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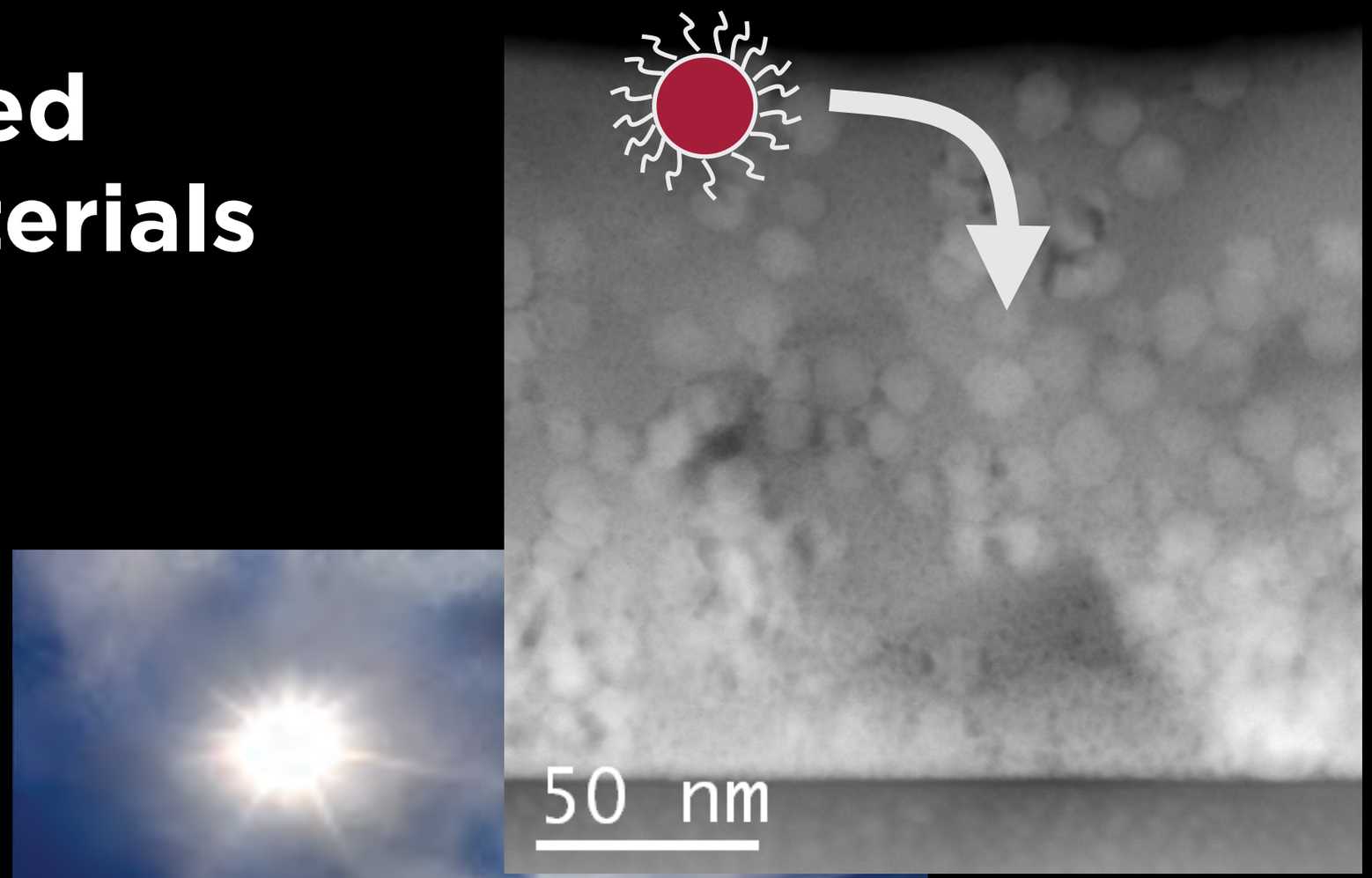
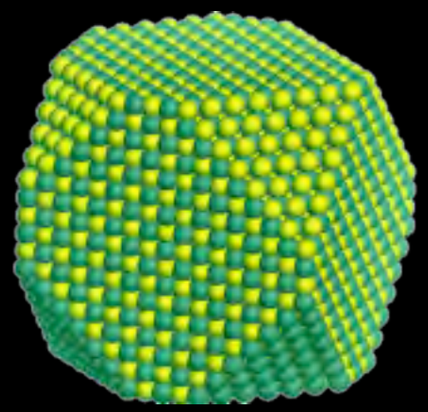
McKetta Department of Chemical Engineering

