Environmental NanoChemistry Lab (ENCL)

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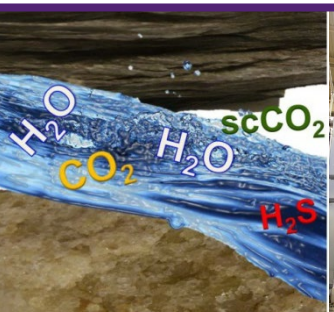
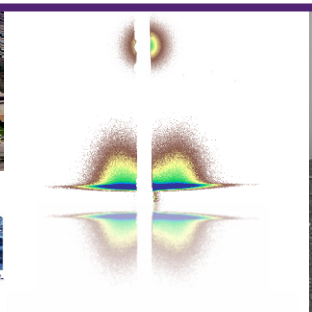
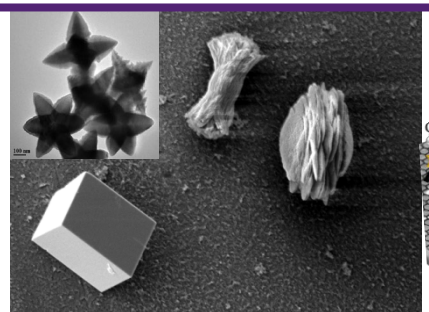
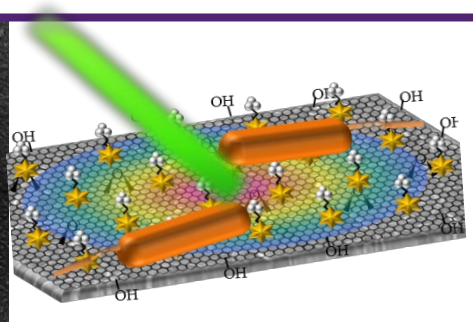
Website: http://encl.engineering.wustl.edu/; Brauer 2029 (lab)

Using **nucleation** and **nanoscale interfacial reactions,** we solve important energy and environmental challenges









The ENCL

We will provide solutions for challenges in water scarcity, energy, and resources

Environmental NanoChemistry Lab (ENCL)

We study the following topics:

- ❑ **Nucleation, growth, and aggregation of nanoparticles and their structures and reactivities in aquatic systems (from freshwater 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**.

We utilize advances in nanoscale interfacial chemistry and solid nucleation to tackle important challenges in energy and the environment, focusing on three areas:

1. ***Energy-related chemical systems***, including CO_2 capture, utilization, and storage (CCUS) and subsurface engineering, such as CO_2 mineralization, geologic CO_2 storage, underground storage of hydrogen, and enhanced geothermal energy.
2. ***New resource recovery methods***. These methods encompass the recovery of critical elements (rare earth elements, nickel, cobalt, and lithium) that are essential to clean energy technologies, the extraction and recycling of phosphorus and nitrogen nutrients and carbon for a sustainable circular economy, and the generation of useful chemical stocks from water desalination.
3. ***Nanomaterials and nanotechnologies*** for purifying drinking water and remediating contaminated water and soil. These materials benefit water reuse, managed aquifer recharge, and membrane processes such as reverse osmosis and ultrafiltration. We also examine the fate and transport of these nanomaterials in the environment.

Energy-related chemical systems

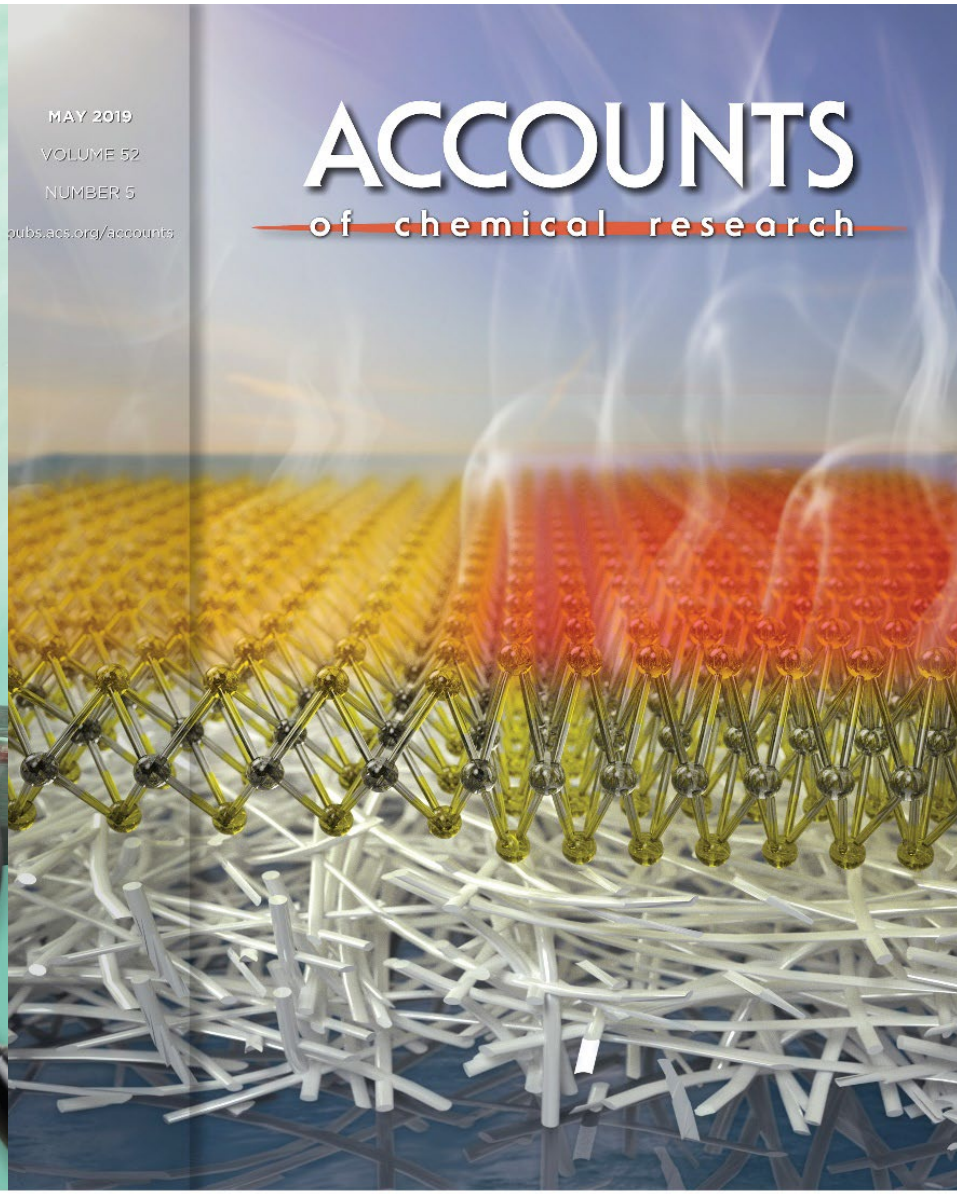
Solid nucleation for durable CO_2 capture, utilization, and storage

Scientific American, 2009

https://doi.org/10.1016/j.jcou.2020.101196

Resource recovery from reverse osmosis concentrates

Green Nanomaterials for Water and Energy



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What do the former doctoral students do next and where are they now?

- **Academia: Tenured Associate professors** at Peking University (formerly at the University of Houston) and at the Technical University of Denmark,
- **Tenure-track Assistant professors** 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 (Staff Scientist)**, 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, the University of Illinois-Urbana Champaign, and the University of Chicago
- **Industry:** 2 alumni at Intel Corporation and 2 alumni at Bayer