



Aerosol Synthesis of Nanomaterials

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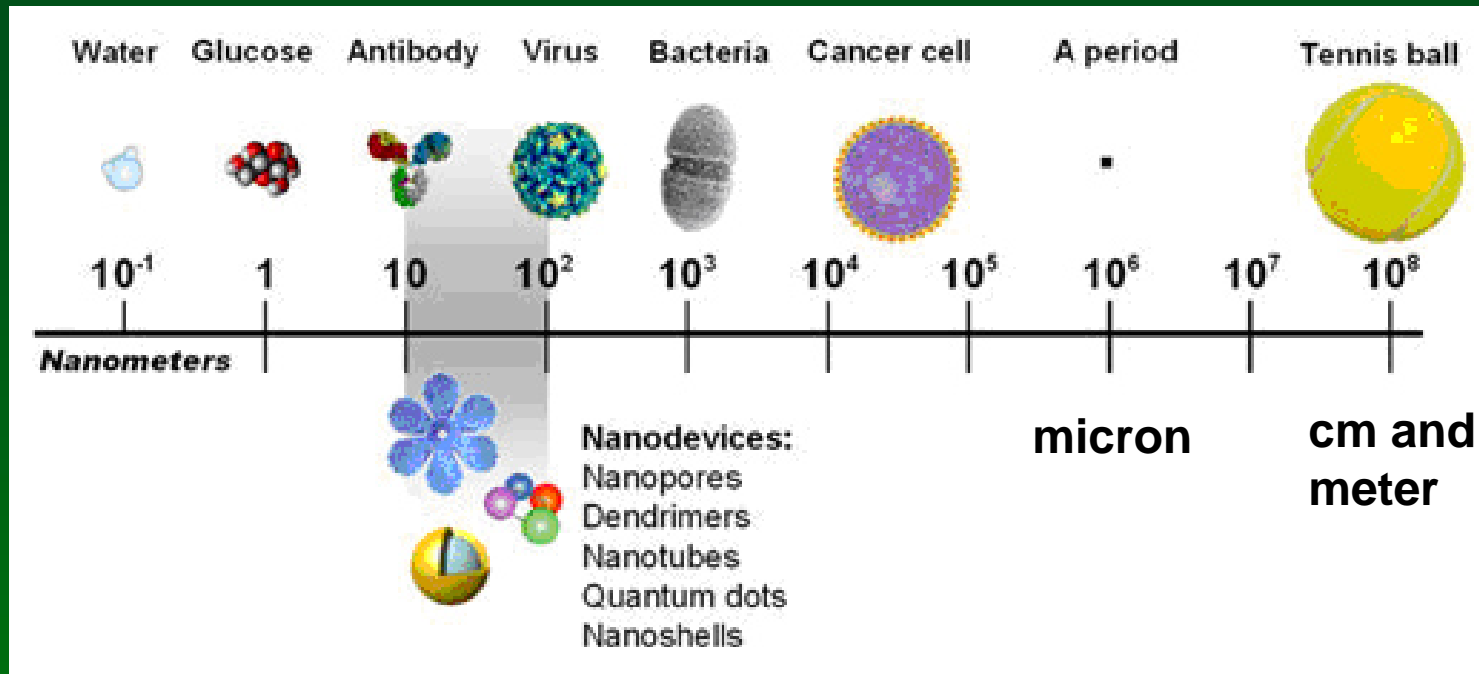
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What are Nanomaterials?



Material structures with dimensions in the “nano” scale (one billionth of a meter)

Particles in this size range have a very large surface area compared to their mass.

Summer Internship 8 Week Goals

Set up ultrasonic spray pyrolysis (USP).

Synthesize SiO₂ and TiO₂ nanocomposite microspheres (μSpheres) and TiO₂ nanoparticles (NPs) (as described in reference paper: *Adv. Mater.* 2006, 18, 1832-1837).

