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INSTITUTO DE FÍSICA APLICADA E ENGENHARIA DE MATERIAIS
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IAPME Seminar

Celebrating the 45th Anniversary of the University of Macau: Engineering Non-Equilibrium Active Biomaterials: From Molecular Actuation to Autonomous Chemical Evolution

10 February 2026

Prof. Yijun ZHENG
ShanghaiTech University

Venue: N23-1004b
Time: 14:30 - 15:30
Hosted by: Prof. Guoxing SUN

Abstract

Life is distinguished by its dynamic, non-equilibrium nature—constantly consuming energy to maintain structure and function. In contrast, most synthetic biomaterials are static and passive, limiting their ability to interact with living systems. This presentation outlines our approach to bridging this gap by engineering "active" biomaterials that mimic the autonomy of life. We focus on two key strategies. First, to simulate the mechanical activity of life, we developed light-responsive polymer actuators. These molecular tools allow us to exert precise forces on cells, enabling the regulation of cell behavior and fate. Second, to mimic the metabolic-like evolution of life, we constructed autonomous chemical reaction networks. These systems can self-regulate and evolve over time, creating dynamic patterns similar to those found in biological tissues. By integrating these physical and chemical approaches, we aim to create a new generation of materials that are not just passive scaffolds, but active participants in biological processes.

Biography

Prof. Yijun ZHENG is a Principal Investigator at the School of Physical Science and Technology, ShanghaiTech University. She obtained her Ph.D. from Peking University in 2011 and completed postdoctoral training in Germany at the Max Planck Institute for Polymer Research and the Leibniz Institute for New Materials. Since 2019, Prof. Zheng has led a research group focusing on dynamic biomaterials. She is a recipient of several awards, including the Shanghai Eastern Scholar and Pujiang Talent titles. She has published over 60 papers in leading journals such as Nature Communications, Angewandte Chemie, Advanced Materials et.al and currently directs General Programs funded by the NSFC and the Shanghai Natural Science Foundation.

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