

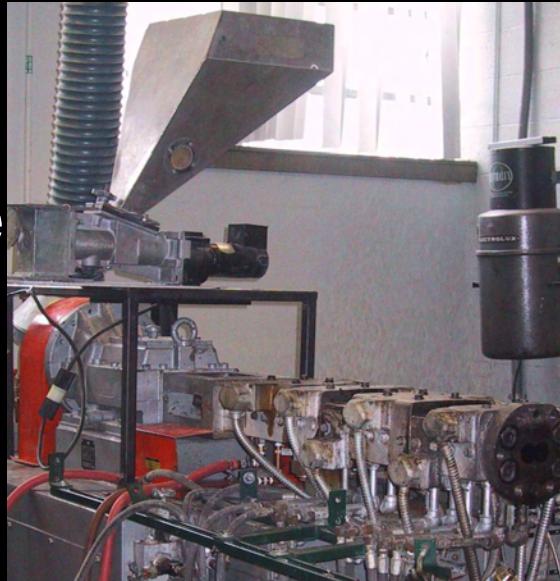
# **Advanced Techniques for Nanoparticle Measurement**

**Dr. Candace Tsai**

**Dr. Michael Ellenbecker**

# Particle Measurement

Measure airborne nanoparticle concentration



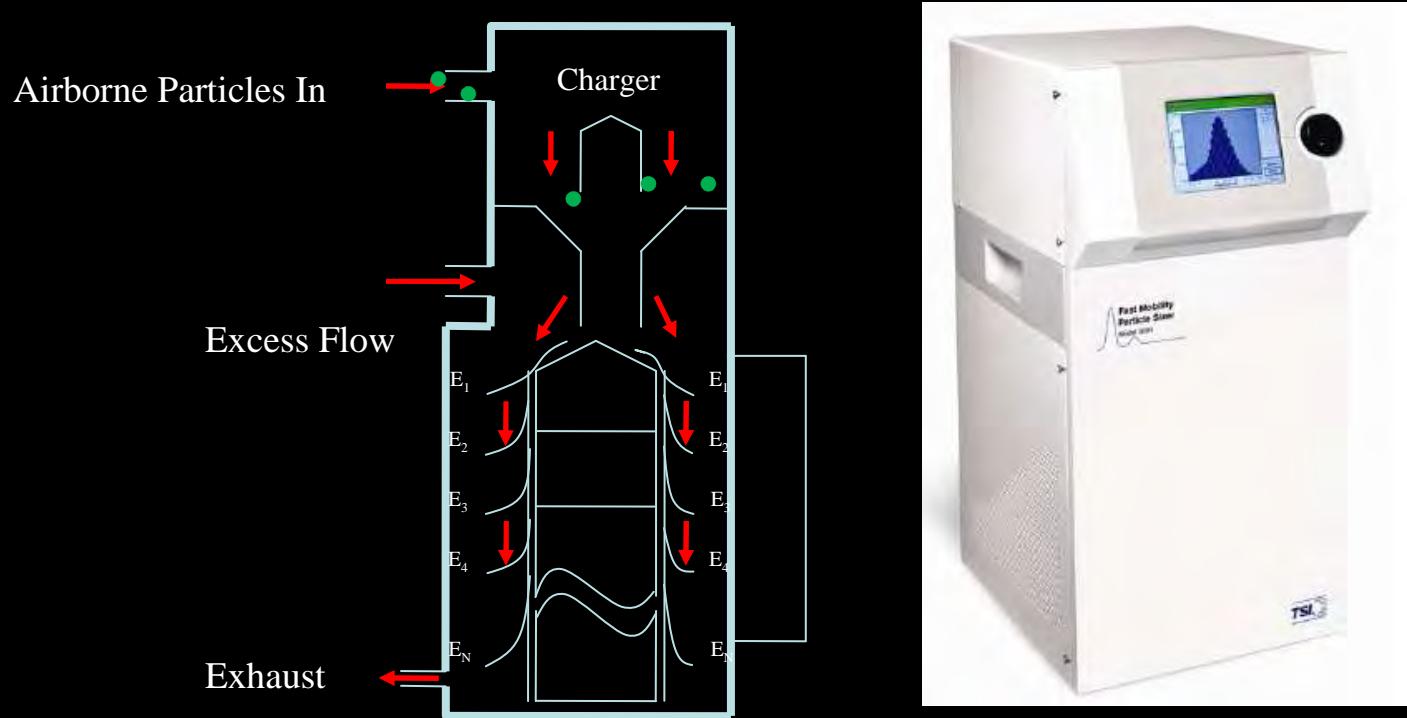
Collect airborne nanoparticle samples

Release source- TSE

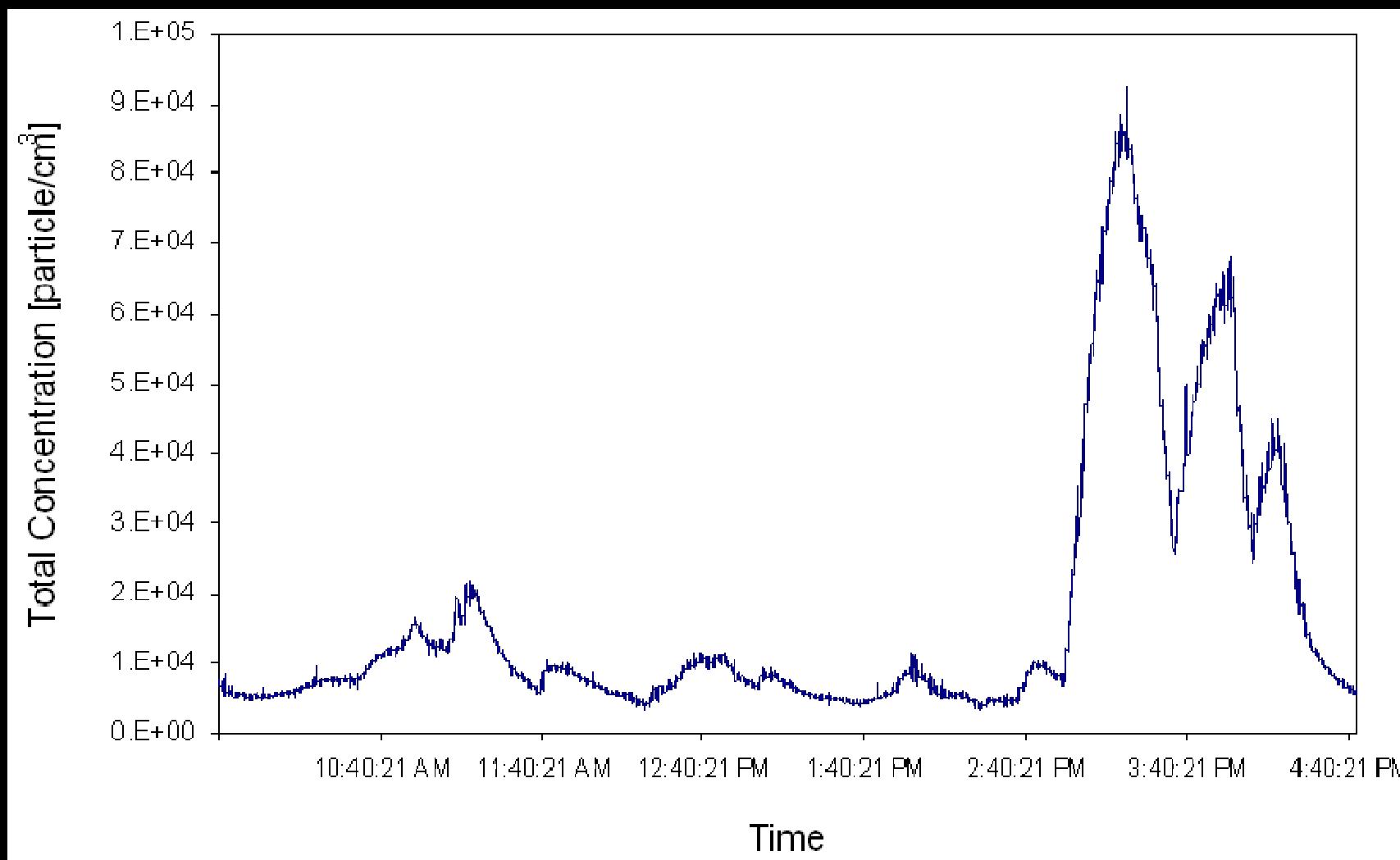
# Particle Concentration Measurement

TSI Fast Mobility Particle Spectrometer (FMPS)