Get exposed to characterization techniques

Scanning Electron Microscope (SEM)

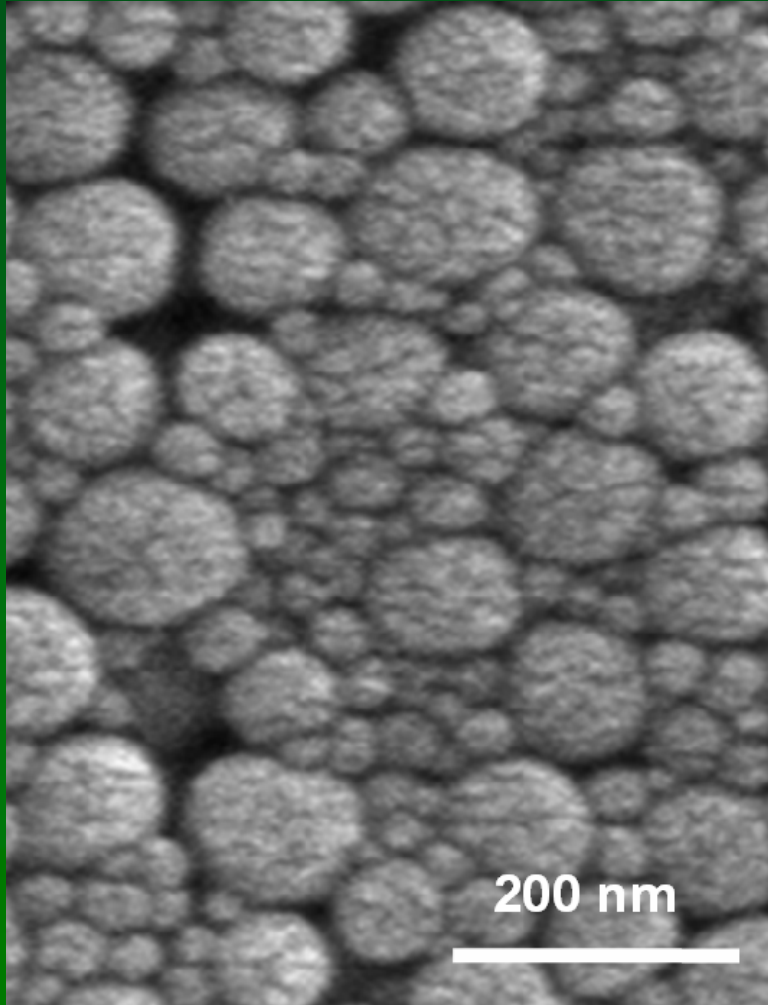
Transmission Electron Microscope (TEM)

X-Ray Diffraction (XRD)

Dynamic light scattering (DLS)

UV-VIS spectroscopy.

Nanomaterials: design parameters



Feature Size:

