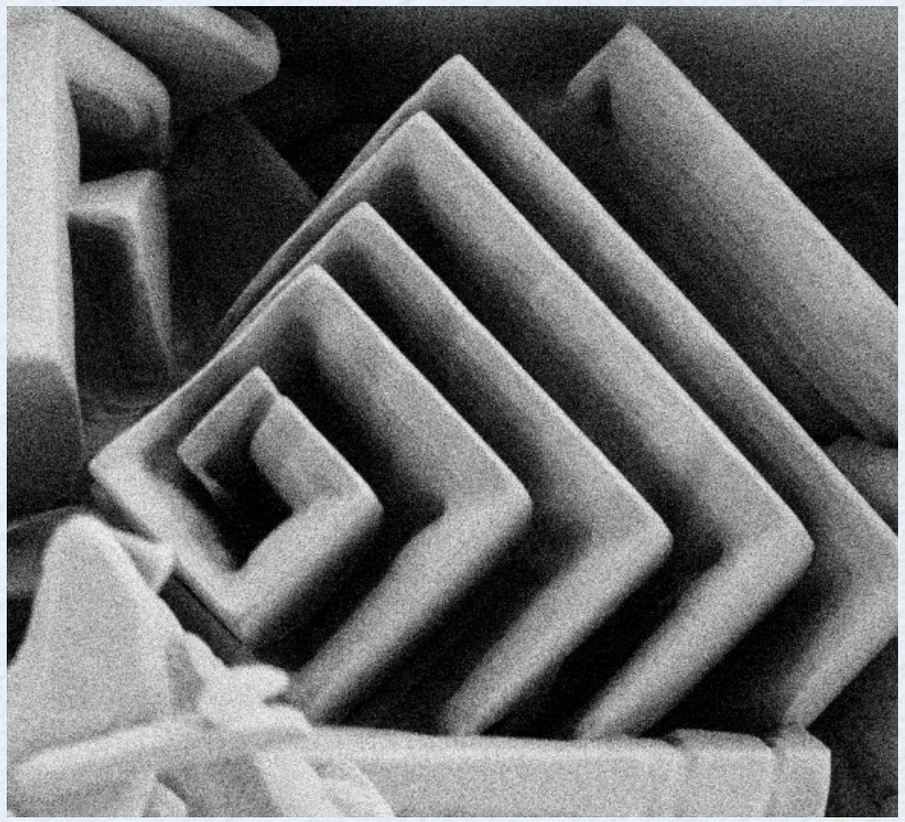
Pore morphology and distribution. This data will be directly imported into a mesoscale shock physics simulation.

