



Sustainable Materials and Design Approaches for Soft Electronics and Robotics

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Speaker:
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Abstract

Modern societies rely on a wide range of electronic and robotic systems, with emerging stretchable and soft form factors enabling an ever more intimate integration of the digital and biological spheres. These advances however often take their toll on our ecosystem, with high demands on energy, contributions to greenhouse gas emissions and severe environmental pollution. Mitigating these adverse effects is amongst the grand challenges of our society and at the forefront of materials research. The currently emerging forms of soft, biologically inspired electronics and robotics have the unique potential of becoming not only like their natural antitypes in performance and capabilities, but also in terms of their ecological footprint. This talk introduces materials and methods or soft systems that facilitate a broad range of applications, from sustainably powered, transient electronic skins to metabolizable soft robots. Based on highly stretchable biogels and degradable elastomers, our forms of soft electronics and robots are designed for prolonged operation in ambient conditions without fatigue, but fully degrade after use through biological triggers. Electronic skins provide sensory feedback such as pressure maps, strain, temperature and humidity sensing. Recent advances in 3D printing of biodegradable hydrogels enables omnidirectional soft robots with multifaceted optical sensing abilities. wearable sweat sensors.

Tackling the challenge of autonomous operation, soft, stretchable and biodegradable batteries are introduced that power Pushing the boundaries further, design concepts that exploit mechanical instabilities for fast actuation in soft robotics systems to environmentally friendly cooling systems based on the giant elastocaloric crystallization effect are demonstrated.

Bio

Martin Kaltenbrunner is a full professor at the Johannes Kepler University, heading the Soft Matter Physics Division and the LIT Soft Materials Lab. He received his master's and PhD degrees in physics from the Johannes Kepler University in 2008 and 2012, respectively. He then joined the Someya-Sekitani Lab for Organic Electronics at The University of Tokyo as postdoctoral researcher prior to his present position. Kaltenbrunner's research interests include soft electronics and machines, sustainable and biodegradable soft materials, organic and hybrid organic-inorganic semiconductors, photovoltaics, lightning and thin film transistors, soft transducers and robotics, flexible and stretchable electronics, and electronic skin.

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