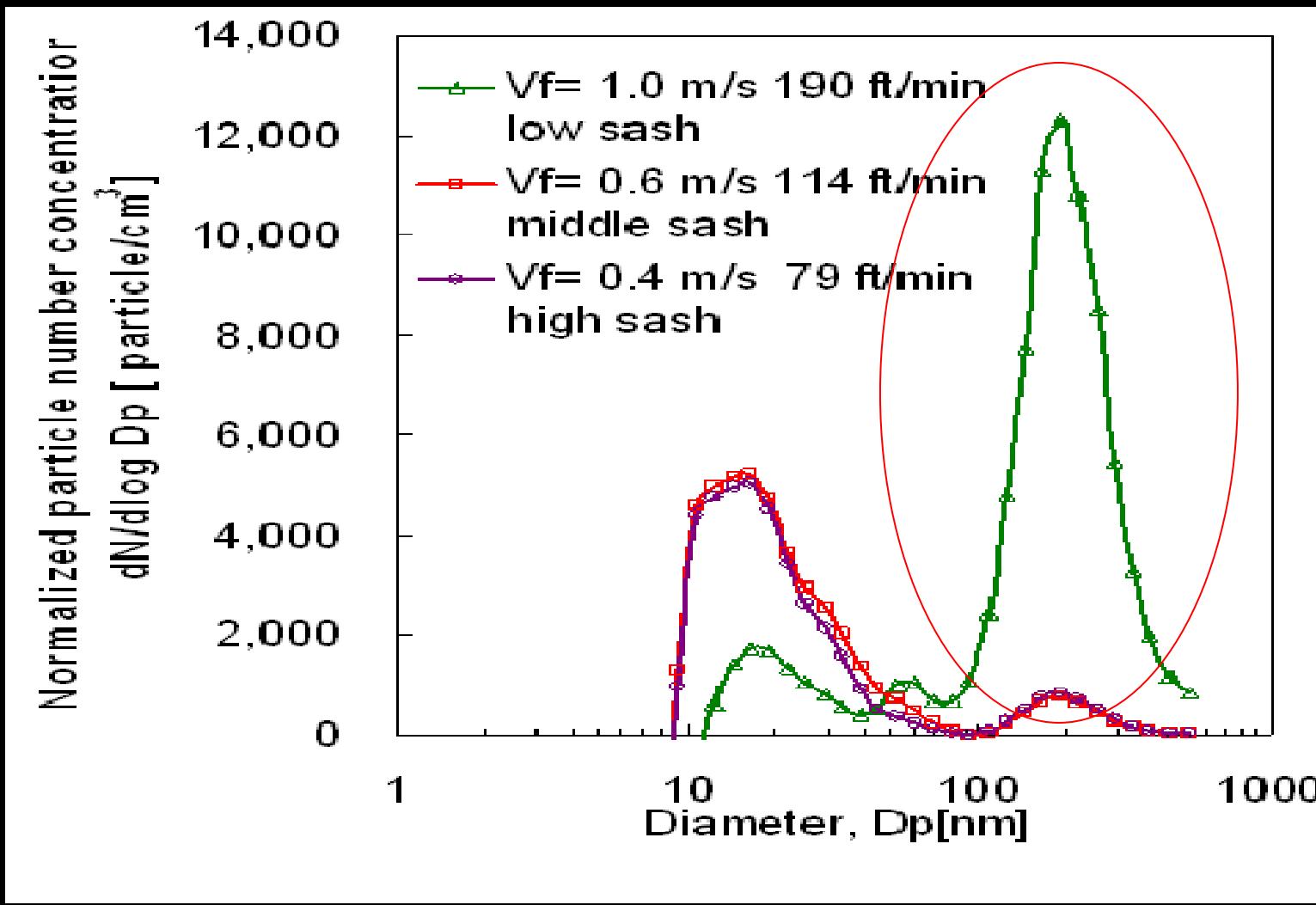
- 5.6 to 560 nm, 32 channels, 1 second cycle time, 10L/min flow rate



