

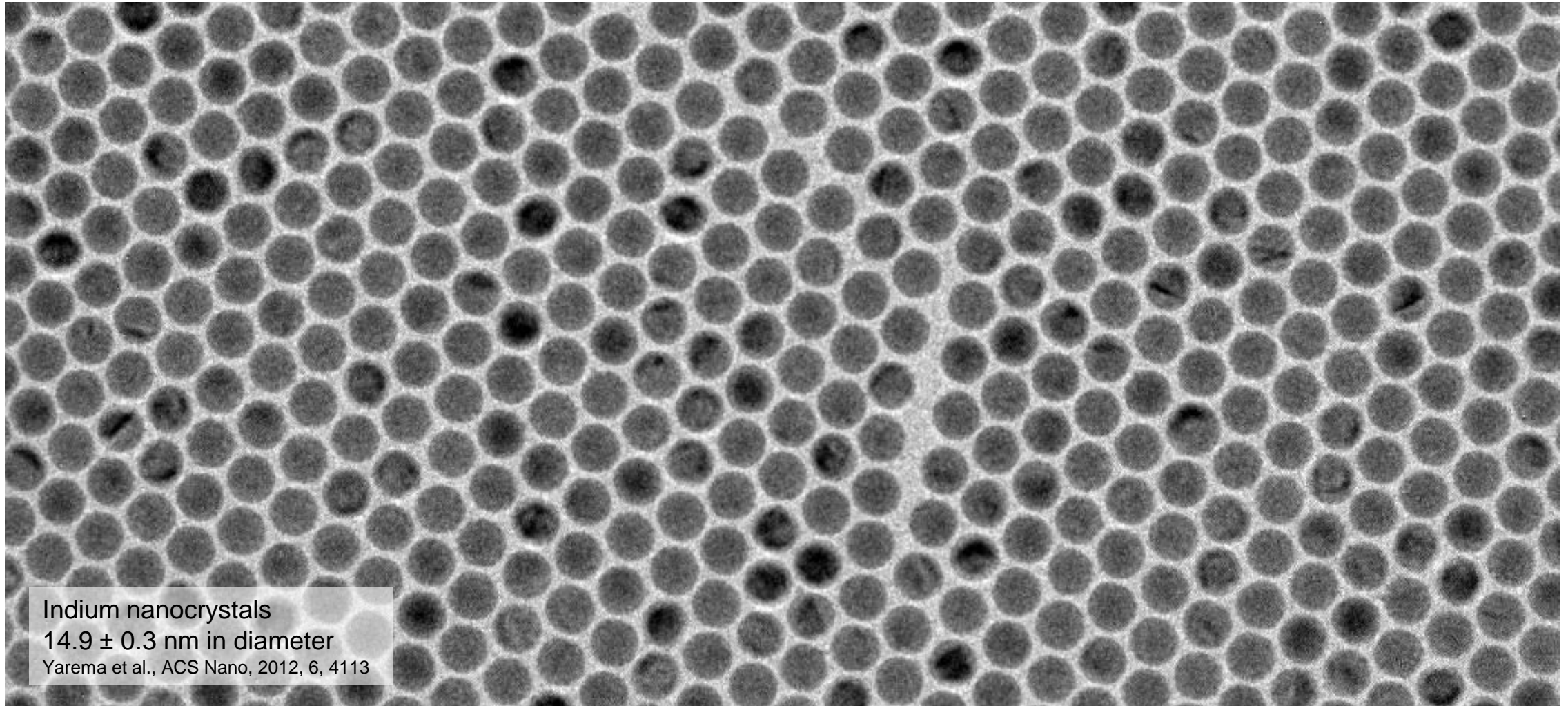
Synthesis and Use of Colloidal Nanocrystals

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Colloidal Nanocrystals: Beautiful, Functional, Unique



