ETH zürich

Institute of Fluid Dynamics
Institute of Energy and Process Engineering

Colloquium Thermo- and Fluid Dynamics

Leverage Liquid-Vapor Phase Change for High-Performance Sustainable Cooling

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Fundamental understanding of phase change phenomena, despite its great impact on the world's energy and water systems, has been limited, mainly due to the difficulty of experimentally isolating and characterizing interfacial thermal resistance. In the first part of my talk, I will discuss how we overcame this challenge and elucidated a unified relationship for evaporative transport under different working conditions. In the second part of my talk, I will discuss how we leveraged the obtained understanding to create high-performance passive cooling solutions. For electronics thermal management, we created a membrane-based hierarchical evaporator and demonstrated a record pure evaporation heat flux for dielectric fluids. For temperature regulation of buildings and perishable goods, our hydrogel-aerogel structures exhibited significantly longer cooling time and delivered much higher cooling power by synergistically combining different cooling mechanisms. Overall, we show that combining fundamental interfacial transport physics with novel materials and interface engineering enables unique opportunities for innovations toward more sustainable energy and water technologies.

Zhengmao Lu is a Tenure Track Assistant Professor of Mechanical Engineering at EPFL. Previously, Zhengmao was a postdoctoral scholar in the Department of Materials Science and Engineering at MIT where he also received his Ph.D. and M.S. in Mechanical Engineering. At EPFL, Zhengmao leads the Energy Transport Advances Laboratory (ETA-Lab), focusing on interfacial transport research for energy and water applications.

Date: Wednesday, 29 November 2023
Time: 16:15 - 17:15h
Place: ETH Zurich, ML F 36
Host: Prof. Aldo Steinfeld, PREC

Further information: https://ifd.ethz.ch/events/ktf.html

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