# Data from FMPS- Total Concentration



# Data from FMPS- size distribution



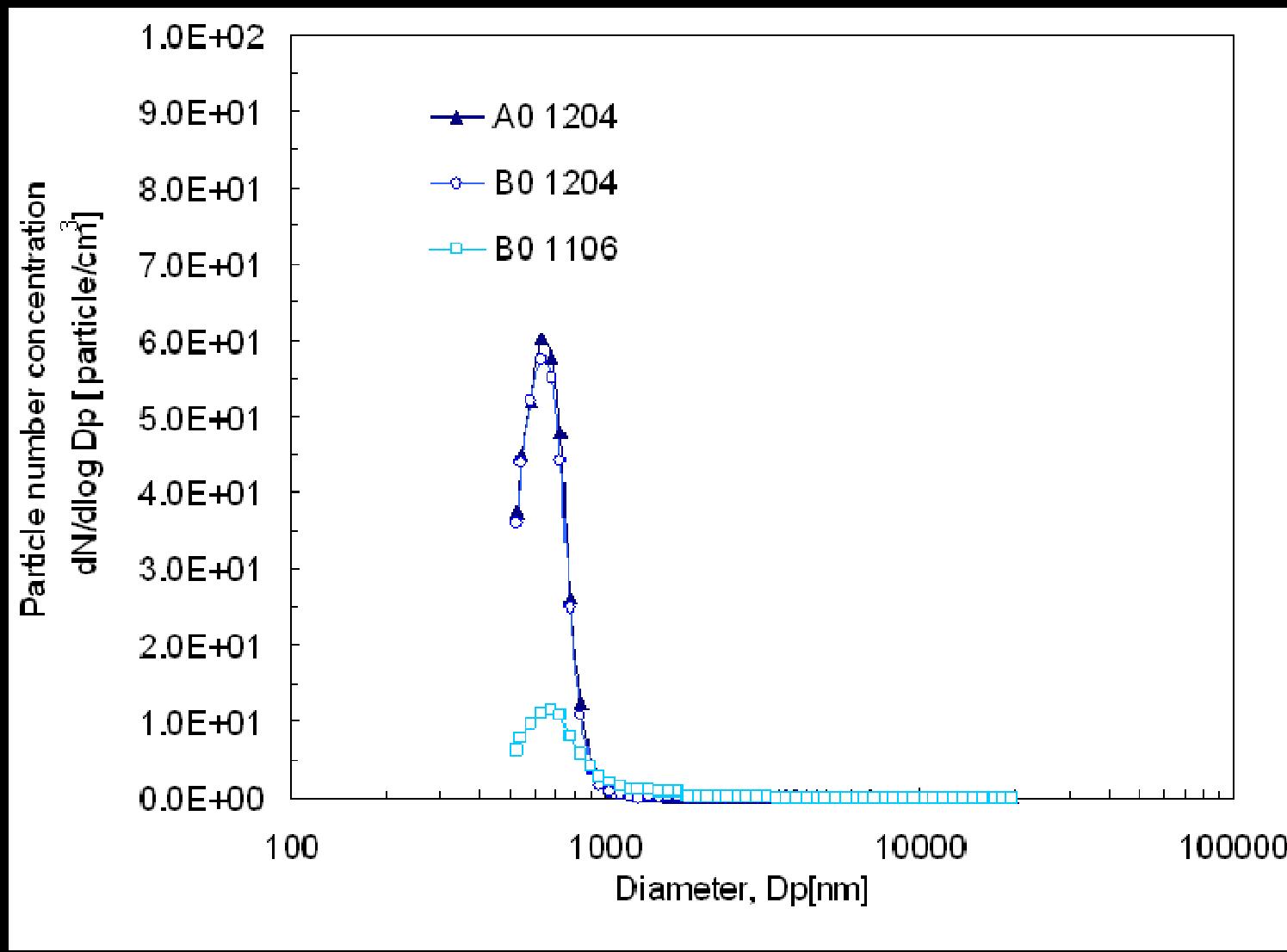
# Particle Concentration Measurement

TSI Aerodynamic Particle Sizer Spectrometer  
(APS)