sub 100 nm scale

Shape: spherical

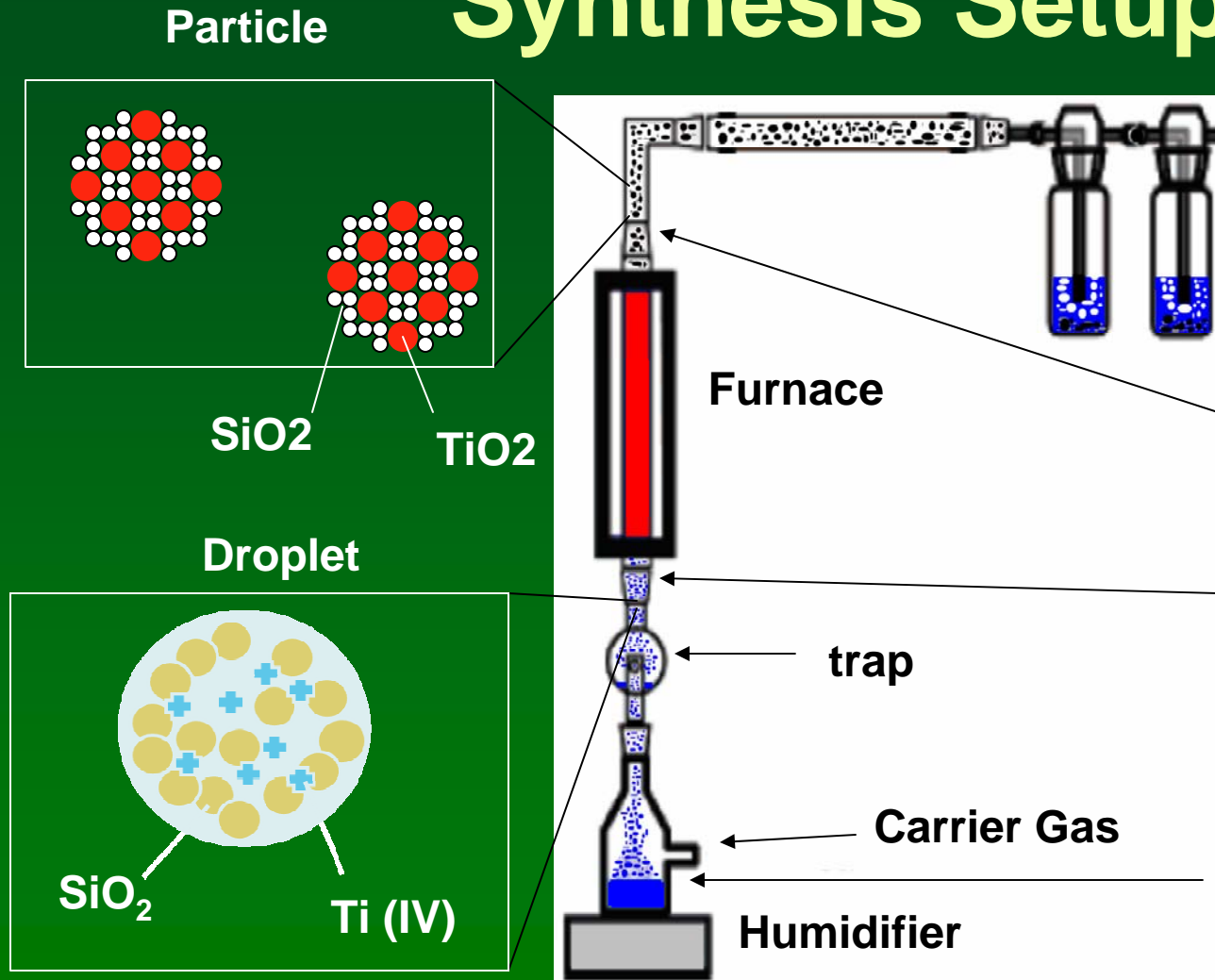
Surface morphology:

porous

Particle composition:

