# Functional Nanomaterial Laboratory for Green Energy Harvesting

**Weiwei Zheng, Ph.D.**
Associate professor, Department of Chemistry, Syracuse University

## Mission

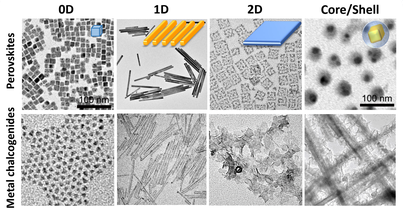
Our group focuses on designing, synthesizing, and characterizing novel functional inorganic nanomaterials for emerging applications in renewable energy. We are particularly interested in the optical, electric, and magnetic properties of semiconductor nanomaterials and transition metal ion doped nanomaterials, selective surface functionalization of nanoparticles, hybrid nanocomposites, and the meso-scale assembly of 3-D nanoparticle superlattices. We aim to answer the fundamental questions pertaining to the role of composition, band gap engineering, and assembly of semiconductor nanomaterials on their physical properties.

## Current Research

The research in the Zheng group is highly interdisciplinary and lies at the intersection of materials chemistry, nanotechnology, solid state chemistry, and photocatalysis. There are four ongoing research areas as follows:

**Advanced Synthesis for Low-Dimensional Nanomaterials**

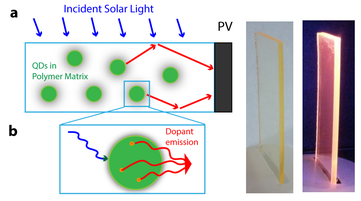
0-2 D and multi-dimensional core/shell NCs




Zheng. et.al. ***Chem. Mater.*** 2018, *30*, 3854
Zheng. et.al. ***Chem. Mater.*** 2019, *31*, 2516
Zheng. et.al. ***JMCC.*** 2021, *9*, 14226

**Doping for New Optical and Electrical Properties/Devices**

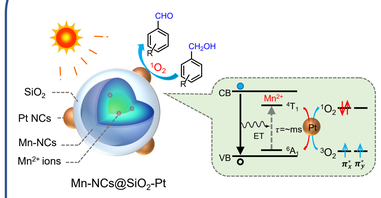
Nanocrystal-based luminescence sol concentrators




Zheng. et.al. ***JACS.*** 2017, *139*, 8878
Zheng. et.al. ***ACS Nano.*** 2017, *11*, 12591
Zheng. et.al. ***JPCL***. 2020, *11*, 5992

**Nanocomposites for Enhanced Stability & Charge Transportation**

Photocatalysis using hybrid nanocomposites




Zheng. et.al. ***Adv. Funct. Mater.*** 2018, 28
Zheng. et.al. ***Green Chem.*** 2020, *22*, 1911
Zheng. et.al. ***Nano Res.*** 2020, *13*, 1668

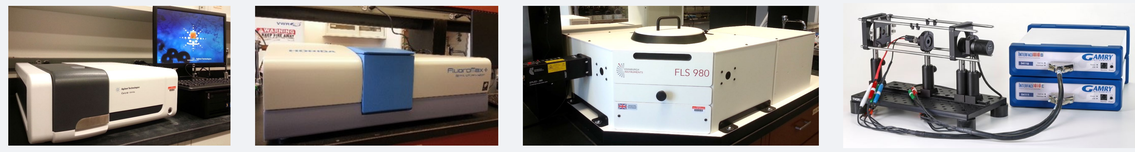
## Team Members

Dr. Weiwei Zheng, Principal Investigator
Dr. Shuya Li, Postdoctoral Fellow
Mr. Hanjie Lin, Ph.D. student
Ms. Chun Chu, Ph.D. student
Mr. Walker MacSwain, Ph.D. student
Ms. Huanxin Zhang, Ph.D. student

## Capabilities

- **Nanomaterial synthesis and photosynthesis:** 1) Wet chemistry laboratories; 2) High temperature furnace; 3) Photocatalytic reactors; 4) VAC Genesis glovebox.

- **Optical and electrical characterization:** 1) Agilent Cary 60 UV-vis spectrophotometry; 2) Horiba FluoroMax Plus spectrofluorometer; 3) Edinburgh FLS980 steady state and time-resolved emission spectrometer; 4) Gamry electrochemical workstation.




## Services

- Room to high temperature solution phase material synthesis
- Optical characterization by optical spectroscopy
- Structural characterization by X-ray diffraction

## Active Projects

- The Syntheses and Studies of Perovskite Type Semiconductive Nanomaterials for VOC Gas Sensing Applications, Sponsored by Honda Research Institute
- IUCRC Phase I Syracuse University: Center for Solid-State Green Electric Power Generation and Storage (CEPS), Sponsored by National Science Foundation (NSF)
- CAREER: Controlled Dopant Migration by Atomic Trapping for Site-Specific Doping in Nanocrystals, Sponsored by National Science Foundation (NSF)

## Major Contributions

- Synthesis and assembly for advanced shaped low-dimensional metal chalcogenide and perovskite nanomaterials
- Novel doping strategies for multifunctional nanocrystals
- Enhanced photocatalytic properties of functional nanomaterials

## Sponsors

Syracuse University Founded 1870 · Suos Cultores Scientia Coronat
ACS PRF
NSF
HRI Honda Research Institute USA