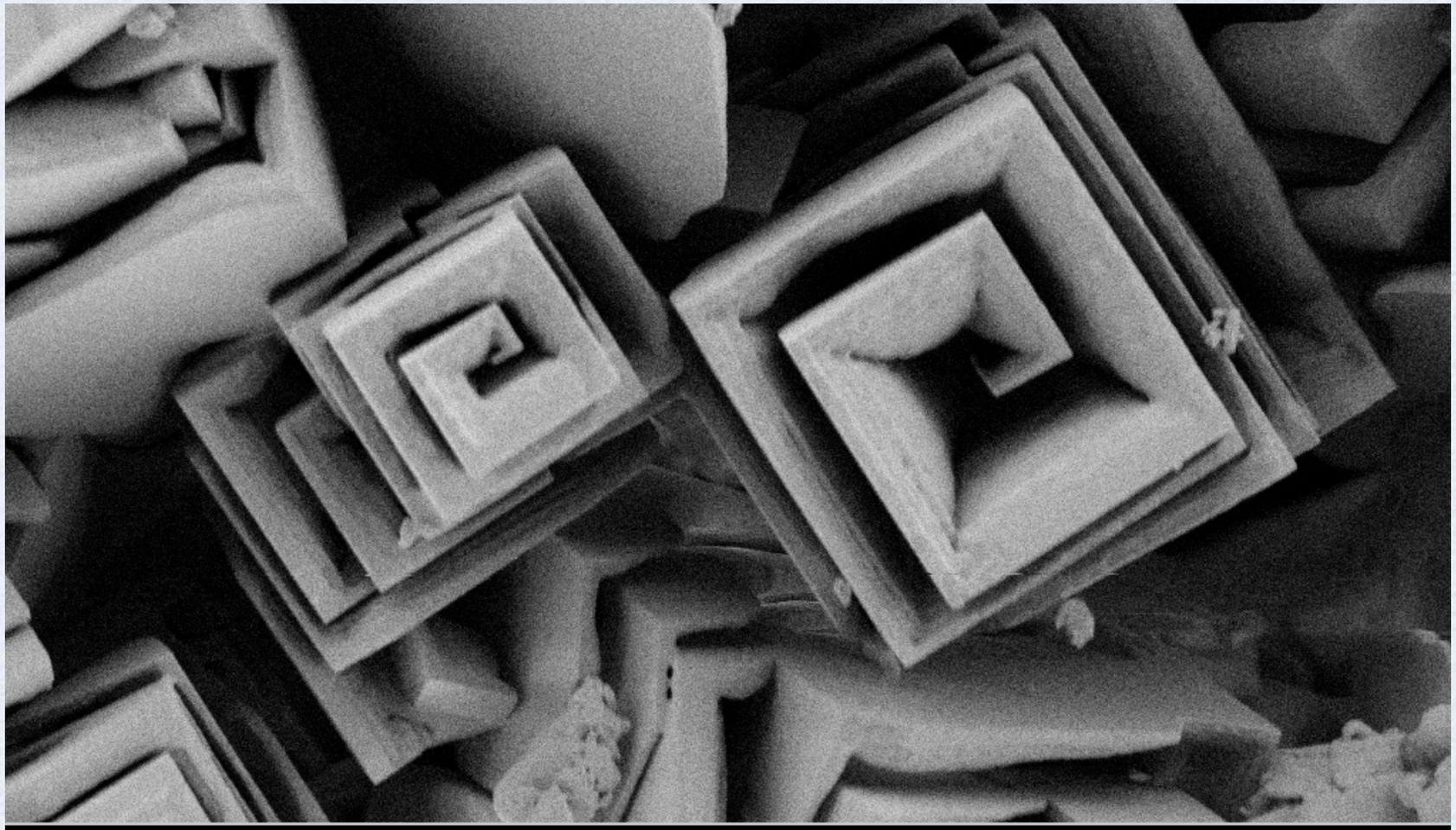


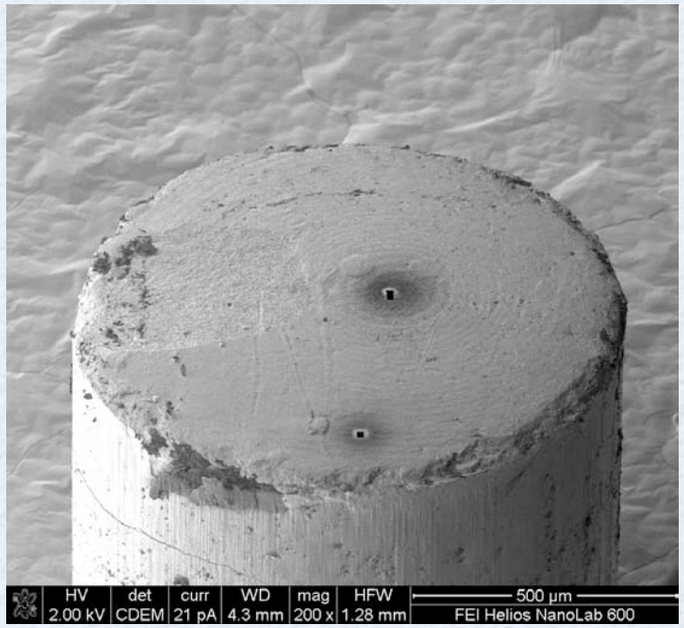
Morphology of a large grain-boundary pore in vapor deposited PETN.

