The Jun group investigates chemical reactions at the water-energy nexus, including geologic CO₂ sequestration, underground hydrogen storage, resource recovery, water purification and reuse, and membrane process.

Based on our strong scientific understanding of nanoscale interfacial chemistry and solid nucleation, we seek for technological innovation for clean water by developing new treatment techniques and green chemistry-enabled catalysts for environmental sustainability.
We study the following topics:

- Nucleation, growth, and aggregation of nanoparticles and their structures and reactivities in aquatic systems (from fresh water systems to highly saline systems).

- Chemical kinetics, thermodynamics, and mechanisms of interfacial reactions at nanoscale.

We use interdisciplinary tools

**Synchrotron-Based Techniques** at national synchrotron facilities (X-ray scattering, spectroscopy, and diffraction)

We work with national laboratory scientists at national facilities and travel to work with them.

We are experts who use various **surface-sensitive techniques** and provide in-depth knowledge of **water, surface, and solid state chemistry**. We also simulate your experimental results using **reactive transport models**.

- CO₂ capture, utilization, and sequestration.
- Solid-liquid interfacial reaction in energy-related subsurface operations (e.g., Underground hydrogen storage)
- Nutrient (P & N) and Critical Materials (Rare Earth Elements, Co, Ni, & Li) recovery and reuse from unconventional resources.
- Hydrogel technology for environmental applications
- Photothermal membrane development for water purification
- Photochemically-enabled green chemistry for nanostructure synthesis
- Water reuse (managed aquifer recharge) and water quality (advanced oxidation process)
- Biomineralization, biomaterials, and bio-inspired chemistry for novel materials development
Water: New ways to do desalination
Climate change and water scarcity

Managed Aquifer Recharge

Image source: https://www.confectionerynews.com/Article/2017/08/01/
Food-Water: Support sound circular economy

Environmentally sustainable fertilizer

Phosphorus removal

Image: USDA.gov
Image: NIEHS.NIH.gov
CO₂ capture and utilization: Support a decarbonized future

[www.energy.gov/eere/bioenergy/algal-production](www.energy.gov/eere/bioenergy/algal-production)
Do something that matters:

Alleviating CO$_2$ emission
Green Materials Synthesis for Energy

Two-dimensional nanomaterials

Li dendrite
Bone Health for a Aging Society

Kim et al, Nature Communications, DOI: 10.1038/s41467-018-03041-1
What former doctoral students do next and are now?

- **Academia: Tenured Associate professor** at Peking University (University of Houston)
**Tenure-track Assistant professors** at the Technical University of Denmark, the University of Washington, Changwon National University, Stony Brook University, New Jersey Institute of Technology, and Zhejiang University.

- **National Laboratory**: the U.S. Environmental Protection Agency, the National Energy Technology Laboratory, **the Los Alamos National Laboratory**, and the Oak Ridge National Laboratory

- **Postdoctoral scholars at Universities**: Georgia Tech, MIT, the University of California-Berkeley (with Miller fellowship), the University of California-Los Angeles, the University of Copenhagen, Stanford University, Yale University, Princeton University, the Ohio State University, and the University of Chicago

- **Industry**: Intel and Bayer
We need 3-4 new, ambitious and enthusiastic doctoral students!
Selected papers


