

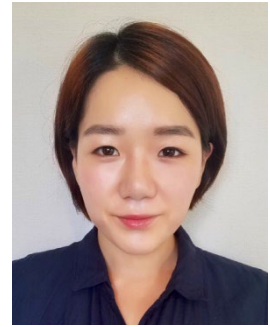
Research topics for graduate students 2025

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Acceptable course(s)

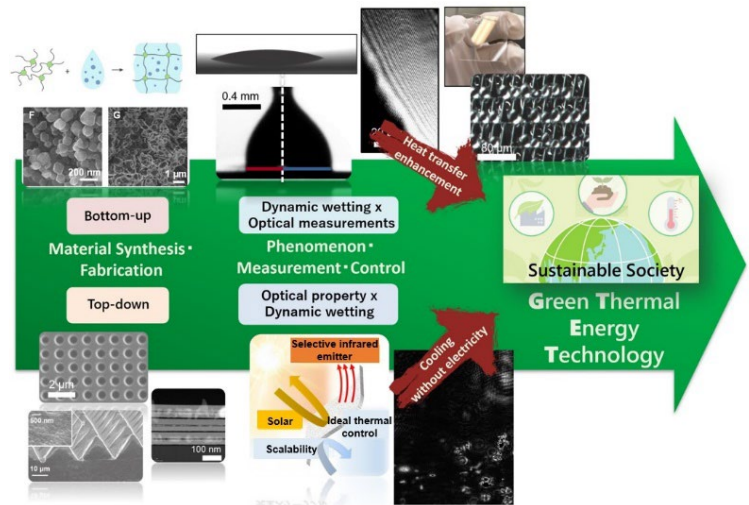
- Master's Degree
- Doctoral Degree



Research Topics

Surface physical and chemical control to control the liquid contact line movement and those applications for

thermal management; To promote sustainability, it is essential to enhance interfacial heat transfer, especially in large-scale industrial applications, and to pioneer cooling technologies that reduce electricity consumption. In this context, we focus on creating functional surfaces and gaining a thorough understanding of dynamic wetting, phase change dynamics at solid-liquid interfaces, and the photo-thermal properties of material surfaces. See below for recent topics.



1. Understanding of dynamic wetting over controlled solid surfaces

Dynamic wetting, wherein liquid spreads over a dry surface, holds significant importance in numerous industrial processes due to its intricate multiphase physics. This topic explores how surface chemistry and micro-scale roughness influence the macroscopic flow in dynamic scenarios such as spreading, oscillation[1-2], sliding, and more.

2. Development of smart surfaces to control condensation and freezing of water

The efficient drainage of condensates and the prevention of frosting are critical considerations in various industries, especially in HVAC and aircraft wings[3]. This topic studies the micro and macro wetting over polymer surfaces, exploring the physics of water mobility and ice nucleation to achieve ideally water-slippy and anti-freezing surfaces.

3. Development of scalable material for manipulating thermal radiation

Thermal radiation control present promising technologies for passive temperature control against solar energy minimizing the electricity consumption. This topic focuses on the scalable materials such as paints and aims to devise an optimal design with the wavelength selectivity using simulation and experimental validation.

Articles Related to Research Topics

- [1] Y. Lee *et al.*, *Scientific Reports* **9**, 7787 (2019).
- [2] Y. Lee *et al.*, *PNAS Nexus* **1**, 2, pgac027 (2022).
- [3] S. Yang *et al.*, *Cell Reports Physical Science* **2**, 100474 (2021).
- [4] K. Lin *et al.*, *Science* **382**, 691-697 (2023).

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