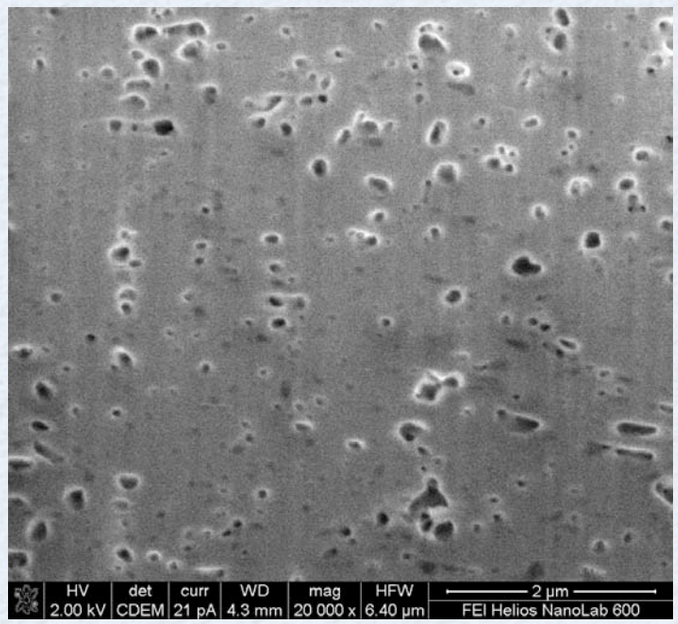


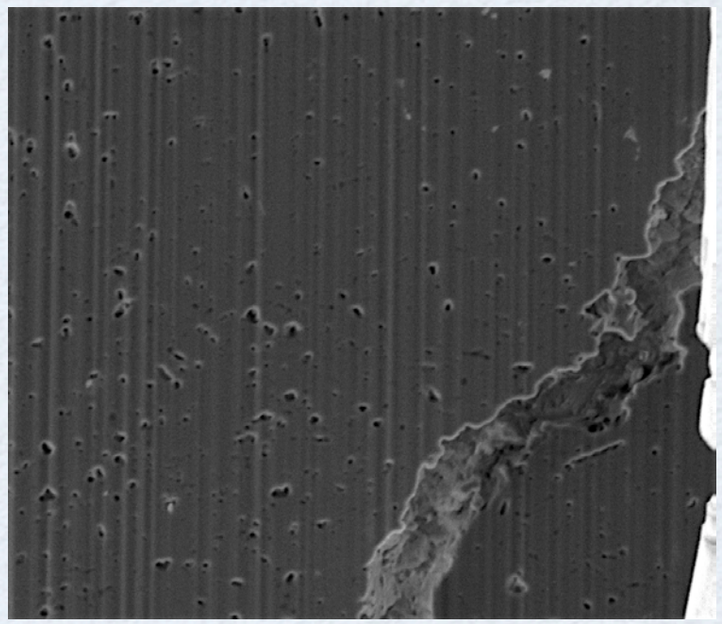





Stage at X = 64.152 mm
Stage at Y = 46.822 mm
2µm
WD = 11 mm
EHT = 2.00 kV
Mag = 2.89 K X
Signal A = SE2
Vacuum Mode = High Vacuum
Date :18 Apr 2008
Time :11:37:03







Pressed FP-HNS :

