Opportunities for Industry Interaction with DOE Nanoscience User Facilities

Office of Science
U.S. Department of Energy

Center for Nanoscale Materials, Argonne National Lab, Argonne, Illinois

Center for Functional Nanomaterials, Brookhaven National Lab, Upton, New York

The Molecular Foundry, Berkeley National Lab, Berkeley, California

Center for Nanophase Materials Sciences, Oak Ridge National Lab, Oakridge, Tennessee

Center for Integrated Nanotechnologies, Sandia and Los Alamos National Labs, Albuquerque, New Mexico

Nanocrystal Solar Cells: Solexant

LBNL scientists developed foundational technology for nanocrystal solar cells.

These nanocrystals allow for low-cost solution-based processing.

Solexant licensed the nanocrystal solar cell IP and is developing a unique, cost-competitive thin film PV technology.

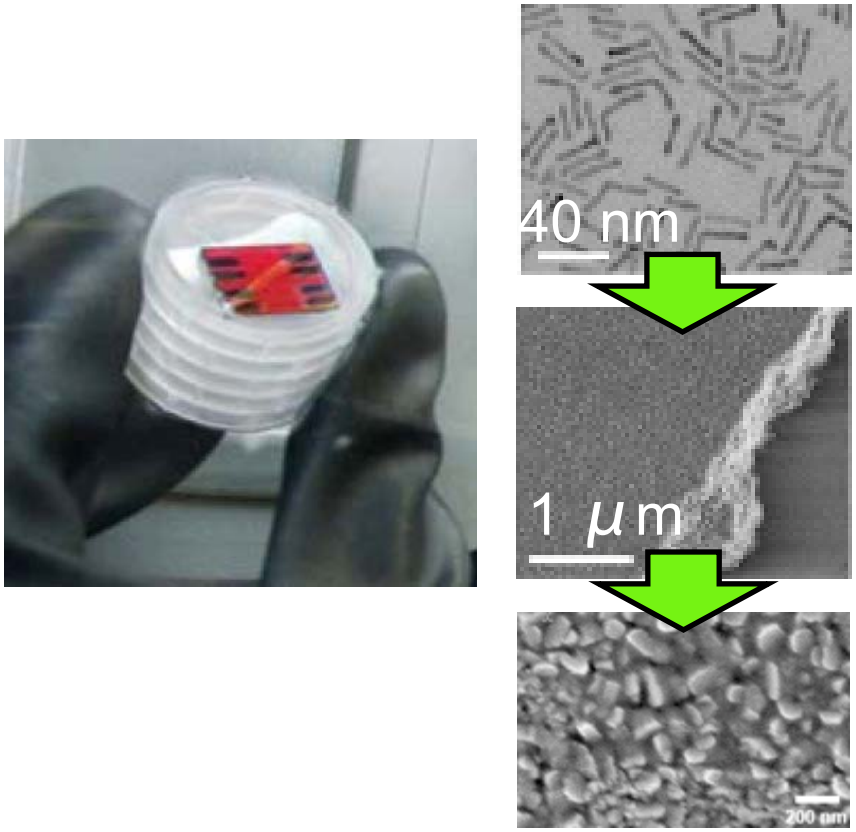
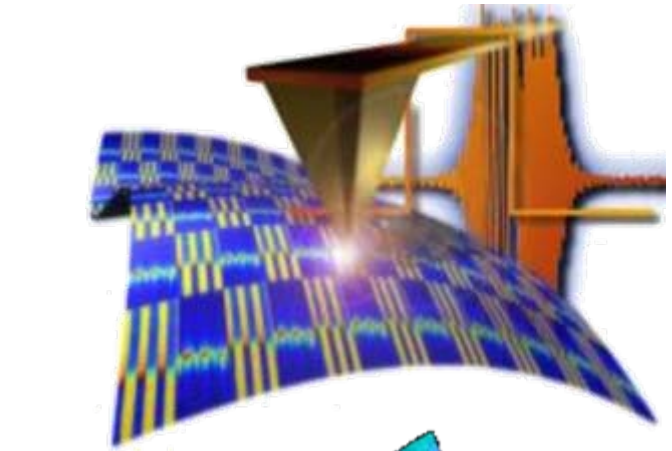
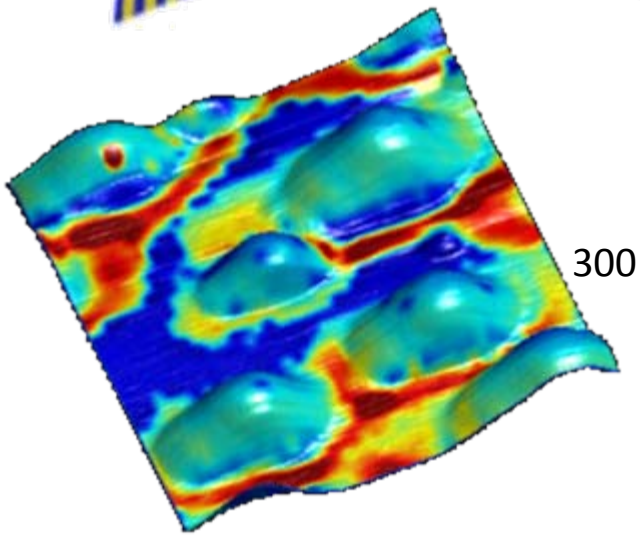


Figure: Ultrathin solar cell films (above, left); nanocrystals are made and coated from solution and then thermally sintered to improve conductivity and solar cell efficiency (above, right).