Synthesis Upscaling, High Quality Preserved



Mild vacuum in the reactor increases the injection speed

10-100x upscaling without modifying an original synthesis

2L lab prototype reactor
Target: 20L+ reactors

8x SloMo video of PbS synthesis

Yarema et al., Chem.Mater., 2017, 29, 796

Lighting Applications

Diversity and purity of emission colors

Energy-efficient emission

Low toxicity of materials



Yarema et al., Chem.Mater., 2018, 30, 1446
Yarema et al., Chem. Commun. 2016, 52, 10878
Yarema et al., ACS Nano, 2015, 9, 11134
Yarema et al., Chem. Mater., 2013, 25, 375

Non-Volatile Phase-Change Memory

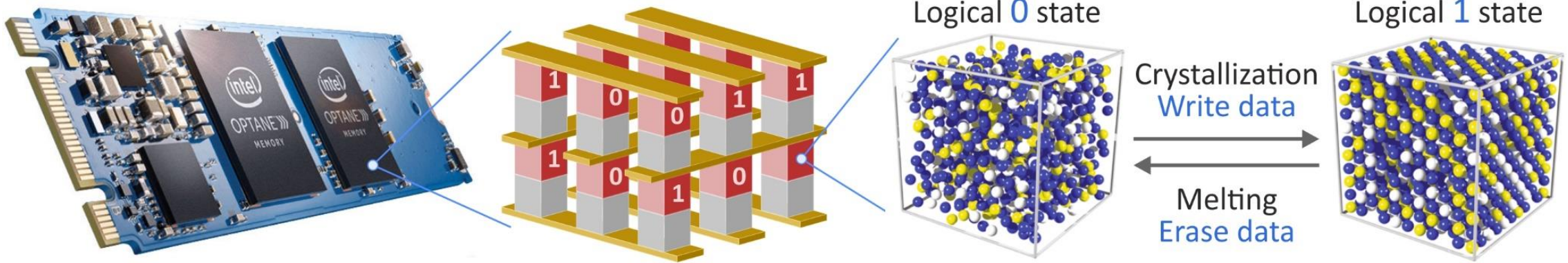
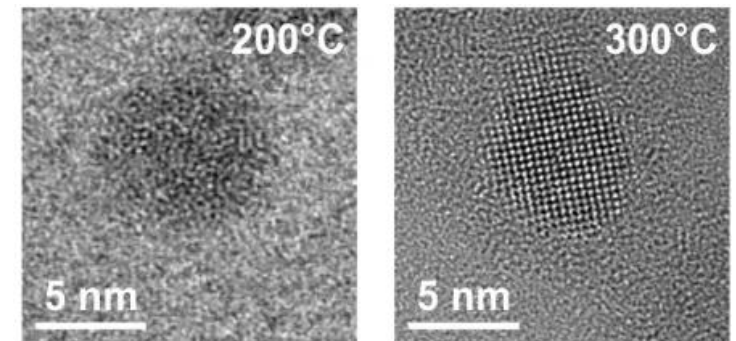
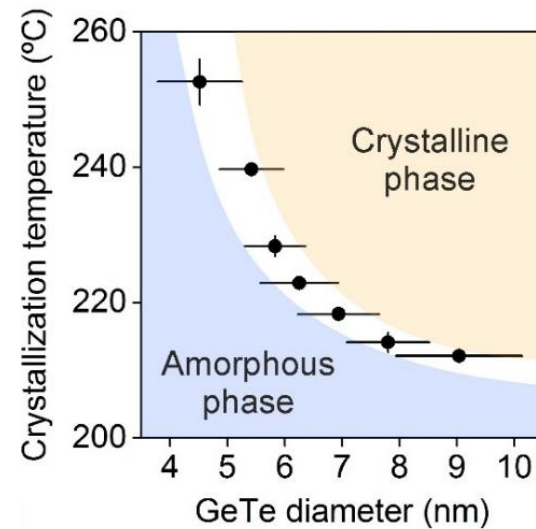