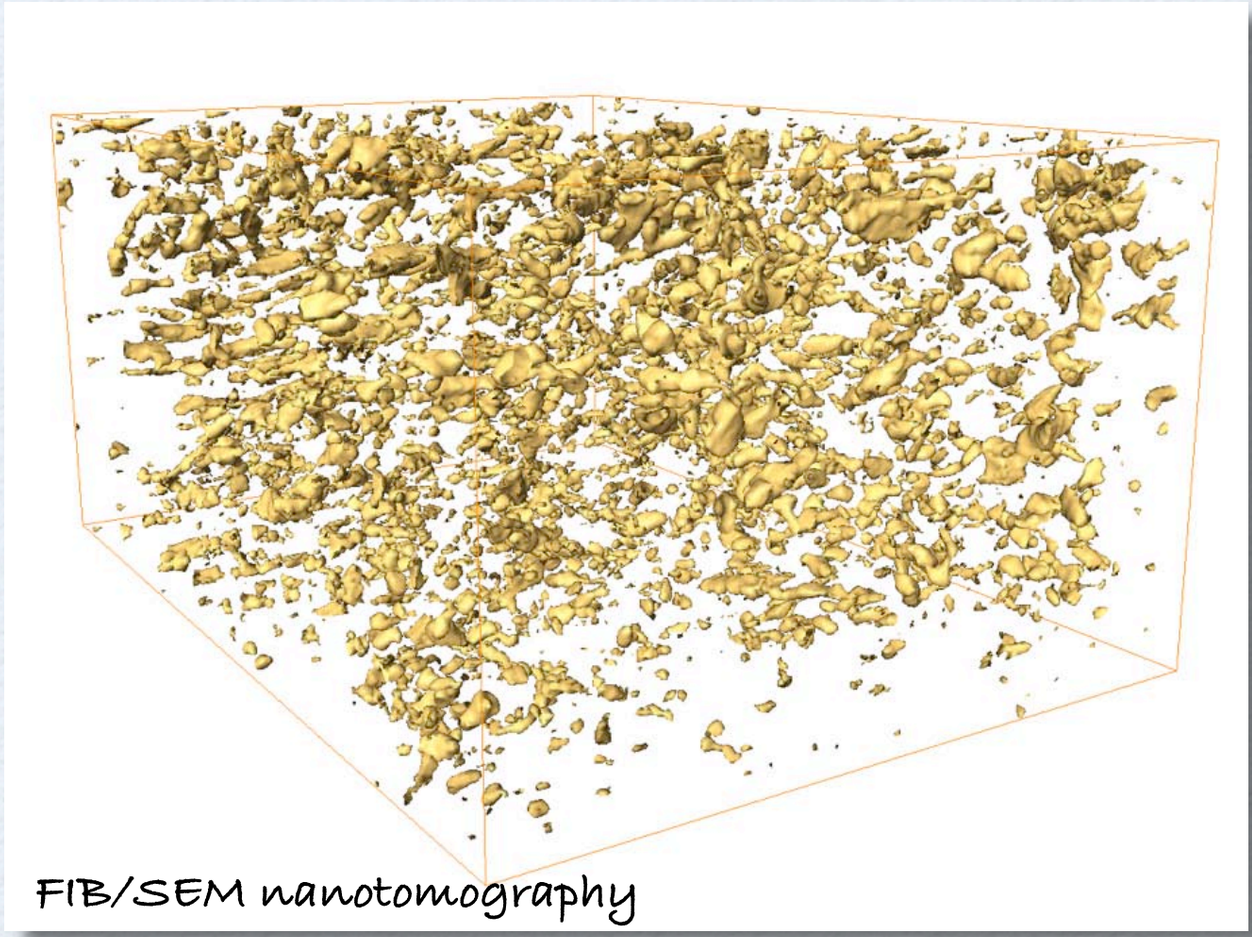
90% TMD nominal

400 slices at 25 nm/slice.

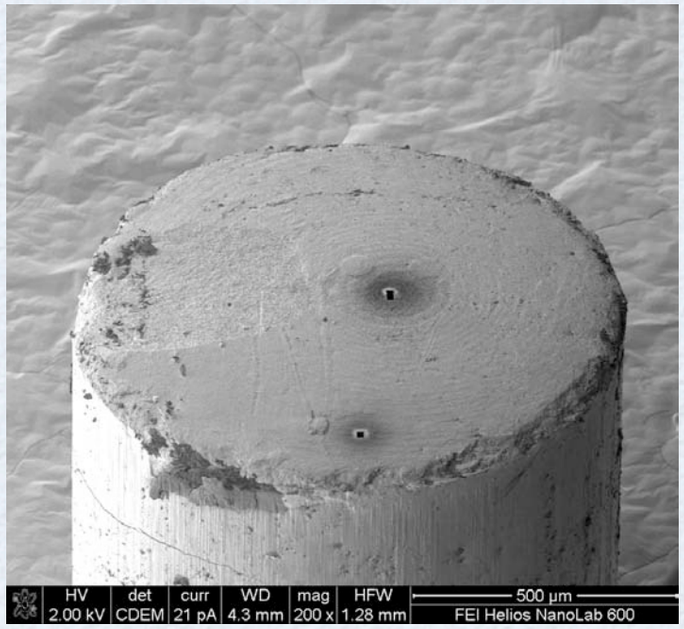
Voxels = 6 x 6 x 25 nm

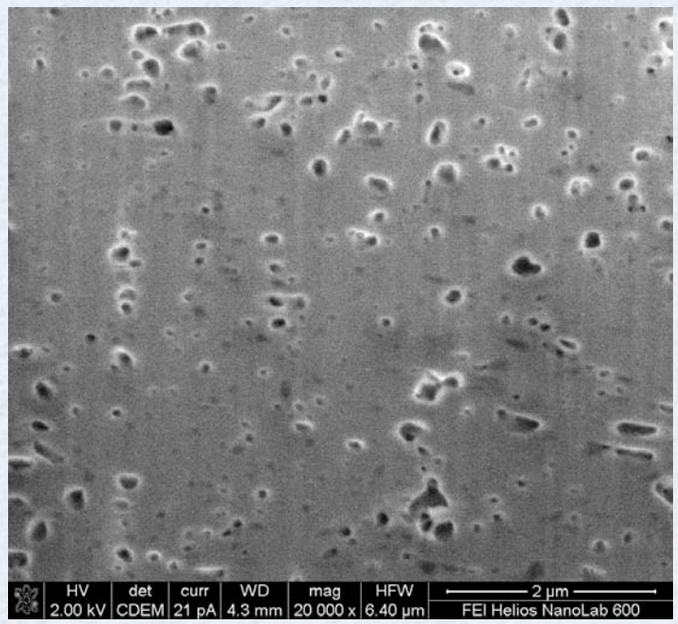
Computed density: 98 % TMD

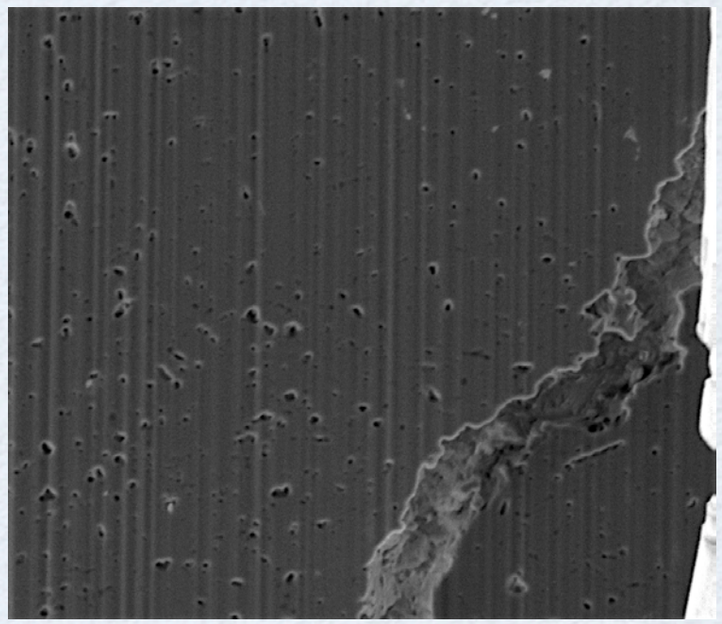
Surface Area: ?