- 0.5 to 20  $\mu\text{gm}$  aerodynamic sizing

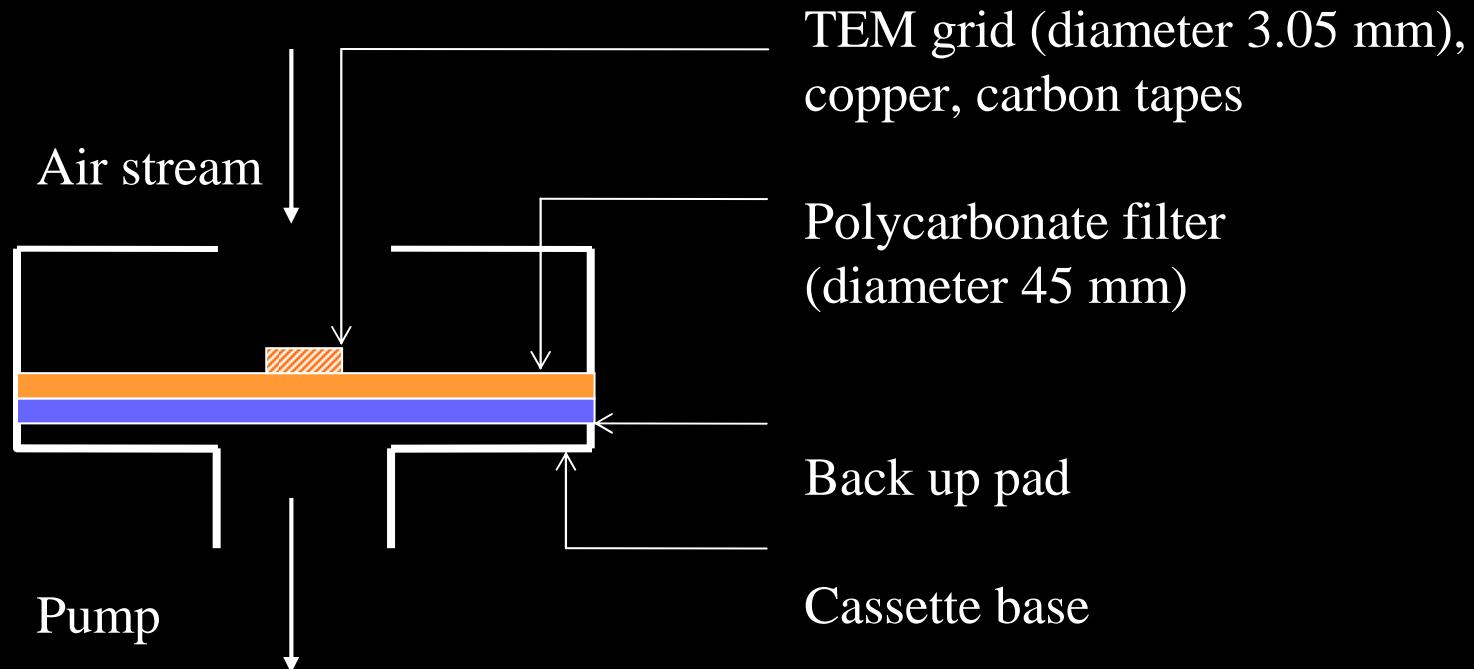


# Data from APS



# Particle Sampling

TEM- PHILIPS EM400T  
SEM- JEOL JSM-1401F FE-SEM

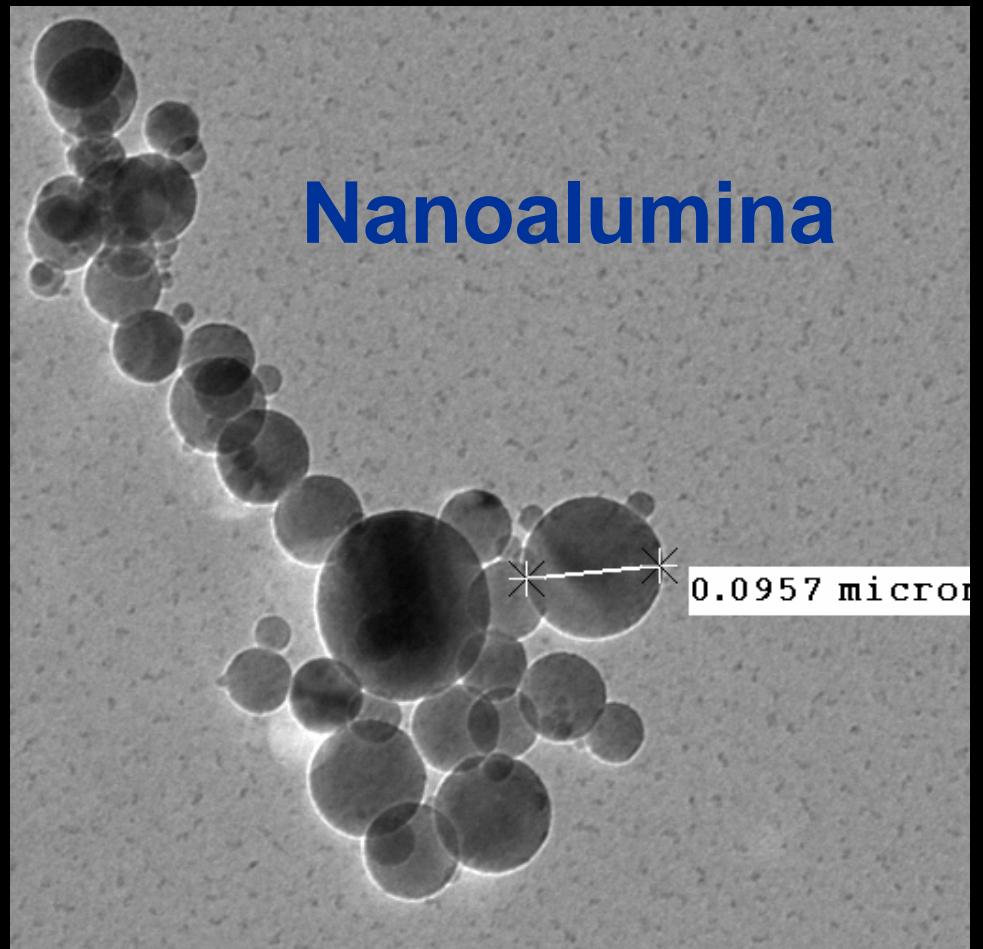