Silicon dioxide coated
with Titanium dioxide

ultrasonic spray pyrolysis Synthesis Setup



particles are collected aqueous bubbler solutions

particles that are ~1 micron

precursor droplet ~5 microns

aqueous precursor solution

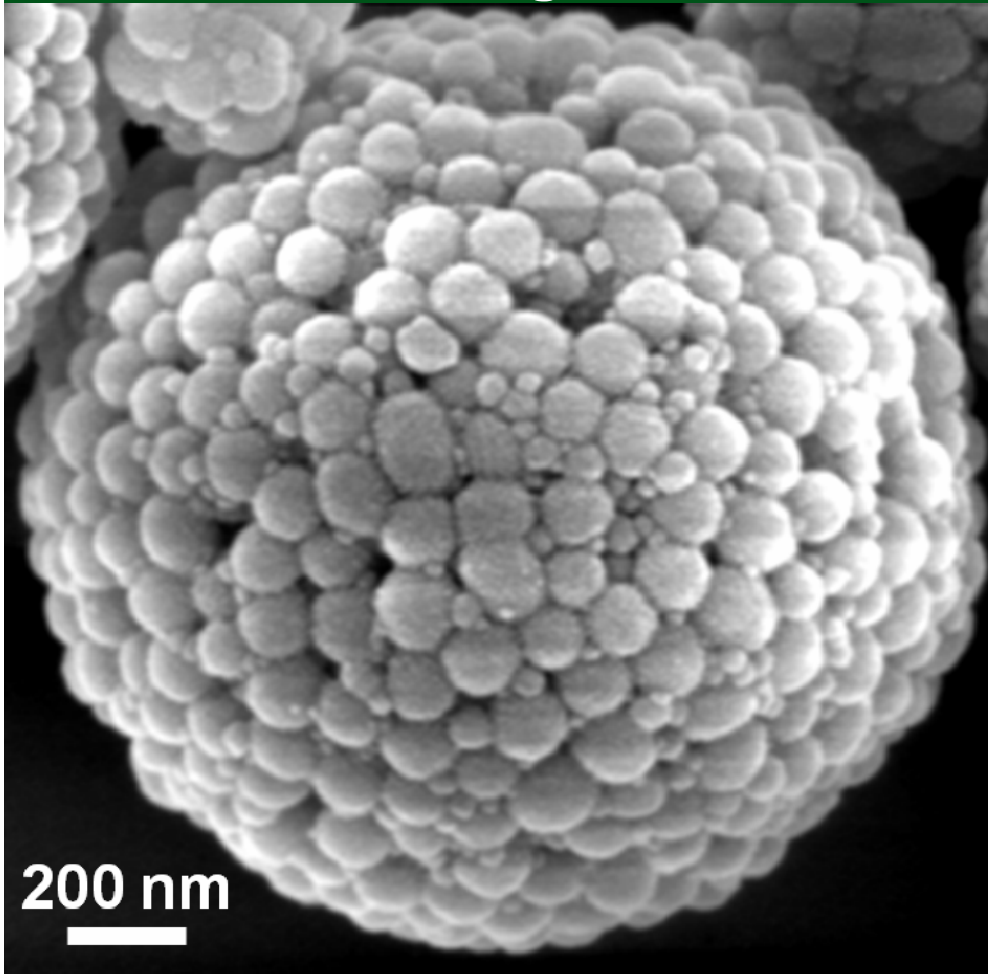
Suh, W. H. *et al. Adv. Mater.* **2006**, 1832-1837.

Li, L. *et al. Adv. Mater.* **2008**, 903-908.

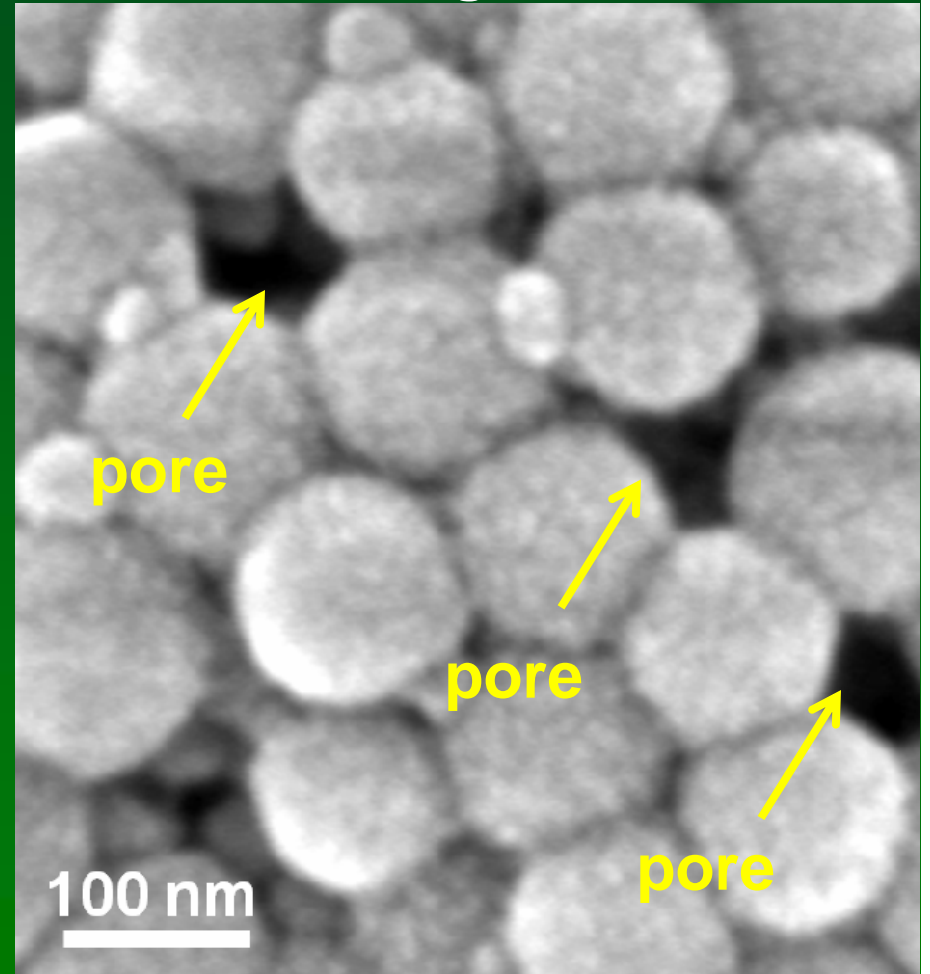
Bang, J. H. *et al. Adv. Mater.* **2008**, 2599-2603