Image from: www.intel.com

Image adapted from: *Nature Rev. Mater.*, 2019, 4, 150

Benefits of using colloidal nanoparticles

- Size-dependent phase transitions
- Ultrasmall sizes of memory devices
- Solution-based fabrication
- New device geometries

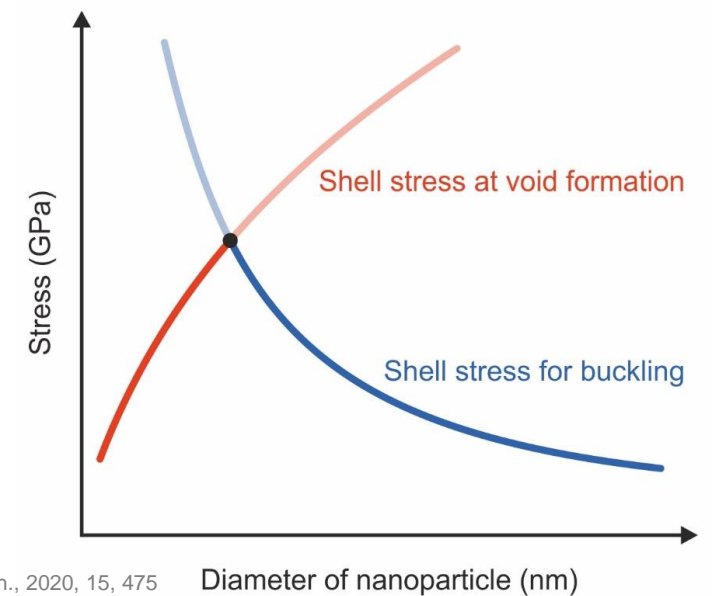
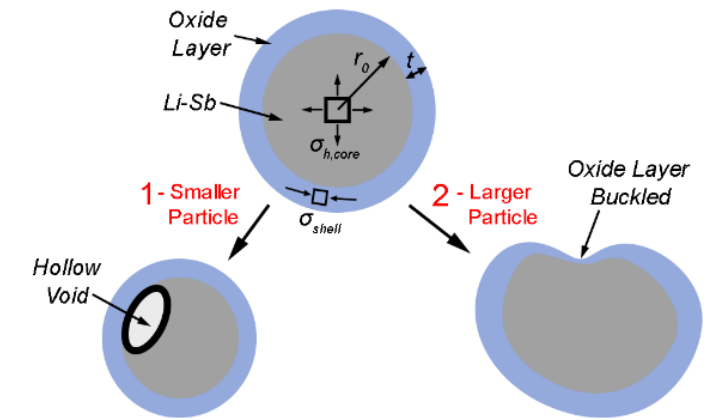
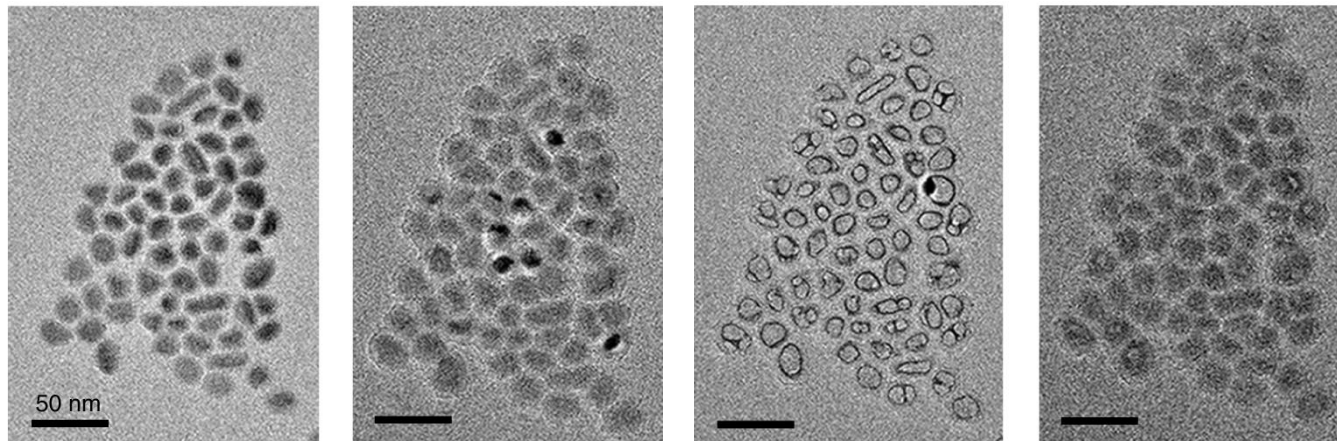
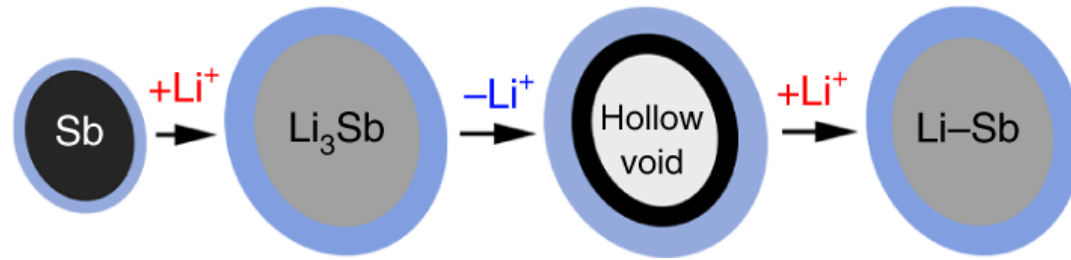


