SEMINAR

Young Researchers in Mechanical Engineering

World at Small-scale: from Touching Molecules to Nature-inspired Self-assembly of Materials

SPEAKER

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ABSTRACT

Self-assembly is a crucial component in the bottom-up fabrication of hierarchical structures and advanced functional materials. However, its control has been merely achieved via common synthetic chemistry approaches. On the other hand, nature succeeds a mastering control on self-assembly processes via regulating the reaction-diffusion (RD) conditions. In this talk, I will begin with the concept of touching molecules by utilizing nano-hands (*i.e.*, atomic force microscopes) to understand the molecular-level interactions, and subsequently focus on the controlled self-assembly of materials by employing microfluidic tools to mimic the nature's RD controlled processes. Remarkably, microfluidic devices allow an advanced spatiotemporal command of reagents; a feature that can strongly affect the outcome of a reaction. For example, the unique RD conditions present in microfluidic devices can enable to unveil unprecedented pathways during the self-assembly of materials, yielding new materials' properties. Additionally, microfluidic devices can be utilized as effective material processing tools to control 2D/3D shape of functional materials, to pattern their thin films, as well as to achieve regioselective self-assembly for the localization of multiple functionalities on a single surface. This exquisite bottom-up approach can also be gainfully exploited in the field of small-scale robotics, as it facilitates tailoring the shape, size, and functionality of materials by mimicking nature's RD controlled processes.

ABOUT THE SPEAKER

Dr. Semih Sevim was born in İzmir, Turkey (1989). He received both his BSc and MSc degrees in Mechanical Engineering from Boğaziçi University, in 2013 and 2016 respectively. He carried out his undergraduate and graduate research by focusing on the bimolecular applications of micro-electro-mechanical systems (MEMS) and atomic force microscopy (AFM). His studies were supported by the Turkish Educational Foundation (TEV) with an undergraduate scholarship (2009-2013), and by The Scientific and Technological Research Council of Turkey (TUBITAK) with a graduate scholarship (2013-2015). In January 2017, he moved to Switzerland to join Prof. Andrew de Mello's group (Department of Chemistry and Applied Biosciences, ETH-Zürich) as a PhD student. He completed his PhD in 2021 under the direct supervision of Prof. Josep Puigmartí-Luis. His doctoral research mainly focused on the controlled self-assembly of functional materials by employing microfluidic tools. He participated in several national and international projects funded by the Swiss National Science Foundation (SNSF), European Research Council (ERC) and European Commission (EC). As a result of the above-mentioned projects as well as other collaborative research, he contributed to more than 20 journal papers published in high impact journals including Chemical Society Reviews, Nature Communications, Advanced Materials, Advanced Energy Materials, Advanced Science, JACS, etc. and two book chapters. During his doctoral studies, he was awarded twice with a COST Action Trainee Grant in 2017 and 2018 by the European Cooperation in Science and Technology (COST), and he received a Chemistry Travel Award in 2019 from the Swiss Academy of Sciences and the Swiss Chemical Society. In April 2021, he joined Prof. Bradley Nelson group (Multi-Scale Robotics Lab, ETH-Zürich) as a postdoctoral associate. His current research is on the manipulation and investigation of single cells within controllable microfluidic environments, and microfluidic-assisted fabrication and characterization of novel soft robots for biomedical applications.

ZOOM DETAILS

https://zoom.us/j/3559981145?pwd=Z25NWU5ra2FGVEptZ0pSeG5GVkZ3Zz09
Meeting ID: 355 998 1145. **Passcode**: 093565

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JANUARY · 18 · 2023
WEDNESDAY 13:30 (GMT+3)