



Constitutive Modeling of Rubbery Networks: from microscale physics to macroscopic behavior

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Abstract:

Rubbery polymer networks, including elastomers and hydrogels, are increasingly employed in advanced applications such as biomedical implants, drug delivery systems, and smart sensors and actuators. Their macroscopic mechanical properties, such as stiffness, strength, and stretchability, are largely governed by network-level features, including polymer chain length distribution, crosslink density, and network heterogeneities and topological defects. Consequently, recent material design strategies have focused on tailoring network architecture to achieve enhanced mechanical performance. Despite these efforts, predictive tools that directly connect molecular- and network-scale parameters to macroscopic mechanical response remain scarce. In this talk, I will present our recent progress toward a predictive multiscale modeling framework for soft rubbery networks that incorporates microscale physics at the single-chain and network levels.

Bio:

Laurence Brassart is an Associate Professor in the Solid Mechanics and Materials Group of the Department of Engineering Science at the University of Oxford. She received her PhD in Engineering Sciences from the University of Louvain in 2011. She then successively held postdoctoral positions at Harvard University and the University of Louvain. From 2015 to 2019, she was a Senior Lecturer in the Department of Materials Science and Engineering at Monash University, Australia. She is the recipient of an EPSRC New Investigator Award (2021) and a UKRI Future Leaders Fellowship (2022). Laurence's research focuses on the development of micromechanical and constitutive modeling approaches for engineering materials, including polymers, composites, soft materials, and energy materials, with emphasis on multiscale and multiphysics aspects.



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