# Airborne Nanoparticles

Nanoalumina particle

Avg. size: 45 nm

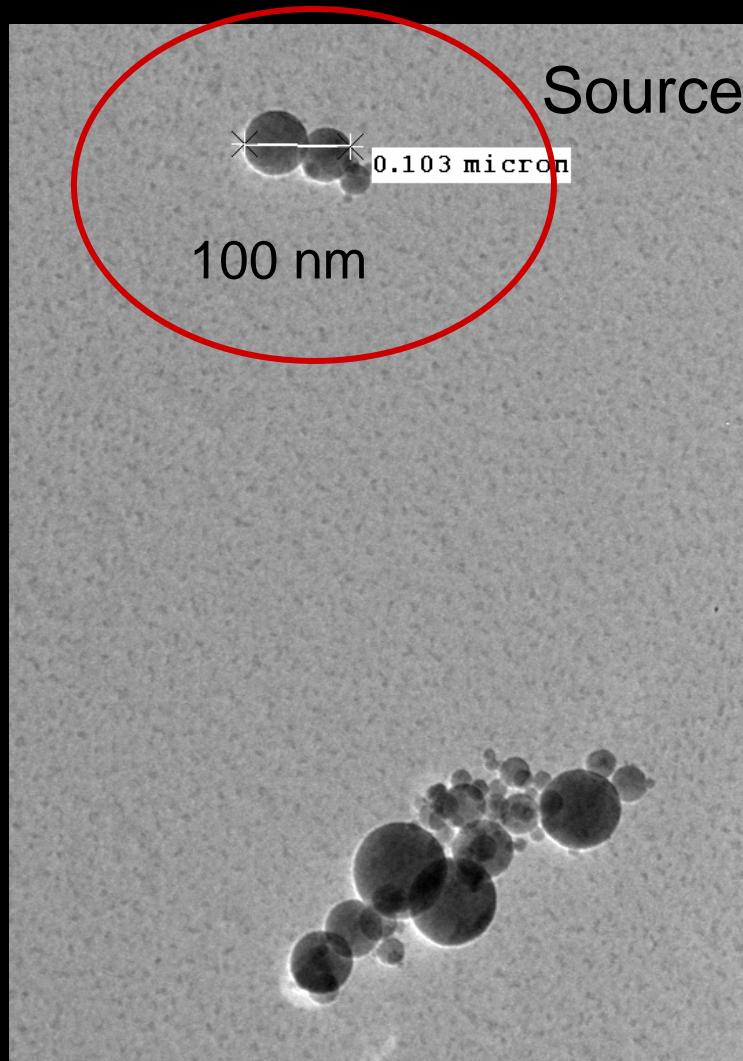
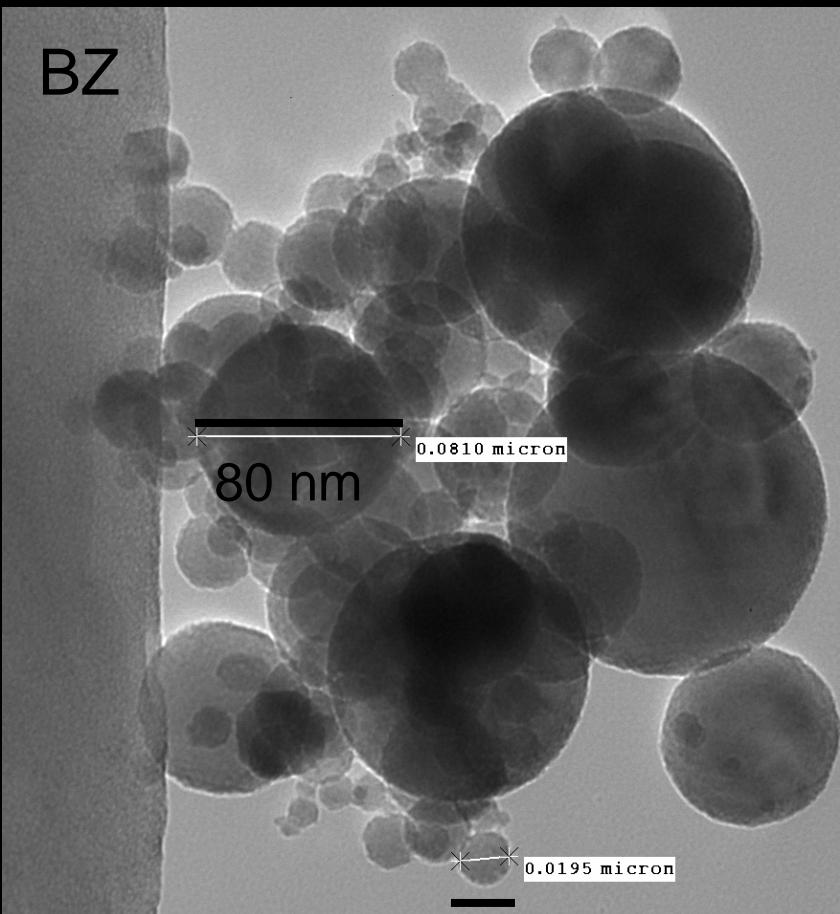
Avg. bulk density: 260 kg/m<sup>3</sup>



