

November 16, 2023

Soft Materials Mechanics for Health and Sustainability



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ABSTRACT:

Polymers and water are the major components that constitute most living species on the earth, ranging from animals, plants, and fungi to bacteria. Polymers are also pervasive and indispensable in almost every aspect of our daily life, ranging from food, clothing, housing, and healthcare to transportation, communication, and entertainment. Furthermore, over 6% of global electricity generated from coal is used to make plastics, and microplastics are already ubiquitous in global biosphere. Intrigued by the irubiquity and impacts, MIT Zhao Lab is focused on the study and development of soft materials and systems mainly constituted of polymers and water. In this talk, I will first discuss a general strategy to design new soft materials that possess extreme physical, chemical, and biological properties—via bioinspired and rational design of unconventional polymer networks. Then I will illustrate the impacts of soft materials mechanics on health and sustainability with examples including soft robots that treat strokes under remote control and wearable devices that image deep organs over days . I will propose two challenges in fundamental science and technology: 🕒 Can we image the full human body over days to months continuously? 🕒 Can we edit the full human body with micro-robots minimally invasively? I will conclude the talk with a vision for the future development and impacts of soft materials and systems—aided by and synergized with modern technologies such as artificial intelligence , synthetic biology , and precision medicine .

BIOGRAPHY:

Xuanhe Zhao is a Professor of Mechanical Engineering at MIT. The mission of Zhao Lab is to advance science and technology between humans and machines for addressing grand societal challenges in health and sustainability. A major focus is the study and development of soft materials and systems. Dr. Zhao won early career awards from NSF, ONR, ASME, SES, AVS, Adhesion Society, JAM, EML, and Materials Today; he is a Clarivate Highly Cited Researcher. Bioadhesive ultrasound based on Zhao Lab's work published in Science won 2022 TIME Magine Best Inventions of the year; SanaHeal Inc based on Zhao Lab's work published in Nature won 2023 Nature Spinoff Prize. Over ten patents from Zhao Lab have been licensed by companies and contributed to FDA-approved and widely-used medical devices.