東京大学 THE UNIVERSITY OF TOKYO

GMSI Graduate Program for Mechanical Systems Innovation

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Leveraging Microscale Heat Transfer and Fluid Flow for Innovations in Sustainable Energy Systems

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Venue: 31A, 3F Faculty of Engineering Bldg. 2

Abstract:

Microscale phase-change can benefit a wide range of applications, ranging from electronics cooling, lab-on-a-chip and bio-mems, typically for miniature devices, all the way to Megawatt scales. This presentation will demonstrate the use of insights into coupled microscale phase-change heat and mass transfer to enable a diverse array of thermally driven HVAC&R, carbon capture, and natural gas cleaning systems. Miniaturization through integration of multiple microscale components into compact, monolithic systems enables the replacement of multiple devices such as conventional air-conditioners, furnaces and water heaters by a single modular thermal hub driven by natural gas or low-grade waste heat. Such microscale phase-change enabled systems are also applied to waste heat driven cooling systems in naval bases, and aircraft carriers at the Megawatt scale. Fast heat and mass transfer kinetics in hollow microchannel fibers with internal coupling fluid flow and loaded externally with adsorbents are also exploited to enable rapid temperature swing adsorption (RTSA) for CO_2 capture from power plants. Such adsorbent-coated hollow fibers are also shown to yield several-fold plant footprint reductions in natural gas purification plants. These representative applications demonstrate the benefits of microscale heat transfer for energy generation, conversion, recovery, utilization and storage.

主催: 東京大学大学院工学系研究科専攻間横断型教育プログラム 機械システム・イノベーション（GMSI）
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