Nanostructured inorganic materials for energy

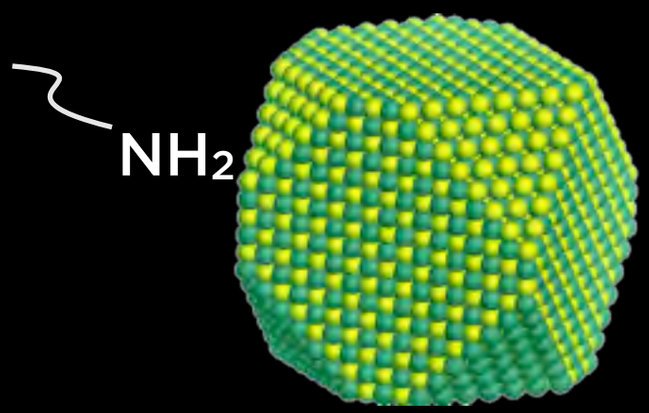
Delia Milliron Group

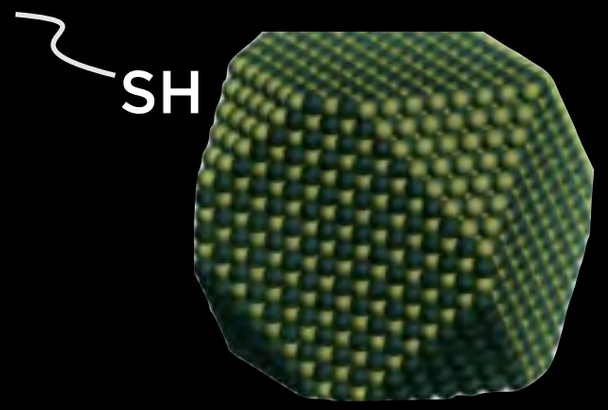


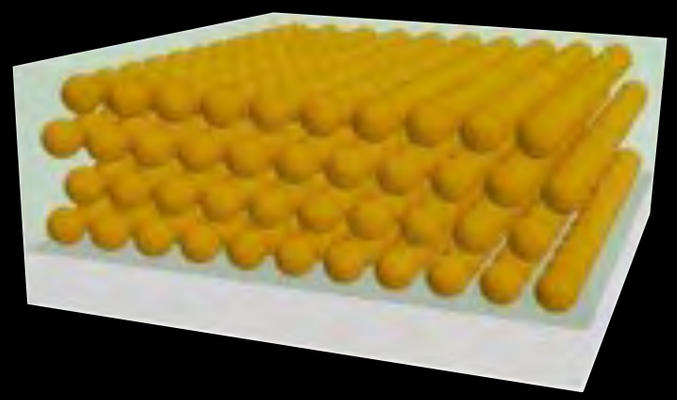
New phenomena at the nanoscale: Interfaces can dominate behavior



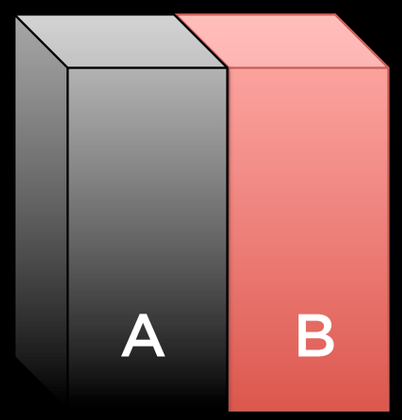
4 nm nanocrystal
> 50% “surface”



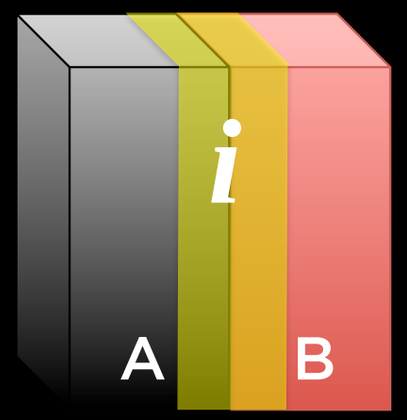




nanocrystal-in-matrix
> 80% “interface”