Yarema et al., *Chem.Mater.*, 2018, 30, 6134

Lithium-Ion Batteries

Spontaneous and reversible hollowing of Sb nanocrystals during lithiation and delithiation

Mechanical stability of small nanocrystals enable long-lasting LIB anodes



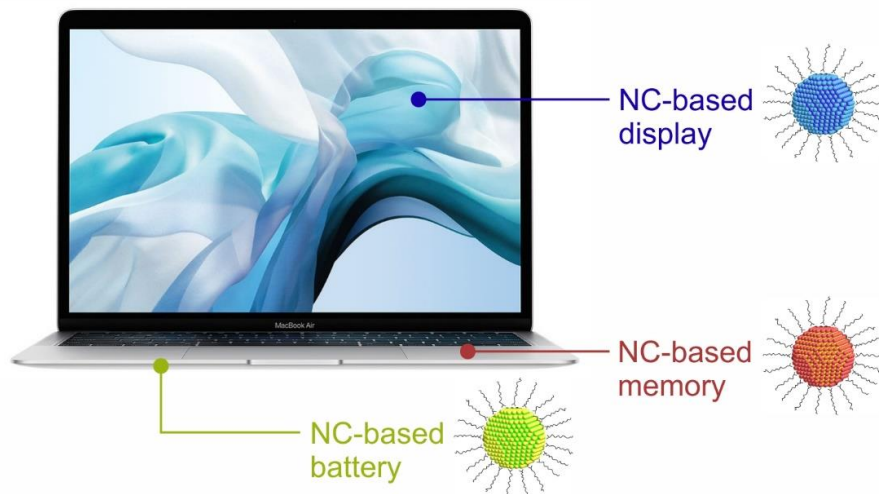
Boebinger, Yarema et al., Nature Nanotech., 2020, 15, 475

Summary

Research object Colloidal nanocrystals, featuring tailorable and unique functionality

Mission Improved technologies: LED, LIB, memory, thermoelectrics, catalysis, ...

Feasibility Synthesis upscaling without compromising the quality of colloidal nanocrystals



Thank you for your attention!

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