

Covalent Academy Episode 25 Q&A

Modernizing Microscopy Methods: Capabilities and Applications of TEM/STEM Systems

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01 Q: What kinds of samples can benefit from a spherical aberration corrector?

Samples thinner than 15-20nm thick or those that are strongly channeling.

02 Q: For what reasons is the corrector generally not a good choice?

The corrector can always be negated by putting in a smaller C2 aperture. The user just has to know when that is appropriate.

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03

Q: Is a high-brightness source necessary to optimize the effectiveness of the condenser aperture? How then do the detectors' performance affect the condenser aperture's efficacy?

The detector efficiency determines the signal to noise. The condenser system sets the beam current/dose and geometry of the beam going into the sample.

04

Q: What is the relationship between the solid angle of the EDS detector and its sensitivity?

The bigger the solid angle, the more efficient the detection. Be careful though, a very efficient detector may give spectra which include too much spurious data if the collimation is not taken care of.

05

Q: What causes the shadowing effect in EDS? How can stage parameters be used to correct for this?

The shadowing can be caused by the sample holder, or the sample mounting itself. Knowing the tilt angle in relation to the shadowing, you can factor that into the quantification calculation.

06

Q: How much time does it take to capture a 3D EDS Map? How long does it normally take to analyze?

It depends on the number of voxels required, and the beam current the sample can handle, and the number of tilts needed to get the required resolution. We normally acquire a dataset on about 1 hr or so, it takes another hour to do the reconstruction and then some time for rendering.

07

Q: What makes a lamella high quality?

That totally depends on the material being investigated, however normally the requirements are even thickness, as thin as possible and no surface amorphization.

08

Q: Why is the thinness of a lamella so significant?

Because that limits the beam/sample interaction volume which improves spatial resolution.

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09

Q: How long does it take on instrument to acquire the data for the 3D EDS of a sample like the one shown?

The data shown was taken automatically, overnight. About 6.5hrs.

10

Q: How long does the 3D reconstruction then take?

If there are fiducials to help the alignment, about an hour.

11

Q: What are the sample/dose limitations for these methods that take such a long time?

It depends on what material property is of interest, as well as the pore sizes in the material. Methods such as SEM, TEM, micro-CT, and confocal laser microscopy can be employed to image pore morphology and structure. Calculations in porometry and porosimetry make some assumptions about linear, cylindrical pores; however, they can still be employed for analysis of other materials. Ultimately it depends on the material: its pore sizes, and what the property of interest is.

13

Q: What limits EDS spatial resolution?

The thickness of the sample, the secondary effects such as fluorescence and brehmstralung, the material density and atomic number of the materials being investigated and beam spreading in the sample.

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Q: Why does the 3d EDS map look so sharp (i.e. higher resolution)?

The rendering can do that. Normally an EDS map will not be as clear as a HAADF image.

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