FIB/SEM nanotomography







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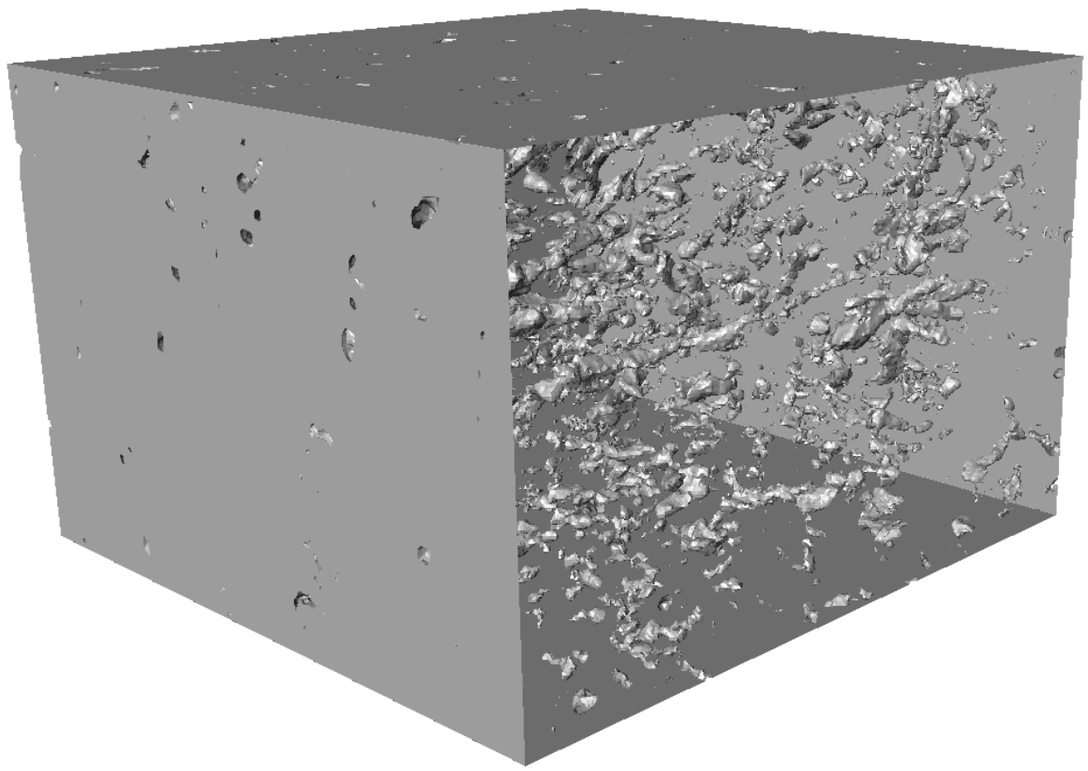

