Environmental Nanomaterials for Pollution Control and Decontamination Technology

Dr. Kaimin Shih

Department of Civil Engineering, The University of Hong Kong
Pokfulam Road, Hong Kong
E-mail: kshih@hku.hk Tel: +852-2859-1973

ABSTRACT

The ability to control, manipulate, and design materials on the nanometer scale to remediate contaminated natural resources, while avoiding environmental impacts of hazardous wastes, will be a major challenge of the 21st century. As nanomaterials are at the forefront of nanotechnology wave, appropriate integration of environmental chemistry and nanomaterials science could create significant breakthroughs in a wide variety of environmental technologies. We have conducted works in stabilizing hazardous solid wastes and developing water purification strategies via use of novel nanomaterials and nanoscience techniques. The feasibility of stabilizing meta-laden waste sludge from aluminum- and iron-rich construction ceramics was investigated; high metal transformation efficiencies and superior stabilizing capability were observed. This study revealed the role of nanocrystalline materials in facilitating metal transformation, and suggests an avenue to economically reduce the environmental hazards of toxic metals in solid wastes.

Highly efficient, visible-light active, and recoverable photocatalysts are fascinating scientists and engineers exploring novel purification technologies for water. Membrane filtration, also commonly used for water treatment, is thought to be an attractive separation technique for photocatalysis units. However, there are a number of scientific challenges that must be overcome before such a system can be fully utilized. Our studies have demonstrated the importance of nanometer scale properties for understanding photocatalyst behavior and photodegradation mechanisms. In addition, nanocharacterization has been a valuable tool in the investigation of membrane fouling, and the exploration of innovative ecomaterials. Furthermore, during our development of a novel strategy via using bimetallic Pd-In catalyst to effectively destroy *N*-nitrosodimethylamine (NDMA; a carcinogen) in drinking water, the nanocharacterization techniques again demonstrated the importance of understanding the materials at nanoscale to reveal the key decontamination mechanisms in the new environmental technology.