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Nanomanufacturing

# TEM images

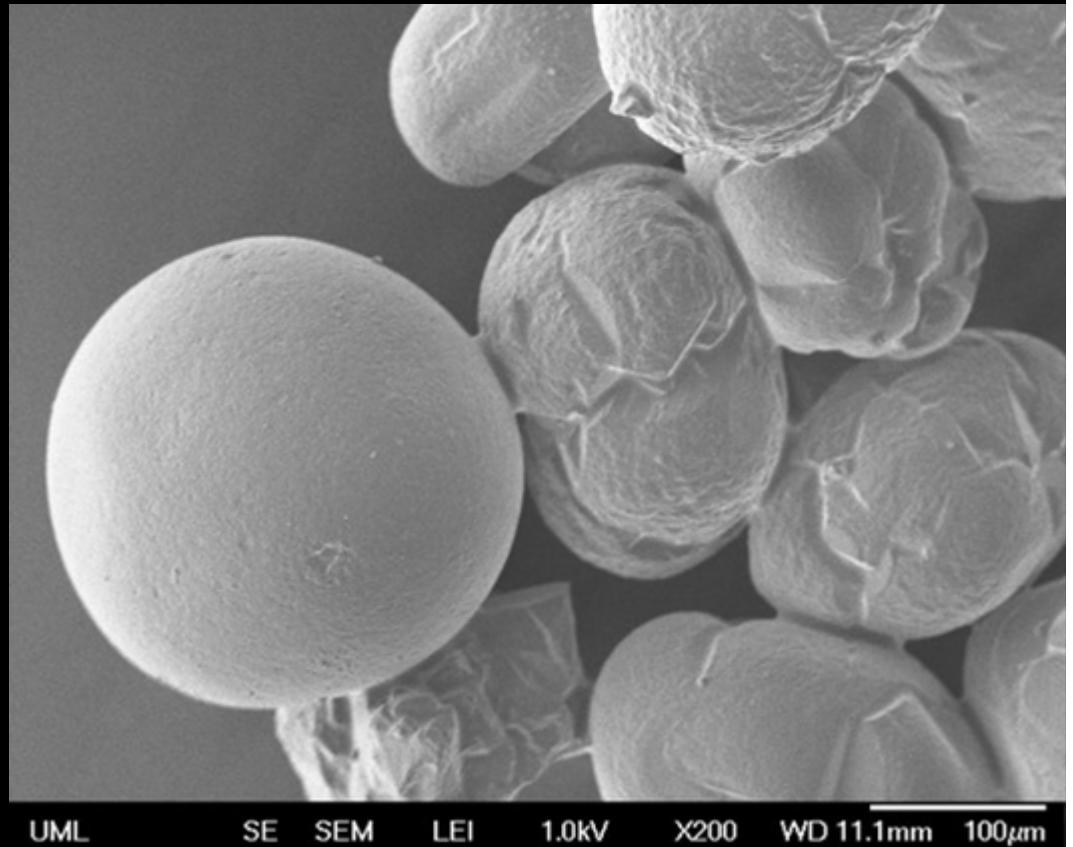
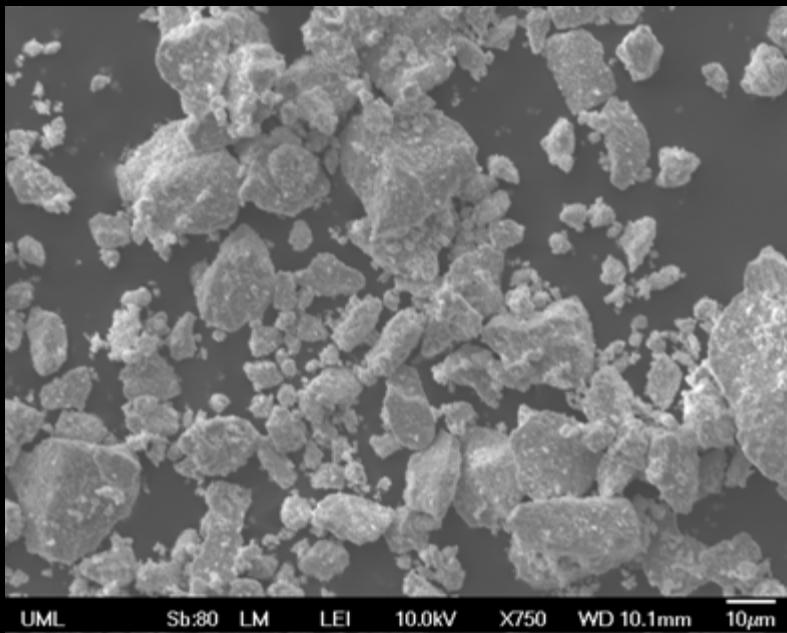
Nanoalumina Aerosols



