

# Boron- or Phosphorus-doped Silicon Nanoparticles

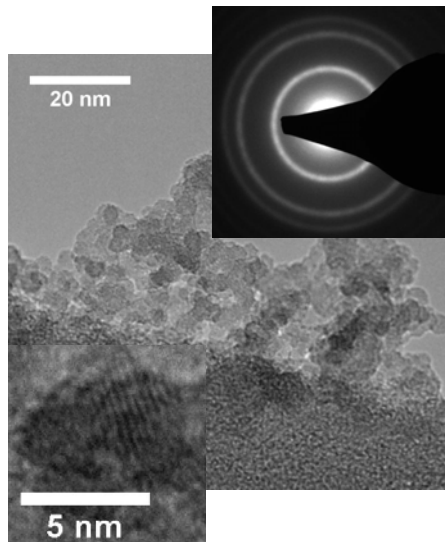
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NNIN Facilities utilized: Characterization Facility & Nanofabrication Center

## DESCRIPTION OF WORK

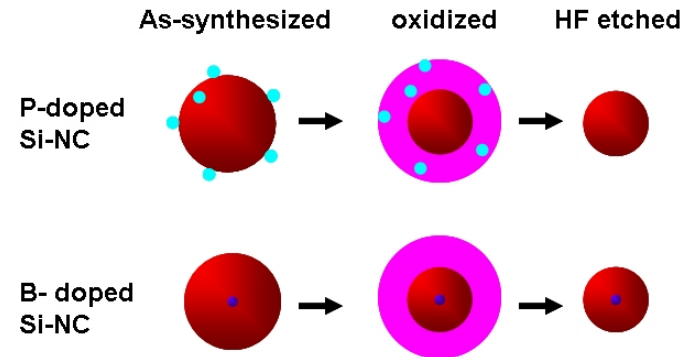
- ◆ Doping silicon nanoparticles in gas phase with B or P.
- ◆ The doping is critical to the realization of electrically conductive silicon-nanoparticle films used for optoelectronic and photovoltaic devices.



~ 3.5 nm silicon nanoparticles with a P atomic concentration of 4.5%.

## MAJOR OBSERVATIONS

- ◆ B is less efficiently doped than P.
- ◆ B is incorporated in the core of silicon nanoparticles, while P resides at or near the surface of silicon nanoparticles.
- ◆ There exist electrically active B and P atoms, which are ionized to induce free carriers.



Schematic of dopants in silicon nanoparticles.

## Publications

1. X. D. Pi, R. Anthony, S. A. Campbell and U. Kortshagen, *Materials Research Society Symposium Proceedings* **1031E**, H14.4 (2007).
2. X. D. Pi, R. Gresback, R. W. Liptak, S. A. Campbell and U. Kortshagen, *Applied Physics Letters* **92**, 123102 (2008)