iFAST: The International Forum on Advanced Environmental Sciences and Technology

A series of distinguished seminars by eminent scientists

8 a.m. CST; 9 a.m. EST; 2 p.m. GMT; 10 p.m. Beijing

Wednesday, Feb. 16, 2022

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P. J. J. Alvarez is the George R. Brown Professor of Civil and Environmental Engineering at Rice University, where he also serves as founding director of the Nanosystems Engineering Research Center for Nanotechnology-Enabled Water Treatment, supported by the National Science Foundation. His research interests include environmental implications and applications of nanotechnology; bioremediation, fate and transport of toxic chemicals; water footprint of biofuels; water treatment and reuse; and antibiotic resistance control. Alvarez earned his bachelor's degree in civil engineering from McGill University and master's and doctoral degrees in environmental engineering from the University of Michigan. He is the 2012 Clarke Prize laureate and won the 2014 American Academy of Environmental Engineers and Scientists Grand Prize for Excellence in Environmental Engineering and Science. Past honors include serving as President of the Association of Environmental Engineering and Science Professors, the Perry McCarty AEESP Founders' Award for Outstanding Contributions to Environmental Engineering Education & Practice, the AEESP Frontiers in Research Award, the WEF McKee Medal for Groundwater Protection, the Strategic Environmental Research and Development Program cleanup project of the year award, the Brown and Caldwell lifetime achievement award for site remediation, the ASCE Freese Award, and various best paper awards with his students. Alvarez has served on the advisory committee of the NSF Engineering Directorate and on the scientific advisory board of the EPA and is currently an associate editor of *Environmental Science and Technology*. He was elected to the National Academy of Engineering for pedagogical and practical contributions to bioremediation and environmental nanotechnology.

Nanotechnology-Enabled Water Treatment

Through control over material size, morphology and chemical structure, nanotechnology offers novel materials that are nearly "all surface" and that can be more reactive per atom than bulk materials. Such engineered nanomaterials can offer superior catalytic, adsorptive, optical, quantum, electrical and/or antimicrobial properties that enable multi-functional technology platforms for next-generation water treatment. This presentation will address emerging opportunities for nanotechnology to improve the selectivity and efficiency to remove priority pollutants, decrease electrical energy requirements, and meet a growing need for safer and more affordable decentralized water treatment and reuse. Examples of applicable nano-enabled technologies include capacitive deionization with highly conductive and selective electrodes to remove multivalent ions that precipitate or cause scaling; solar-thermal processes enabled by nanophotonics to desalinate with membrane distillation; disinfection and advanced oxidation using nanocatalysts; and nanostructured surfaces that discourage microbial adhesion and protect infrastructure against biofouling and corrosion. We envision using these enabling technologies to develop compact modular water treatment systems that are easy to deploy and can treat challenging waters to protect human lives and support economic development.

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