Scanning Electron Microscopy

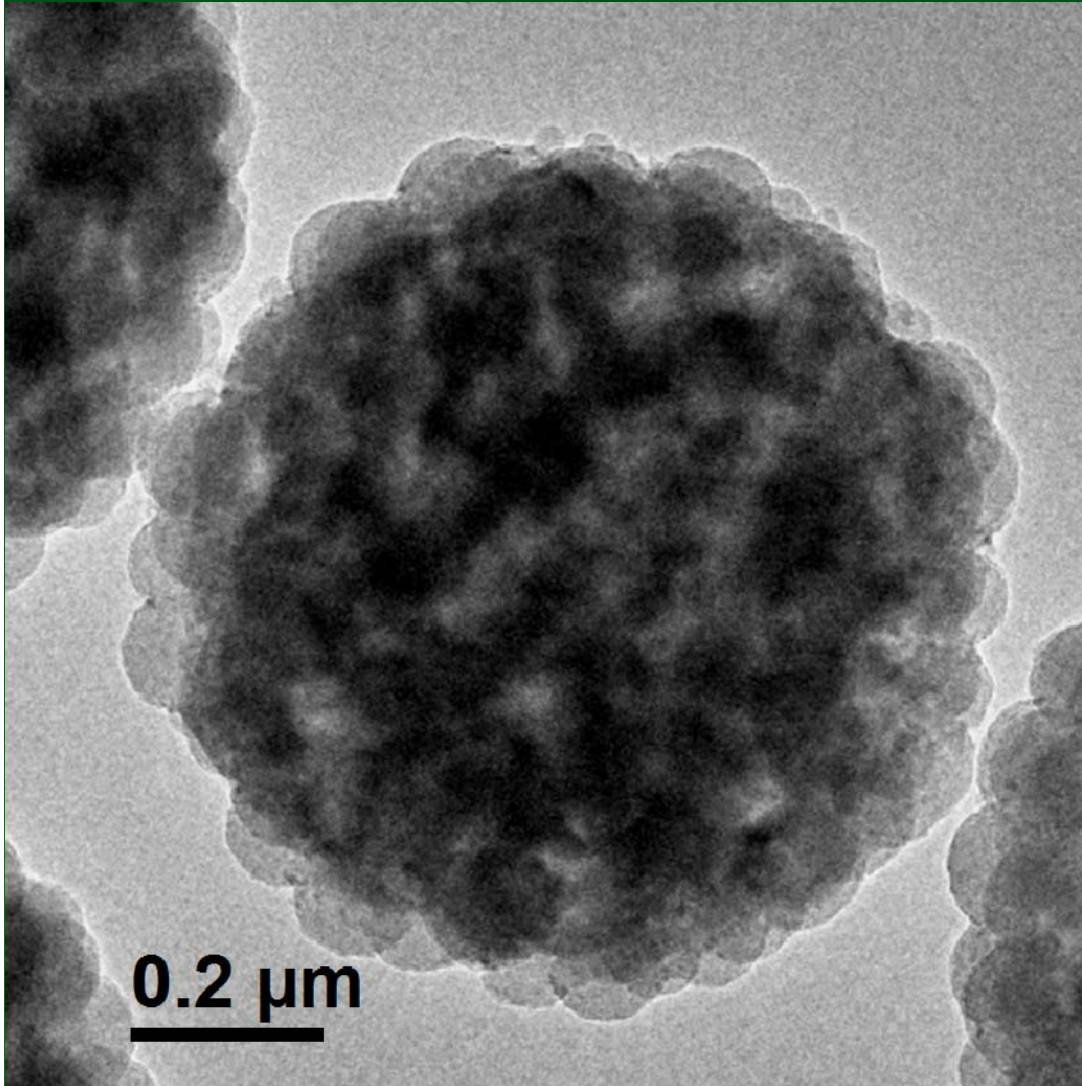
50kX magnification



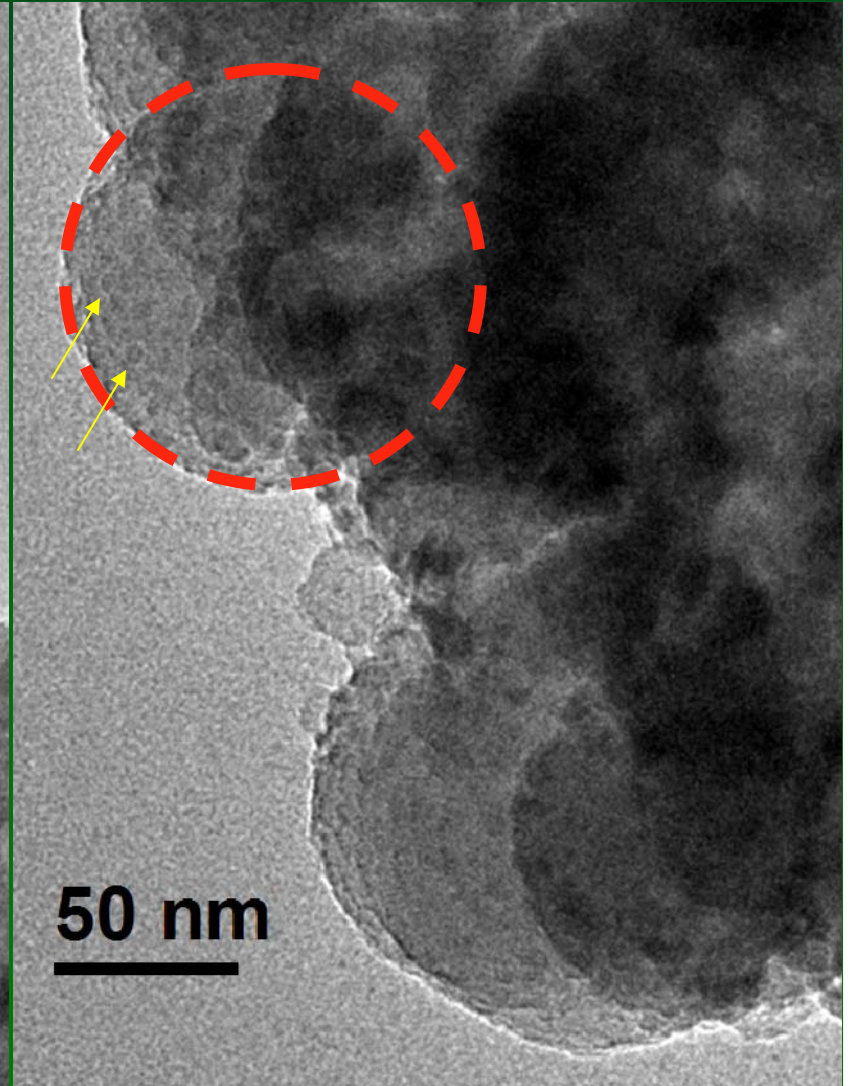
120kX magnification



Transmission Electron Microscopy

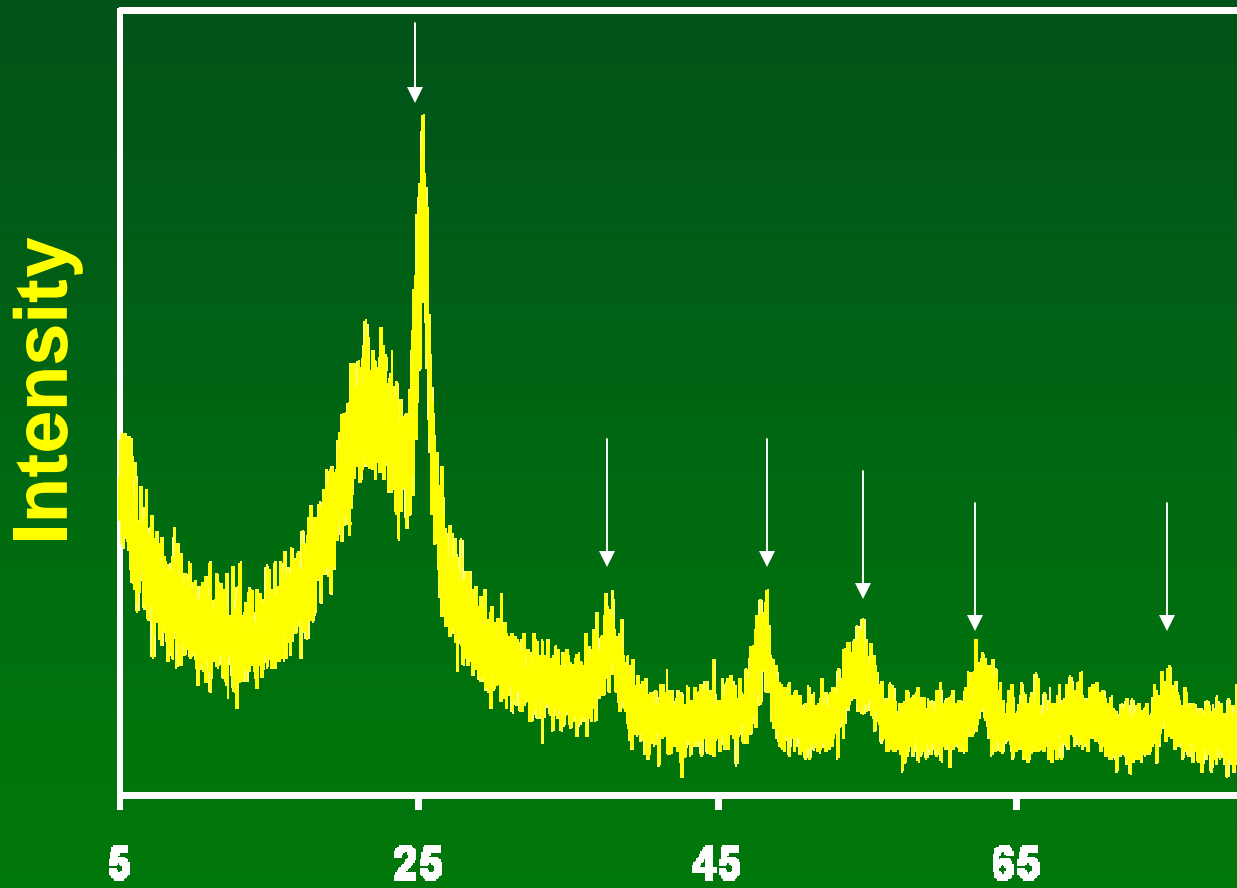


solid inside



darker areas = NPs

X-ray Powder Diffraction



Control
diffraction peaks



2θ

Conclusions and Future Plans

SiO₂-TiO₂ μSpheres were synthesized readily using ultrasonic spray pyrolysis.

Nanostructured materials were synthesized

Adsorptions studies using UV-VIS spectroscopy

Surface area determination

Create more SiO₂-TiO₂ μSpheres

Create other metal oxides using USP

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