

UCSD NANOENGINEERING/CHEMICAL ENGINEERING
SEMINAR SERIES

Wednesday, May 10th, 2023

Seminar Presentation: 11:00am - 12:00pm

SME room 248***“Halide perovskites for durable and high-efficiency photovoltaics and solar fuels”*****Dr. Aditya Mohite, PhD***Associate Professor
Rice University*

Abstract: Halide (hybrid) perovskites (HaP) have emerged as a new class of semiconductors that truly encompass all the desired physical properties for building optoelectronic and quantum devices such as large tunable bandgaps, large absorption coefficients, long diffusion lengths, low effective mass, good mobility, and long radiative lifetimes. In addition, HaPs are solution processed or low-temperature vapor grown semiconductors and are made from earth abundant materials thus making them technologically relevant in terms of cost/performance. As a result, proof-of-concept high efficiency optoelectronic devices such as photovoltaics and LEDs have been fabricated. In fact, photovoltaic efficiencies have sky-rocketed from 3.9% to 26.2% in a decade. Despite the high-efficiencies, a long-enduring challenge has been achieving technologically relevant durability. In this talk I will describe our recent work on HaPs on understanding solvation dynamics, thin-film processing to achieve highly crystalline and homogenous films, novel photo-doping induced structural behaviors, which enhance charge carrier transport which enable solar cells with >24.5% power conversion efficiency and technologically relevant durability. Finally, I will also demonstrate an integrated photoelectrochemical reactor that uses high-efficiency HaP/Si tandem solar cells with >28% efficiency, which results in an unassisted water-splitting solar-to-hydrogen conversion efficiency of 20.8% with continuous operation over 100 hours.

Biosketch: Aditya D. Mohite is an Associate professor in the Department of Chemical and Biomolecular Engineering with joint positions in Department of Material Science and Nanoengineering, Department of Chemistry, Department of Electrical & Computer Engineering at Rice University and directs an energy and optoelectronic devices lab working on understanding structure-function properties in materials with the aim of controlling charge and energy flow across interfaces. His research philosophy is applying creative and out-of-the-box approaches to solve fundamental scientific bottlenecks and utilize the knowledge to demonstrate performances in devices that is on par or exceeds the current state-of-the-art devices. A key mission of his group is to advance the knowledge of materials, chemistry, physics, and engineering to develop next-generation technologies by working with a multidisciplinary and diverse group. He has published 170 peer reviewed papers in journals such as Science, Nature, Nature Materials, Nature Nanotechnology, Nature Physics, Nano Letters, ACS Nano, Chemical Society Reviews, Applied Physics Letters and Advanced Materials amongst others, which has been cited >20,000 times. He has also delivered more than 90 invited talks, has 8 patents. He is currently also the director of the Rice Engineering INitiative for ENergy Transition and Sustainability (REINVENTS) with the goal of coordinating and organizing research in sustainable clean energy in the areas of energy generation, long-term energy storage and energy efficient processes and materials with the goal of creating disruptive solutions for decarbonization.

Recent awards and honors

1. DOE Hydrogen Program Research & Development Award 2022 for outstanding work demonstrating record solar-to-hydrogen conversion and durability for halide perovskite based photoelectrochemical cells
2. Outstanding faculty research award in the school of engineering at Rice University 2022
3. Winner of the Resonate Resnick award for Sustainability Research 2017 presented by Caltech to shine a light upon an individual who has done outstanding work in the field of sustainable energy.
4. The 2022, 2021, 2020, 2019 Highly Cited Researchers list is a global accounting of scientists who produced the last decade's most influential papers, compiled by the Web of Science group, a Clarivate Analytics company. The list recognizes researchers “who produced multiple papers ranking in the top 1% by citations for their field and year of publication, demonstrating significant research influence among their peers,” according to Web of Science.