additive function



functional interface

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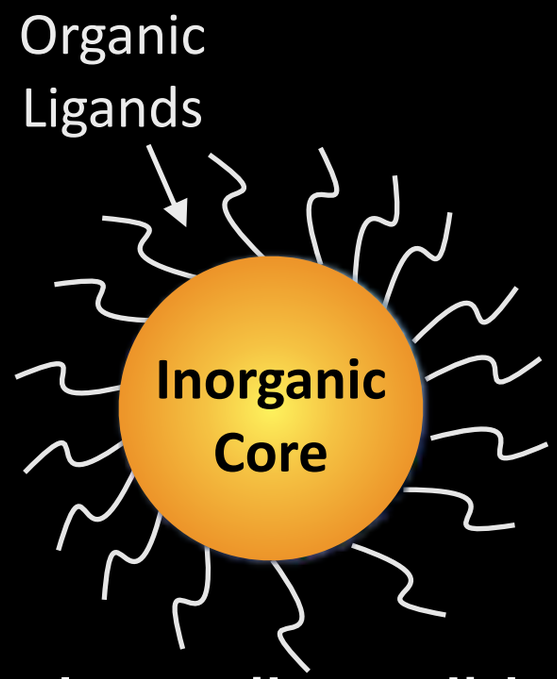
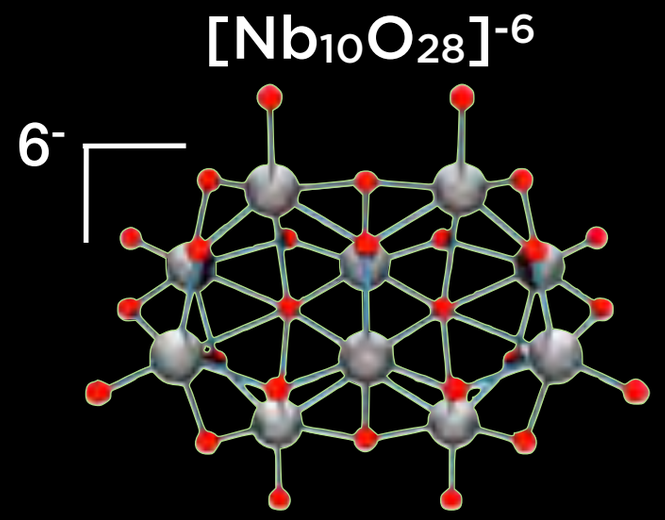
Green manufacturing with nanomaterials



- Solution phase synthesis and processing
- Low temperature for low embodied energy
- Low cost for viable large area/scale devices
  - smart windows, solar cells, batteries



