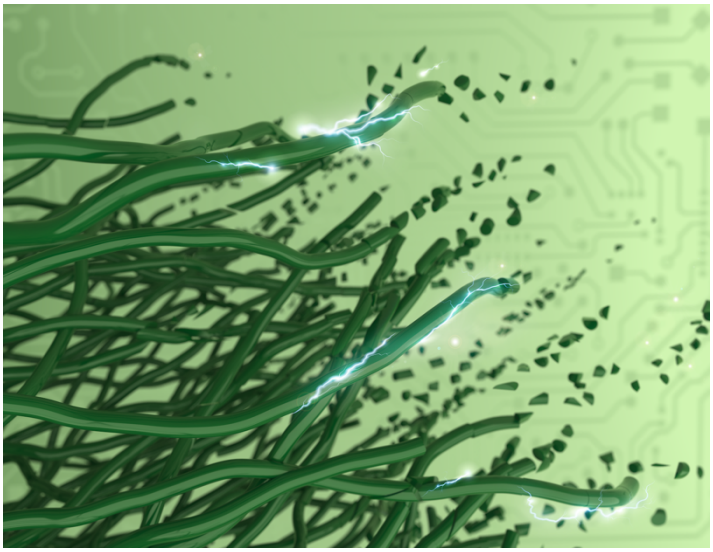
"The New Coffee Break" Rowland Seminar Series

Stretchable and fully degradable semiconductors for transient electronics

Dr. Helen Tran, Stanford University | June 24th, 11 am EST via Zoom



Electronics that can be stretched like human skin and feature skin-inspired functionalities are opening doors for remarkable opportunities in health and environmental monitoring, next-generation consumer products, and sustainability. Notably, degradability is an attractive attribute for applications on dynamic surfaces where manual recovery would be prohibitively difficult and expensive. For example, fully biodegradable electronics promise to accelerate the integration of electronics with health by obviating the need for costly device recovery surgeries that also significantly increase infection risk. Moreover, the environmentally critical problem of discarded electronic waste would be relieved. A key component of such electronics is the development of a stretchable and degradable transistor with electrical performance independent of large mechanical stress. While numerous biodegradable insulators have been demonstrated as suitable device substrates and dielectrics for stretchable electronics, imparting biodegradability to electronically conducting and semiconducting materials for stretchable electronics presents a particular challenge due to the inherent resistance of most conductive chemistries to hydrolytic cleavage. Herein, we decouple the design of stretchability and transience by harmonizing polymer physics principles and molecular design in order to demonstrate for the first time a material that simultaneously possesses three disparate attributes: semiconductivity, intrinsic stretchability, and full degradability. We show that we can design acid-labile semiconducting polymers to appropriately phase segregate within a biodegradable elastomer, yielding semiconducting nanofibers which concurrently enable controlled transience and strain-independent transistor mobilities. This fully degradable semiconductor represents a promising advance towards developing multifunctional materials for skin-inspired electronic devices that can address previously inaccessible challenges and in turn create new technologies.

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Helen Tran, Ph.D., works at the intersection of chemistry, bioelectronics, and engineering. Her core expertise lies in functional polymer synthesis, and she has collaborated with tissue engineers, solid state physicists, chemical biologists, and electrical engineers. She is an Intelligence Community Postdoctoral Fellow working at Stanford University. She earned her doctorate in chemistry from Columbia University, and her bachelor's degree in chemistry from the University of California, Berkeley. She also was a post-baccalaureate fellow at the Lawrence Berkeley National Labs. Helen will starting as an Assistant Professor at the University of Toronto in January 2021 in the Department of Chemistry, cross-appointed in the Department of Chemical Engineering and Applied Science. She enjoys graphic design, interactive theater, hiking, biking, and cross-country skiing.

Zoom Information

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