Hierarchically-Structured NiO Photocathodes

Meyer/UNC

Scientific Achievement

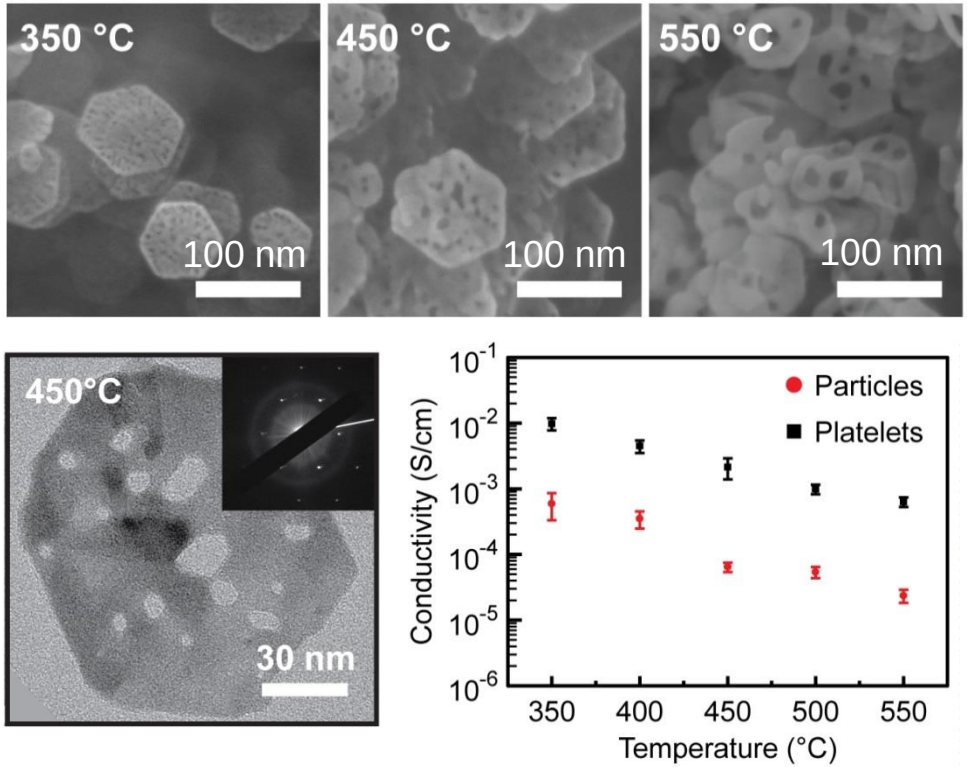
NiO with a hierarchical platelet/pore morphology improves conductivity ten fold and increases performance of dye-sensitized p-type photocathodes.

Significance and Impact

Provides basis for a photocathode material that can be integrated with a photoanode, such as TiO_2, to create dye-sensitized photoelectrosynthesis cells

Research Details

- Ultrathin (~10 nm) platelets of $Ni(OH)_2$ are synthesized in solution in high yield
- Calcination from 250-550 °C yields NiO platelets with pores of progressively increasing diameter
- The novel platelet/pore morphology retains high surface area and leads to a more than ten-fold improvement in mobility of thin films and ~30% improvement in DSSC devices



Upper: SEM images of hexagonal NiO nanoplatelets calcined at several temperatures and perforated with nanoscale pores

Lower: TEM image (left) of a single platelet and comparison (right) of the conductivity of nanoplatelets and conventional particles, showing a more than ten-fold enhancement for platelets

"Hierarchically-Structured NiO Nanoplatelets as Mesoscale p-Type Photocathodes for Dye-Sensitized Solar Cells," C. J. Flynn, E. E. Oh, S. M. McCullough, C. L. Donley, J. F. Cahoon. J. Phys. Chem. C. Under revision

Work was performed at UNC-Chapel Hill