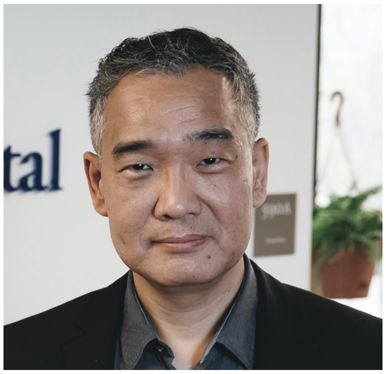
Environmental Engineering Seminar

The Astani Department of Civil & Environmental Engineering presents



Prof. Jaehong Kim
Yale University

Date: September 21st, 2022
Time: 2:00 pm – 3:00 pm
Location: RRI 101

Toward Single Atom Catalysis for Environmental Application

Various noble metals have been employed as catalysts and co-catalysts to enhance the kinetics of reactions that are critical for environmental remediation. The need to maximize the available catalytic sites per unit mass, particularly due to noble metal scarcity and high cost, as well as the unique material properties manifested at nanoscale, has driven the development of material architectures at the nanoscale. Recent theoretical and experimental studies have explored noble metal catalysts on sub-nanometer, atomic scale to maximize atomic efficiency. A single atom catalyst (SAC), also called atomically dispersed catalyst or single site catalyst, is the theoretical limit in this endeavor, and previous studies have identified additional benefits such as low coordination state and strong interaction with the surrounding substrate resulting in selective catalysis with enhanced activities. For past few years, our group has since been exploring various SACs (Pt, Pd, Ag, and Co) anchored on different substrates (SiC, C_3N_4, and TiO_2) that exhibit unique catalytic properties. This talk summarizes our recent and currently on-going studies to advance the water treatment catalysts from the nano-scale toward the single atom scale such as: (1) single-atom Pt and Pd anchored to SiC for selective hydrogenation of halogenated organic pollutants such as perfluorooctanoic acid (PFOA); (2) single-atom Pd alloyed with Cu for thermocatalytic and electrocatalytic nitrate reduction; (3) spatial separation of two co-catalysts by coordinating single atom cobalt at the void center of C_3N_4 and anchoring anthraquinone at the edges of C_3N_4 platelets to enhance the catalytic synthesis of H_2O_2, a precursor chemical for advanced oxidation; (4) loading Co single atoms onto layered graphene oxide membrane to achieve advanced oxidation during high pressure filtration; and (5) challenges associated with the stability of single atoms during water treatment environment.

About the Speaker

Jaehong Kim is currently Henry P. Becton Sr. Professor of Engineering in School of Engineering and Applied Science at Yale University. His areas of interest include: 1) environmental application of nanomaterials; 2) development of photoluminescence / photocatalysis technology for environmental and energy application; and 3) membrane process and materials development. Kim received B.S. and M.S. degrees in chemical and biological engineering from Seoul National University in Korea in 1995 and 1997, respectively, and a Ph.D. degree in environmental engineering from the University of Illinois at Urbana-Champaign in 2002. After graduation, he joined the School of Civil and Environmental Engineering at Georgia Institute of Technology where he later held the title of Georgia Power Distinguished Professor and Associate Chair for Undergraduate Programs. He then moved to Yale University in 2013 as Barton L. Weller Endowed Professor and served as the chair of the Department of Chemical and Environmental Engineering from 2016 to 2022. He has taught undergraduate courses such as Water Quality Engineering, Environmental Technology in the Developing World, and Environmental Engineering Laboratory, and graduate courses such as Physicochemical Processes and Design of Drinking Water Treatment Facilities. He is a recipient of various awards including Ackerman Award for Teaching and Mentoring from Yale University (2017), Bill Shultz Junior Faculty Teaching Award from School of Civil and Environmental Engineering (2013), Walter L. Huber Civil Engineering Research Prize from American Society of Civil Engineers (2013), Top Paper Award from American Chemical Society (2012, 2020, 2021), and Paul L. Busch Award from Water Environment Research Foundation (2009).

USC University of Southern California