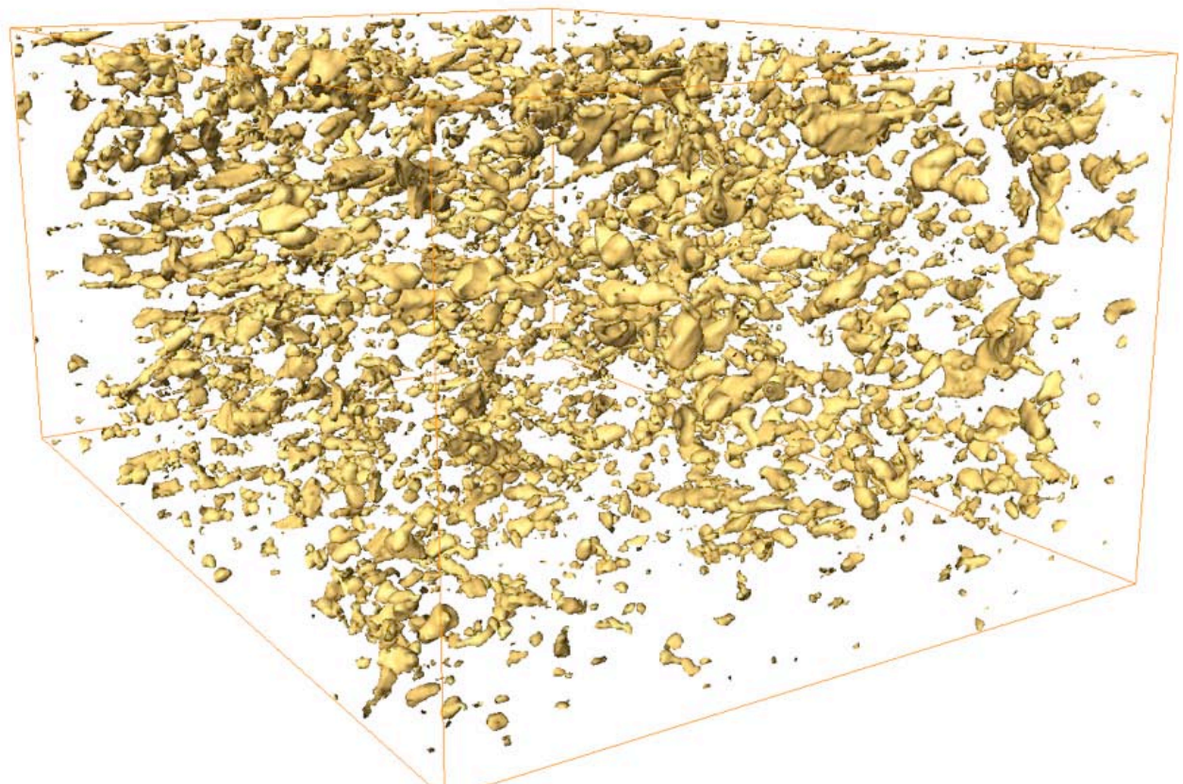

FIB/SEM nanotomography

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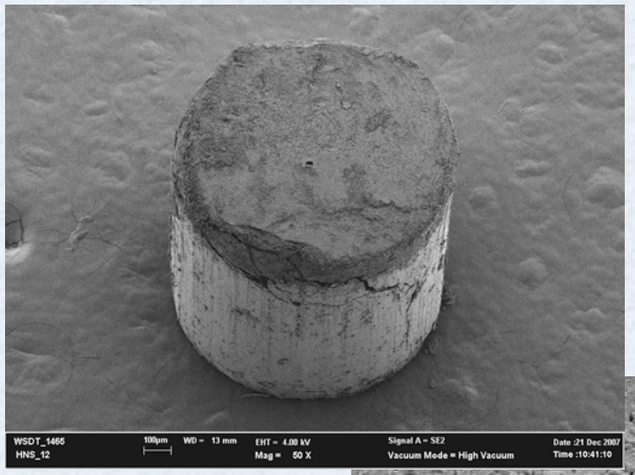