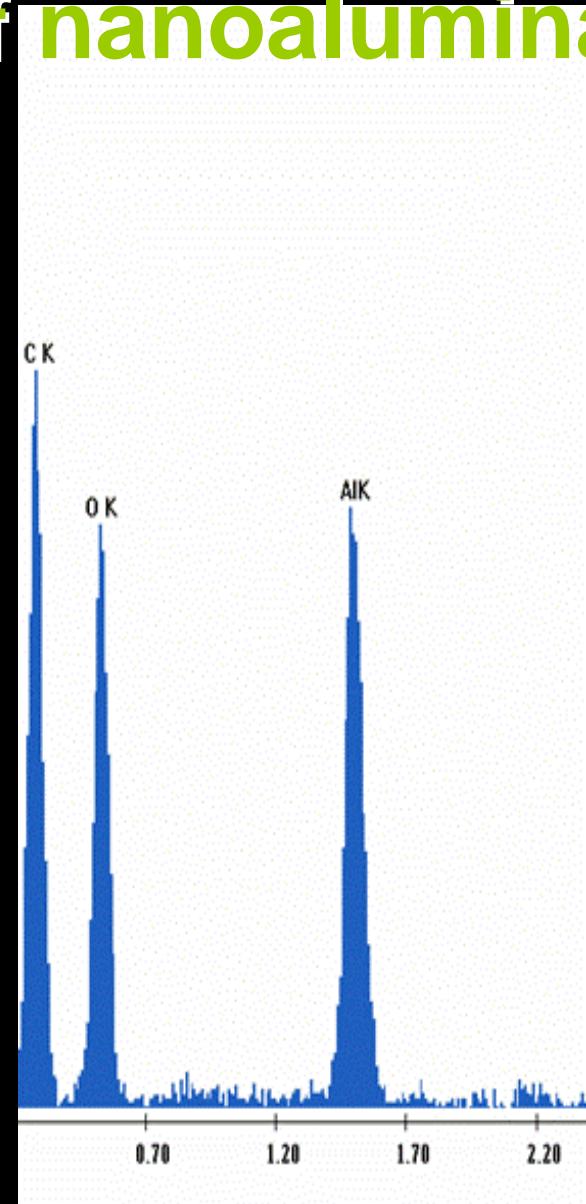
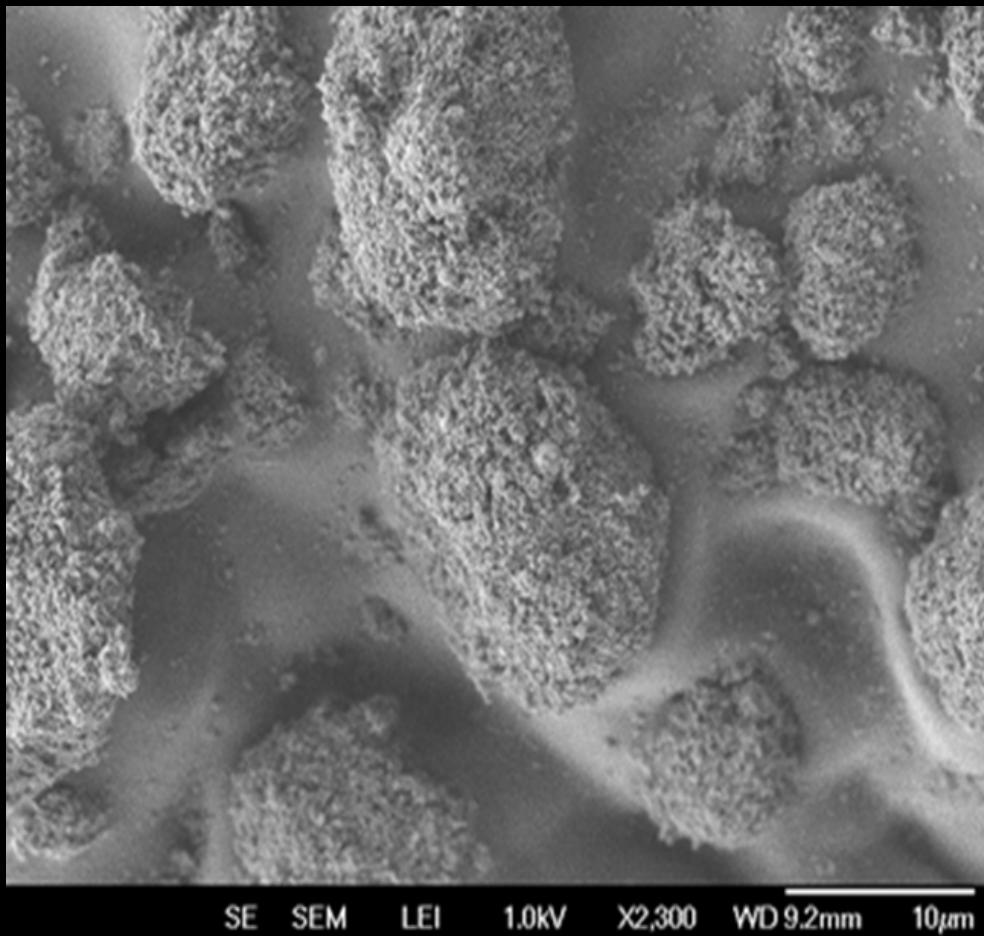
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# SEM images

- Nanosilver and cluster of fullerene



# SEM image and EDS of nanoalumina



# Smoke Test for Airflow Pattern

- Fog machine- Generate smoke for tests.



# Smoke Test

- Conventional hood
- Air-curtain hood



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# Aerosol particles from 5 nm to 20 $\mu$ m

