Catalyst Layer Characterization: Prior methods

TEM images



3D reconstruction with FIB-SEM





50 nm Resolution X-ray CT

- Same fundamental technology as medical CT scans – 3D images
- Non-destructive

Laboratory for Transport Phenomena

Enerav Systems

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- No vacuum required
- Lower in-plane resolution than SEM or TEM
- With optics, 50 nm 3D resolution (32.5 nm voxels)



Xradia, Inc. UltraXRM-L200 Nano-CT

Use nano-CT to image electrode in 3D



PEM Fuel Cell Electrode: Nano-CT



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<u>Challenge</u>: Nafion swell during imaging

Solution: Sample mounted on Kapton

Results validated by:

•Mercury intrusion porosimetry

•Transmission electron microscopy

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Size Distributions



Size distribution: Effect on agglomerate model

- Agglomerate model predicts fuel cell performance¹
- Incorporate distribution of agglomerate sizes, instead of single, representative spherical agglomerate size²