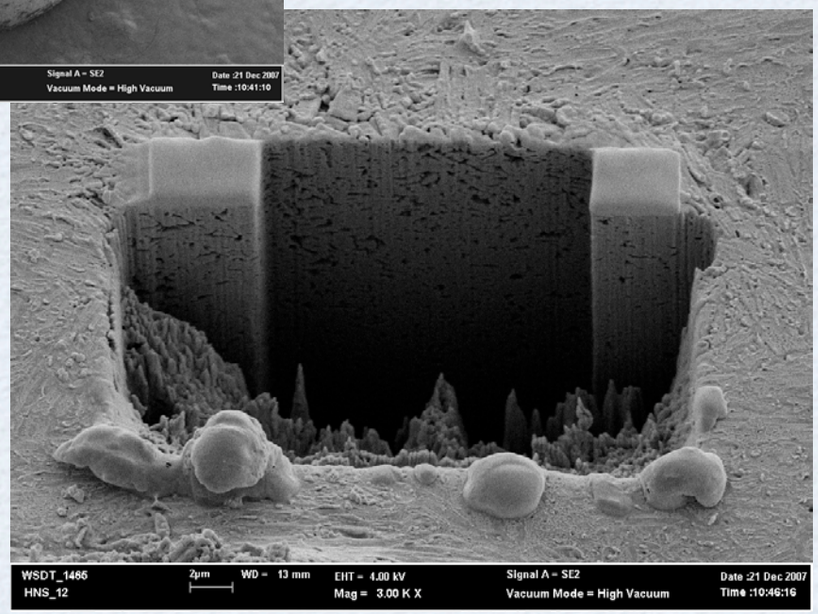
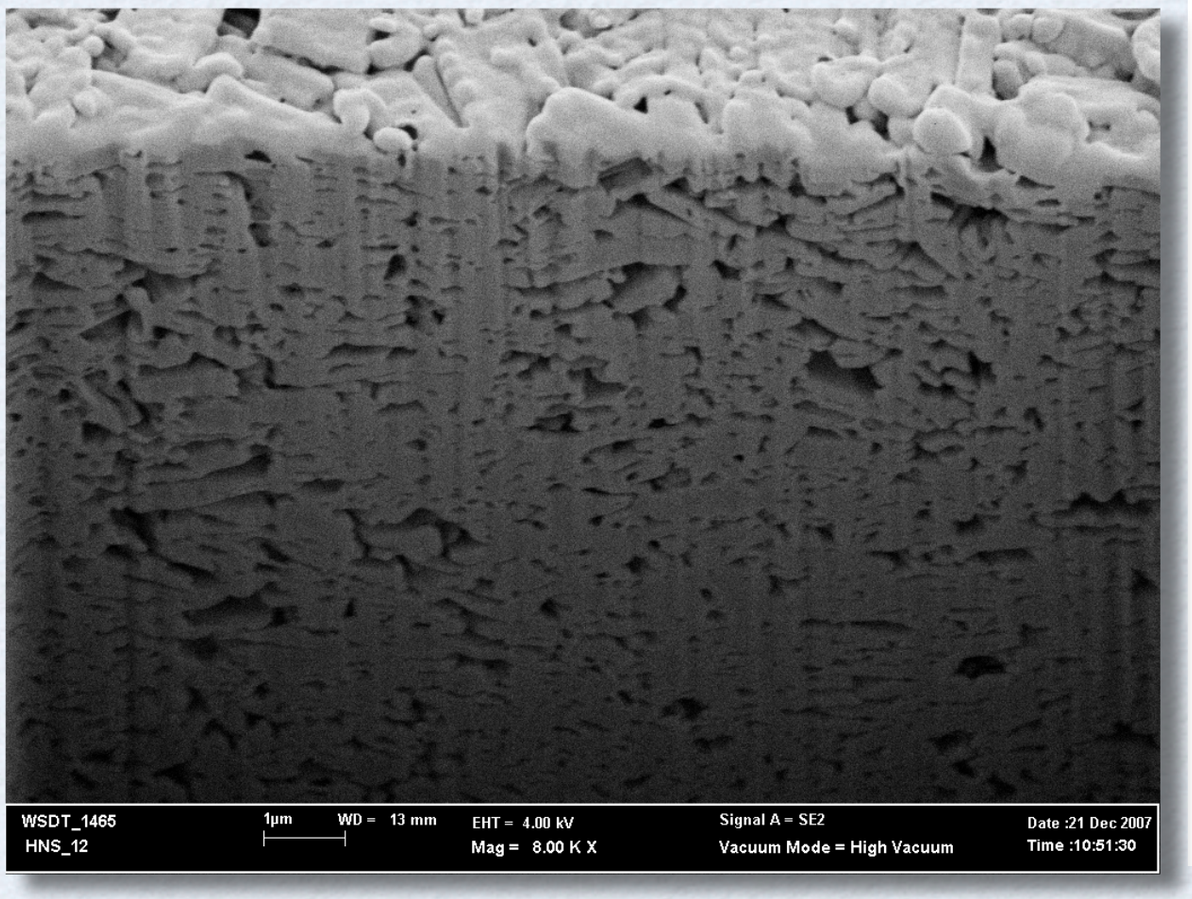
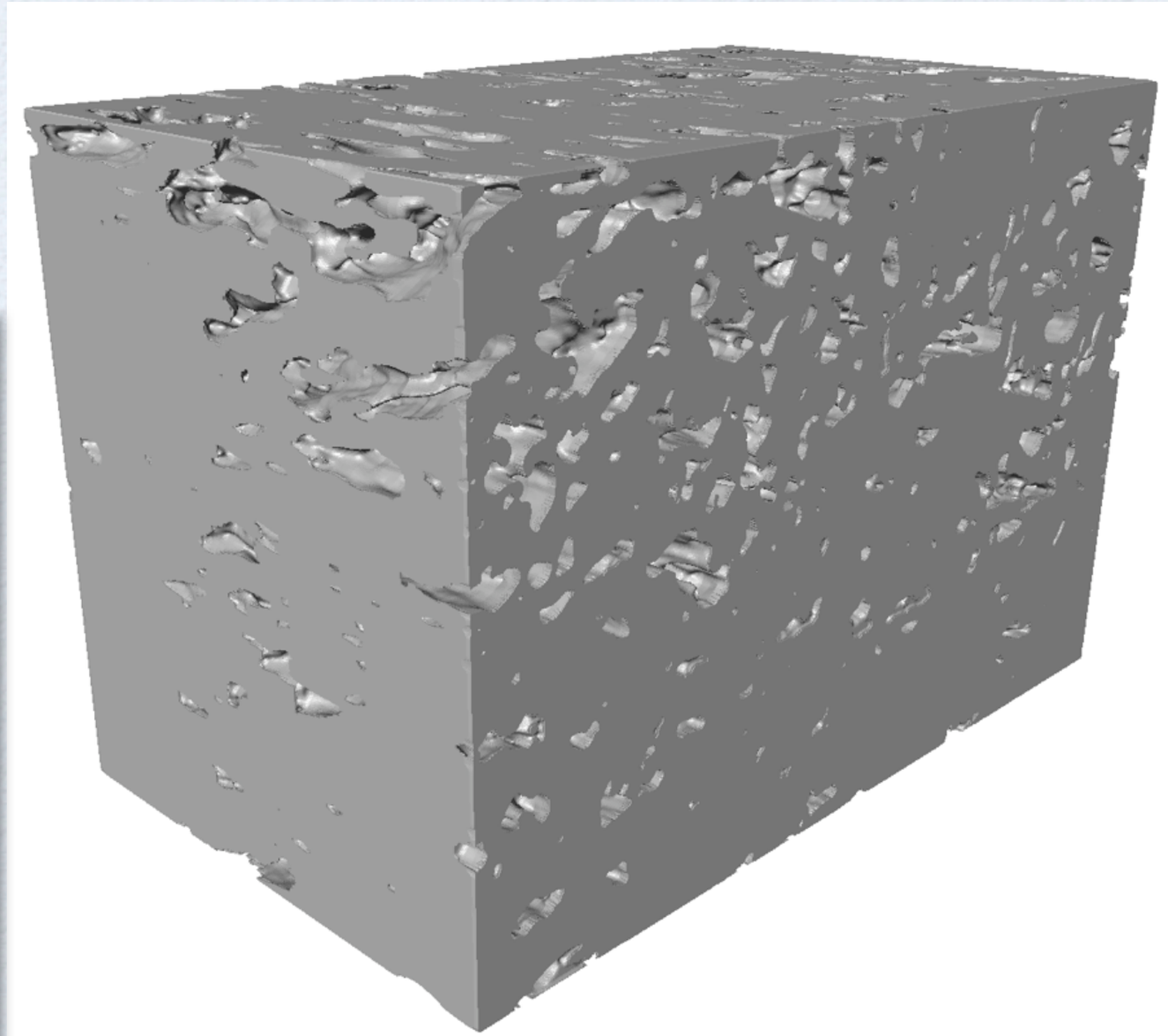