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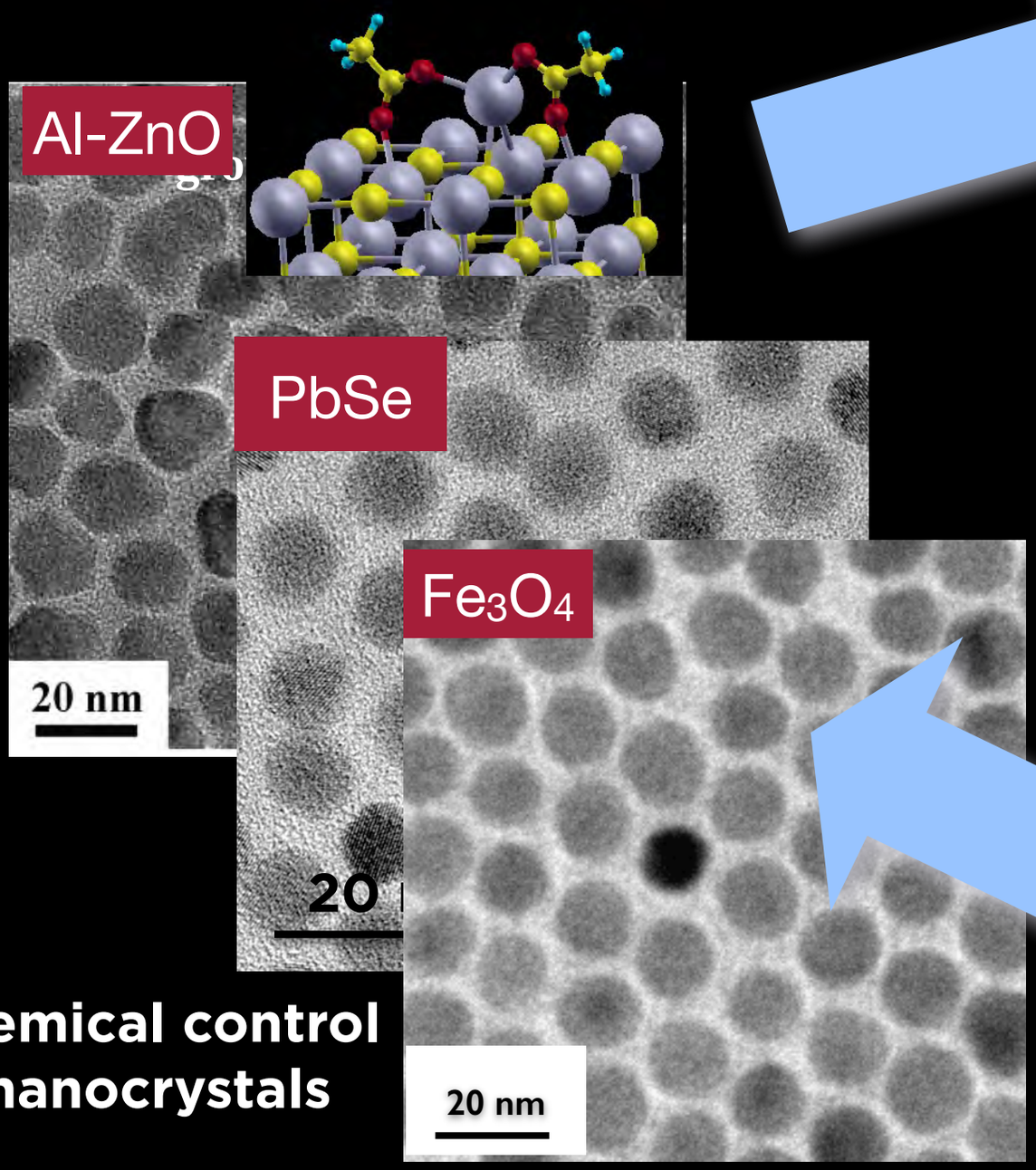
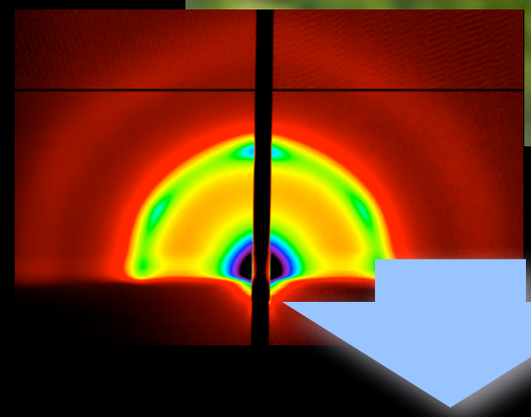
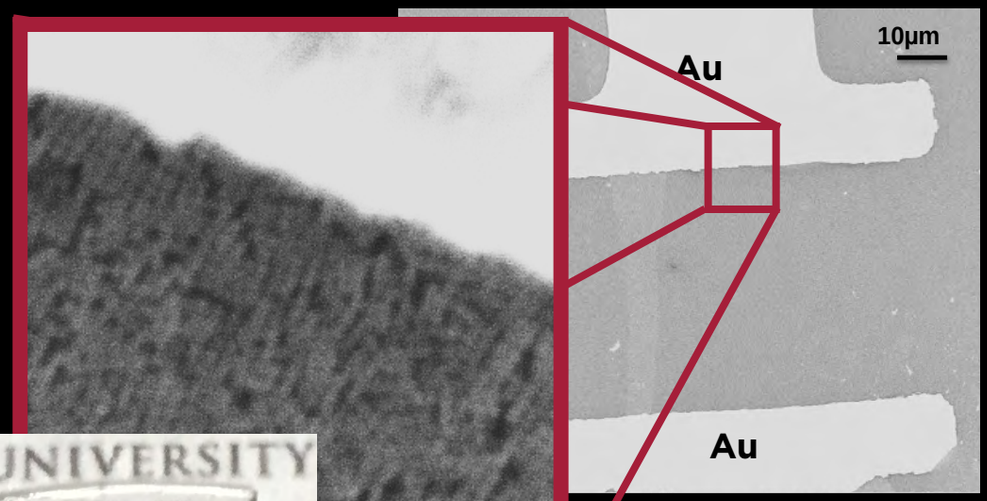
Nanocrystal-based materials and devices

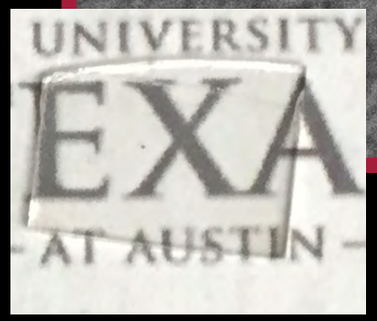


Chemical control of nanocrystals

Optical and structural properties







Assembly and integration

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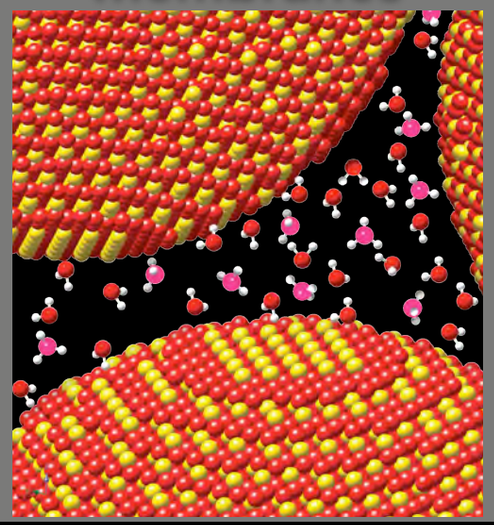
Semiconductor Nanocrystal Plasmonics

