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Aerospace Engineering, IIT Kharagpur

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National Yang Ming Chiao Tung University

Topic: **Applications of Radiative Heat Transfer in Far and Near Fields**

Speaker: **Dr. Jui-Yung Chang, Assistant Professor, Mechanical Engineering, National Yang-Ming Chiao Tung University (NYCU), Taiwan**

Date and Time: **09/12/2022, Friday, 12.00 PM to 1:00 PM (IST)**

Webinar link: **meet.google.com/rtk-pqaa-zah**

Hosts: **Prof. Sunil Manohar Dash, IIT Kharagpur, and Prof. Kim Boon Lua, NYCU Taiwan**

Abstract

Two studies were selected in this webinar, respectively for far and near-field radiative heat transfer. For far-field radiative heat transfer, radiative cooling has become more prevalent in various applications since the heat is dissipated passively with zero energy consumption. Radiative cooling for metallic substrates was developed in this study via the electrophoretic deposition of a chitosan layer. The tailored optical properties, generality to different metals, and the cost-effectiveness of the employed fabrication facility are described. The deposited areas are scalable without requiring high-precision lithography, and the chitosan itself has trivial environmental impacts. For near-field radiative heat transfer, the energy conversion performance of a thermophotovoltaic (TPV) cell made of In0.2Ga0.8Sb is theoretically analyzed with a hyperbolic metamaterial emitter composed of periodic tungsten nanowires embedded in an Al_2O_3 host at nanometer vacuum gaps. Fluctuational electrodynamics integrated with effective medium theory and anisotropic thin-film optics are used to calculate the near-field radiative heat transfer. It is found that the spectral radiative energy is enhanced by the epsilon-near-pole and hyperbolic modes at different polarizations and with which the TPV cell performance can be improved significantly. The fundamental understanding and insights obtained here will facilitate the feasibility of using eco-friendly materials for scalable radiative cooling as well as the design and application of novel materials in enhancing near-field TPV energy conversion.

About the Speaker

Dr. Jui-Yung Chang is an assistant professor of mechanical engineering at NYCU. He studies radiative heat transfer in far and near fields, focusing on energy-harvesting applications such as thermophotovoltaic cells, radiative cooling systems, and wavelength-selective thermal emitters/absorbers. Furthermore, he also works on the electrical and artificial magnetic responses of metamaterials and their effects on radiative heat transfer. Dr. Chang received his Ph.D. in mechanical engineering from Arizona State University in 2017 and his M.S. and B.S. in mechanical and electro-mechanical engineering from Tam Kang University in 2009 and 2005. He received the Outstanding Student Research Award from Arizona State University upon his graduation and was granted by Taiwan NSTC Young Scholar Fellowship in 2020 (The Einstein Program). He authored more than 30 SCI and conference papers and also served as a reviewer for SCI journals such as Renewable & Sustainable Energy Reviews, Solar Energy Materials and Solar Cells, and International Journal of Heat and Mass Transfer.

Admission is free. All are welcome to attend.