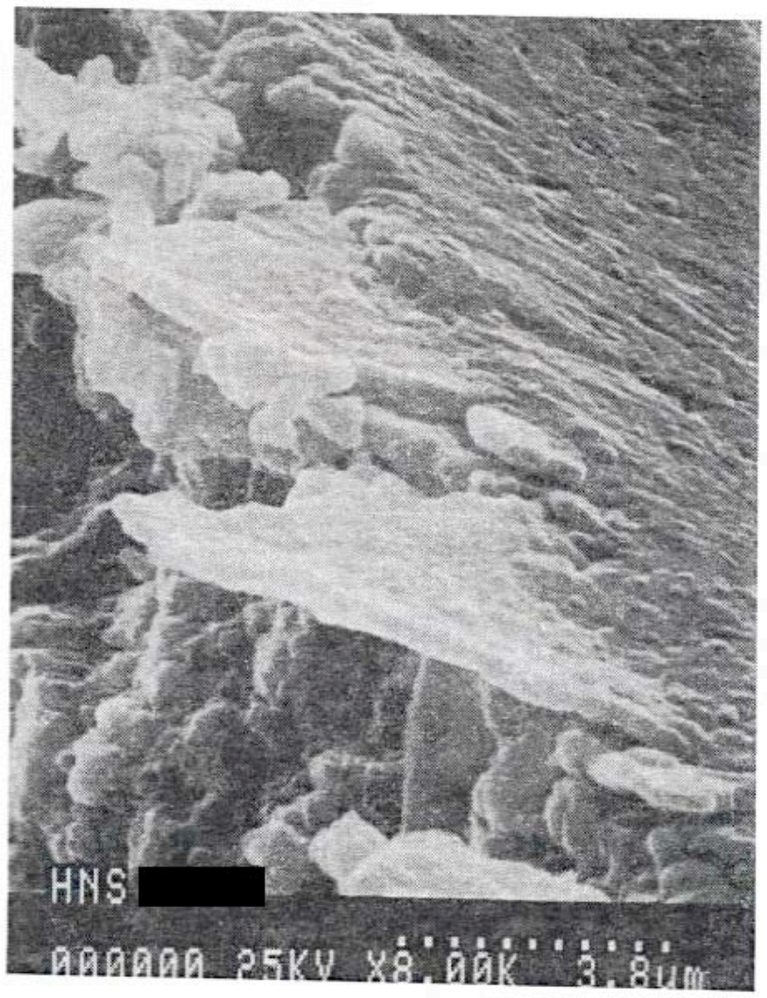


100 nm /slice
each voxel: 12 x 12 x 100 nm
Calculated density 85% TMD
Surface area?



High density skin on the radial surface of an HNS pellet?

fractured-surface (Sandy Klassen)



Micrograph which shows the thickness of the skin on an HNS pellet.

FIB/SEM cross-section