Tunable and responsive properties
Application: Electrochromic windows

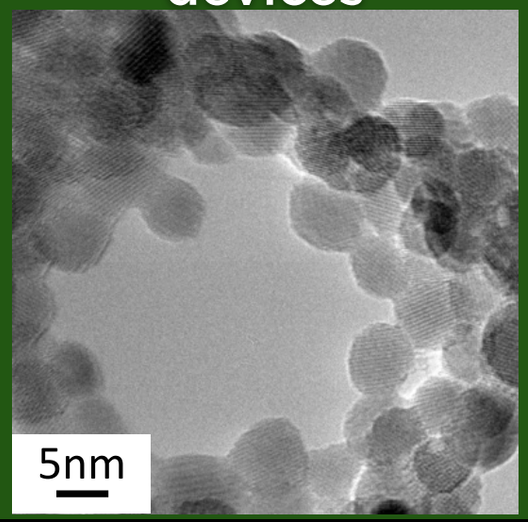
Interface-Mediated Transport

Ion transport through pores and composites
Application: Fuel cell, battery membranes



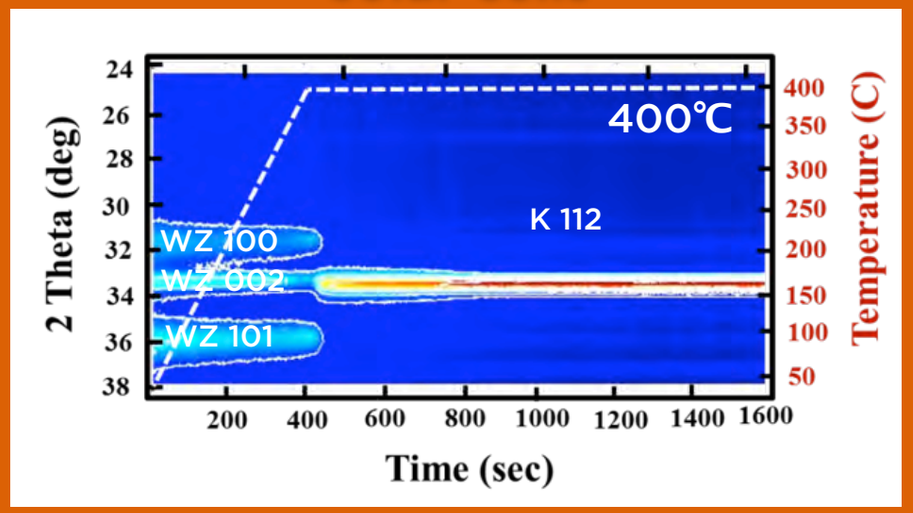
Nanocrystal Assembly and Integration

Polymer-nanocrystal assembly, gels
Application: Sensors, electrochemical devices



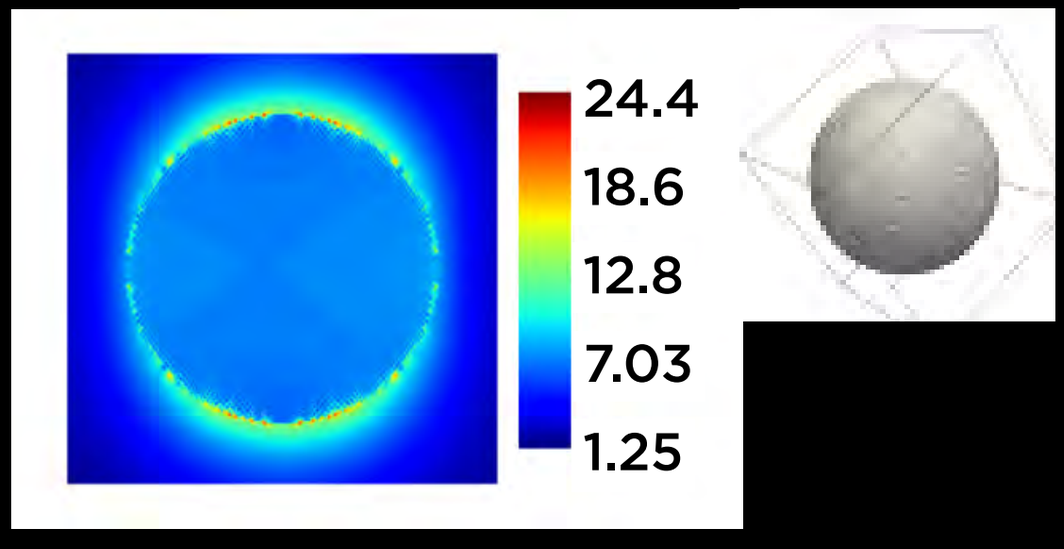
Phase Stability and Transitions

Meta-stable phases and phase switching materials
Application: Thermochromic windows, solar cells