Electrochemical Strain Microscopy (ESM): Asylum Research

- Band excitation enables probing electrochemical reactivity and ionic transport in solids at sub-10nm length scales
- ESM works by detecting picometer strains induced by ion motion
- Effective for:
  - Li-ion solid electrolytes, cathodes/anodes
  - Fuel cell cathodes
  - Memristors
- Licensed to Asylum Research





300 X 300 nm

Stephen Jesse, et al., Nanotech. 2007
Nina Balke, et al., Nature Nano 2010
Amit Kumar, et al., Nature Chem, 2011

U.S. DEPARTMENT OF ENERGY
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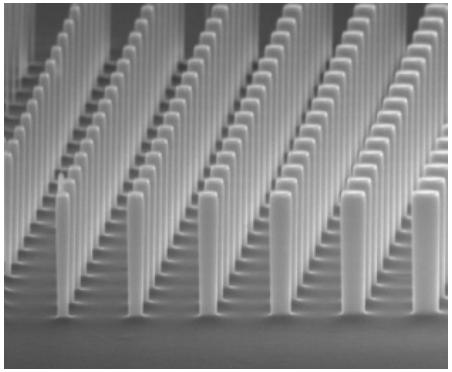
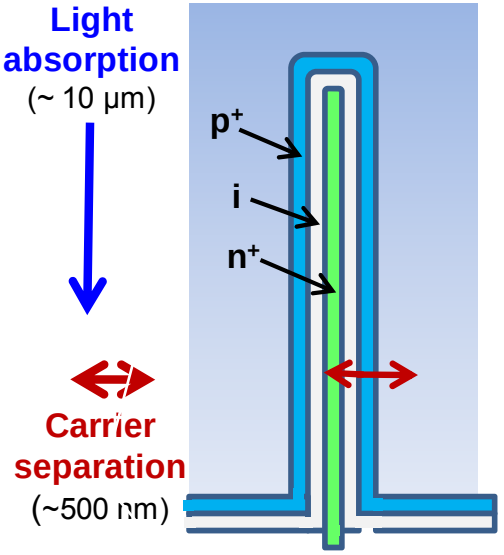
Nanowire Photovoltaics: Sharp Labs

Objective: Si solar cells with single crystal efficiency at thin film cost

- Radial *p-i-n* nanowire arrays enable decoupling of optical absorption and carrier collection for solar energy harvesting
- Collaboration with Sharp Labs to assess viability of this approach for solar cell applications
- New insight into:
  - Nanoscale radial epitaxial, low temperature single crystal growth
  - Fabrication of large area nanowire arrays



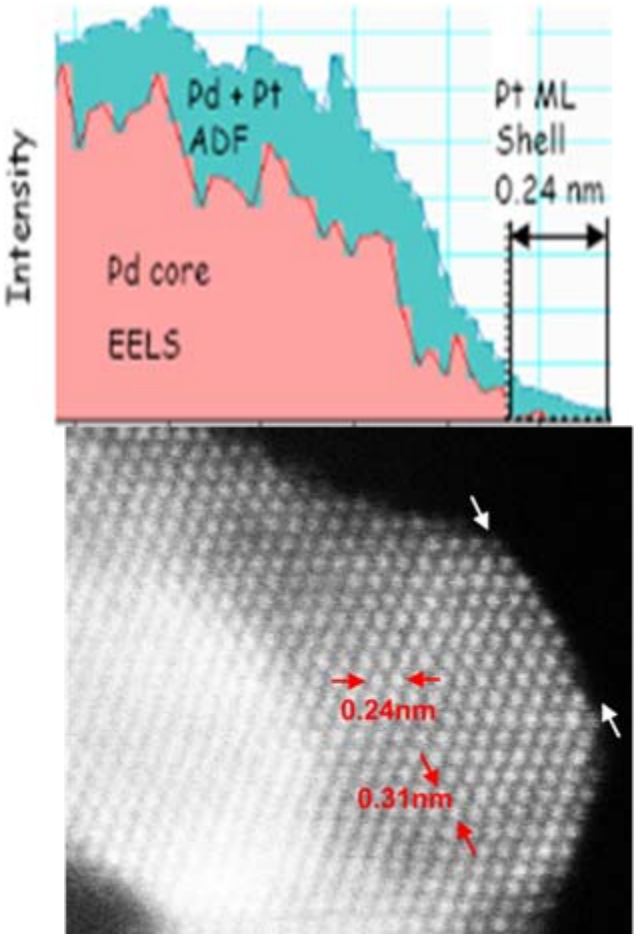


S.T. Picraux, S. Dayeh, I Campbell, J. Yoo, LANL; P. Schuele, D. Evans, Sharp Labs of America
EERE Project: *Assessment of Silicon Nanowire Architecture for PV Application*

Core-shell Nanocatalysts for Fuel Cells: Toyota, GM

Core-shell Pd/Pt nanocatalysts perform better than conventional Pt in fuel cells.

The CFNs' aberration-corrected scanning TEM has examined the nanocatalyst's structure and composition.



K. Sasaki et al, Electrochimica Acta **55**, 2645 (2010)

Industry-Lab Interactions: Challenges

Challenge: Sensitivity of IP issues, need to recognize technology impact during user proposal review

Potential solutions: Apply some measure of transparency (e.g., disclose reviewers after review process), utilize in-Lab reviewers OR industrial reviewers

Challenge: Only two calls for proposal each year– doesn't meet industry timelines

Potential solution: Leverage NSRC Rapid Access programs

Challenge: Need to balance solving near-term problems with long-term big bets

Potential solution: Structure collaboration terms to allow scientific flexibility within industrial areas of interest.