Department of Materials Science and Engineering Seminar Series 2025

SALT–HYDROGEL SYNERGISTIC SYSTEMS FOR CONTINUOUS ATMOSPHERIC WATER HARVESTING AND ENERGY HARVESTING

Xu Xin

Date and time: Wednesday, May 13, 2026, 10:00am

Venue: EA-02-15

Abstract

Freshwater scarcity and decentralized energy demand have intensified interest in atmospheric water harvesting and moisture-enabled electricity generation as sustainable solutions. However, existing systems are limited by low sorption efficiency, slow kinetics, and poor operational stability. This work systematically investigates hygroscopic salt–hydrogel composites as an integrated materials platform for atmospheric water harvesting and moisture-enabled electricity generation from ambient humidity. By confining deliquescent salts within crosslinked hydrophilic polymer networks, the composites achieve high water uptake while suppressing salt leakage and maintaining mechanical integrity. The effects of polymerization route, salt loading, and composite architecture on sorption capacity, uptake kinetics, desorption behavior, and electrical output are systematically elucidated.

Building on these insights, this work develops a continuous atmospheric water harvesting platform and proposes a scalable, low-cost strategy for large-area deployment. In parallel, electricity generation mechanisms associated with evaporation, hygroscopic absorption, and droplet-induced interfacial charge redistribution are investigated, establishing a mechanistic basis for the rational design of moisture-enabled energy conversion systems.

Biography

Xu Xin is currently a Ph.D. candidate in the Department of Materials Science and Engineering at the National University of Singapore, under the supervision of Prof. Ding Jun. His doctoral research focuses on the design and development of hydrogel-based hygroscopic materials for atmospheric water harvesting, moisture-enabled energy harvesting, and dehumidification. He also integrates additive manufacturing with functional materials to develop systems for strain sensing and humidity sensing, as well as porous ceramic materials for thermal insulation applications.

Please join us!

HOST: Asst Prof Zhao Ming