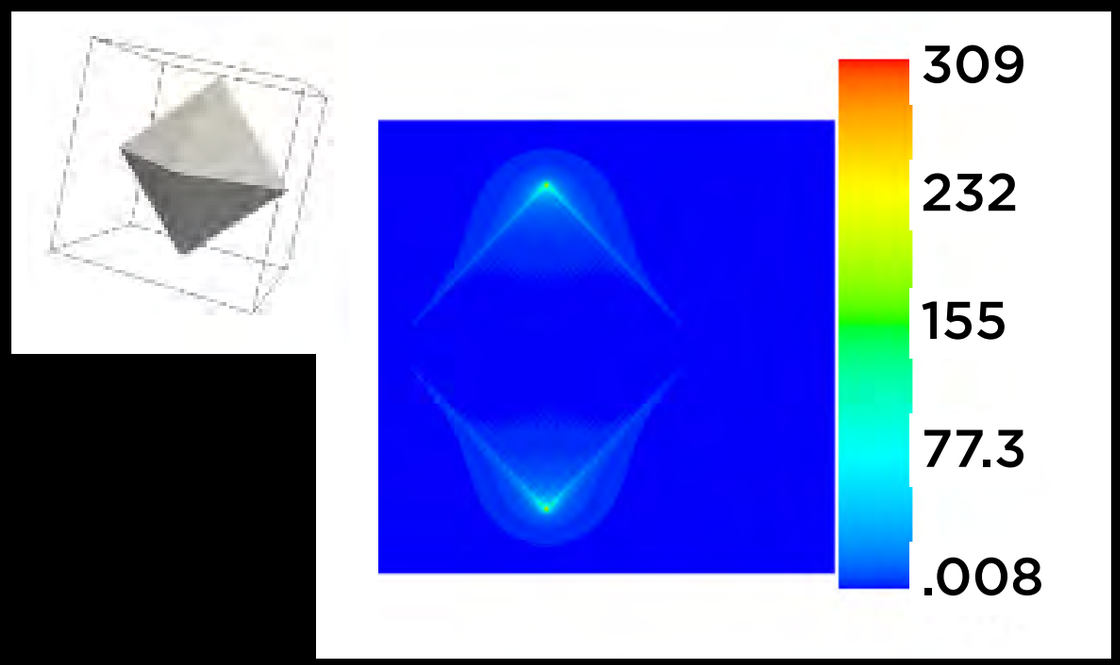


Electric field enhancement using plasmonic metal oxide nanocrystals

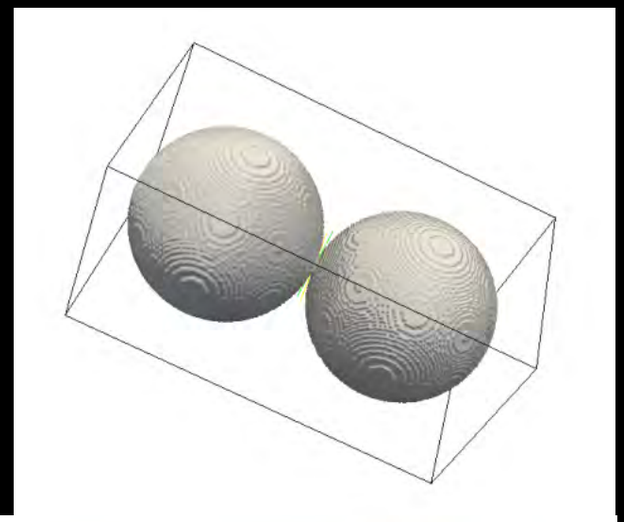
Shape-dependent field-enhancement



E_{pol}



Hot spots in dimers



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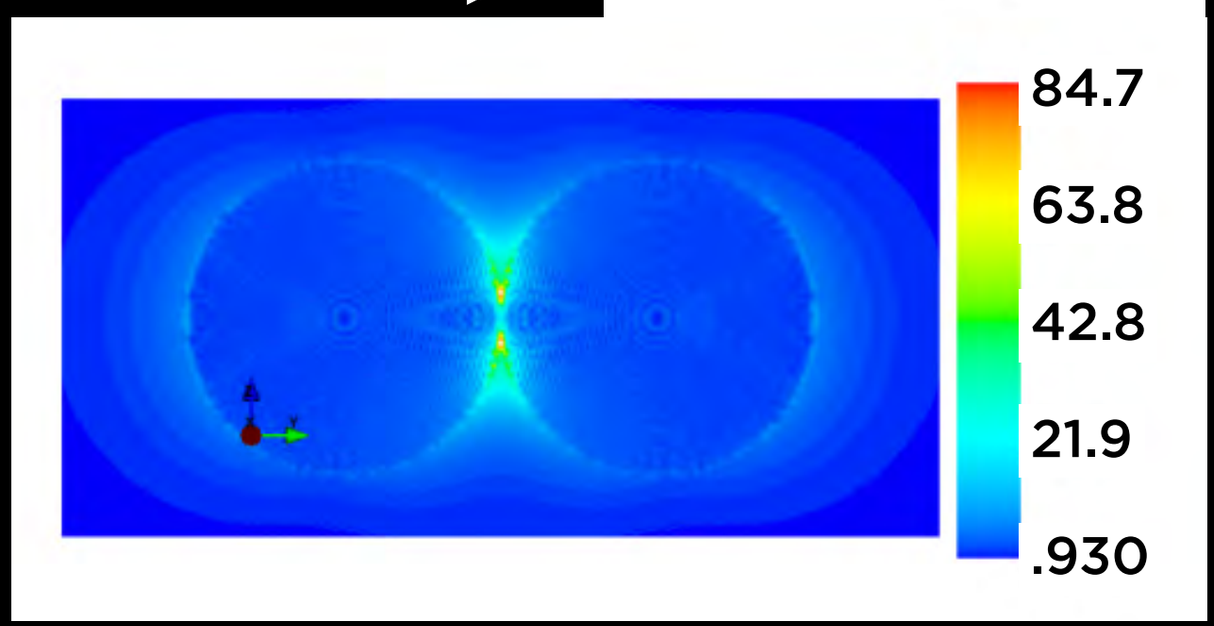

Ankit Agrawal, et al., *in press*.

All are 10 nm-equivalent In-CdO

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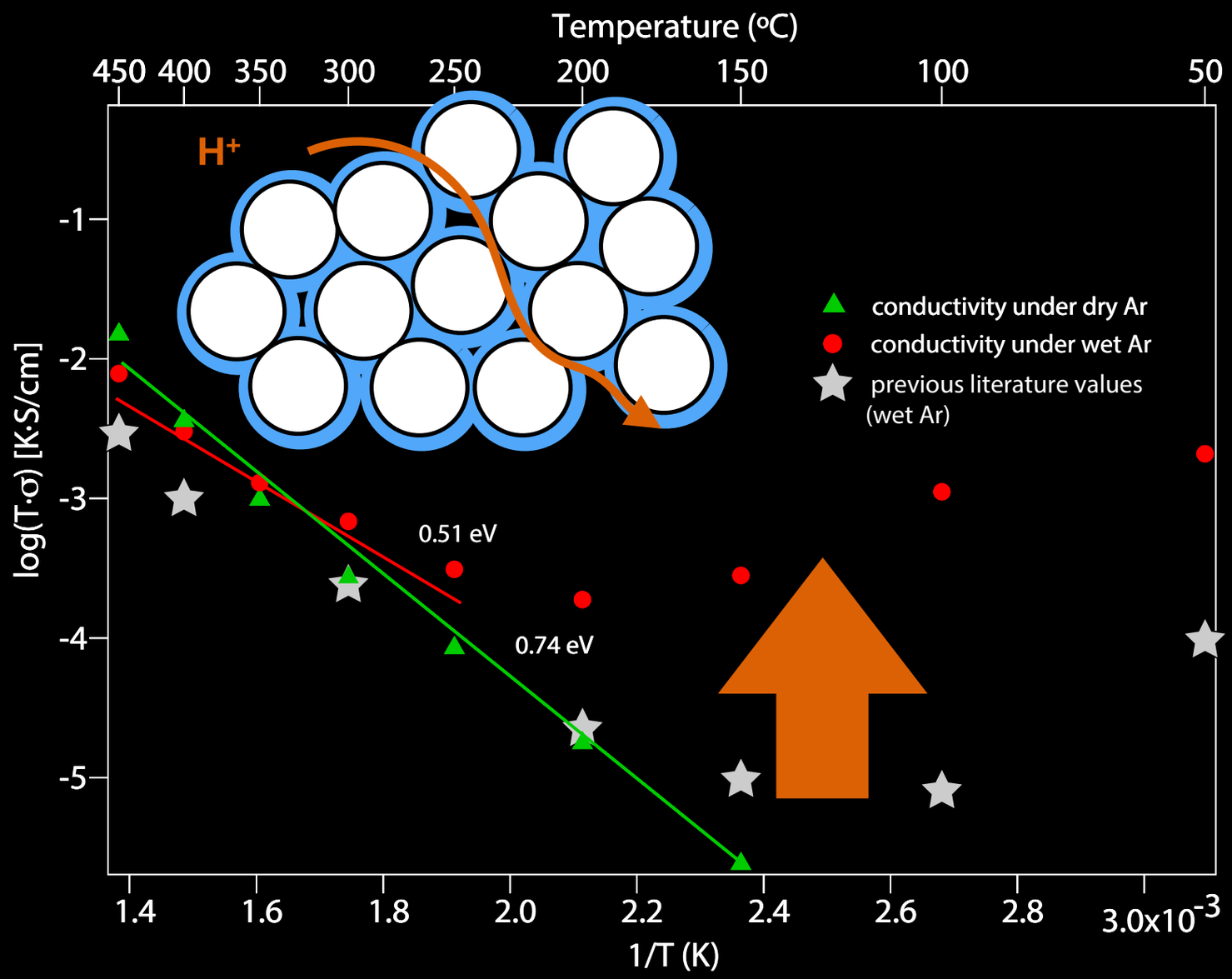
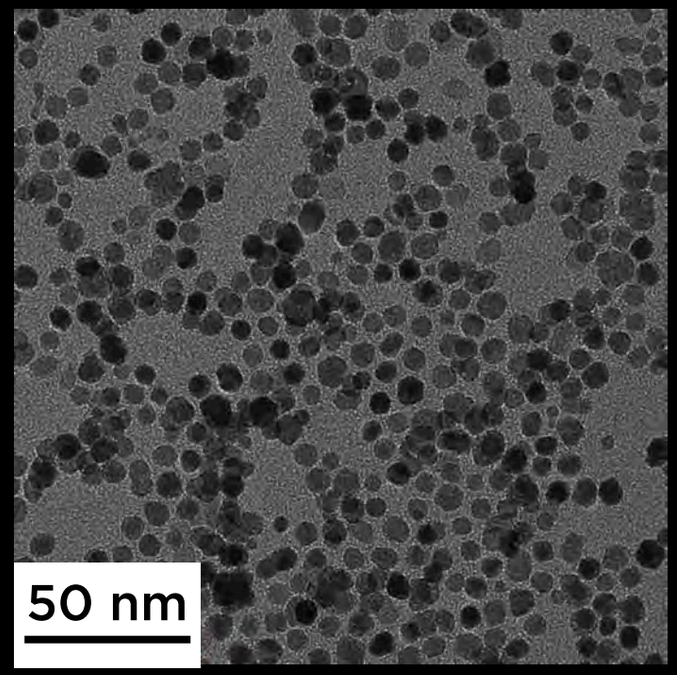
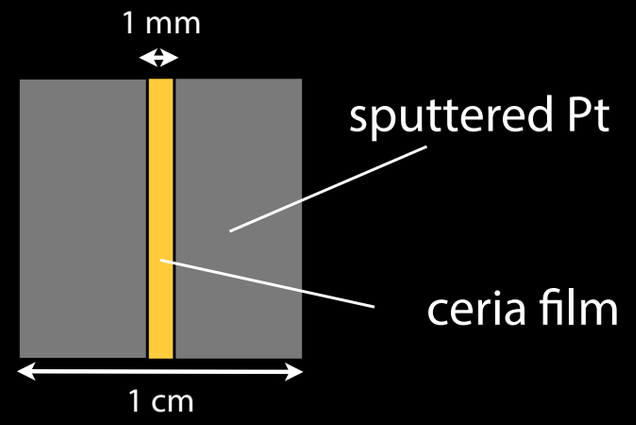
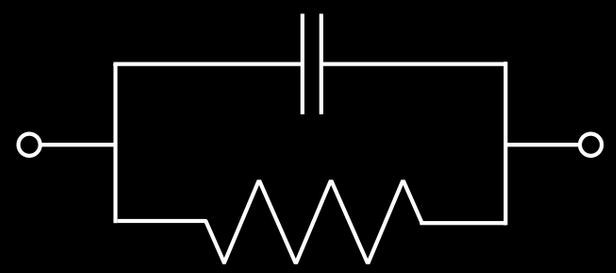
Proton transport through microporous metal oxides









Evan Runnerstrom

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Who we are

- Engineers, chemists, and physicists from around the world
- Visitors and a broad network of collaborators

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