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Abstract

Bioderived and Degradable Materials with Extreme Mechanics for Soft Sensors and Actuators †

Martin Kaltenbrunner [1,2]

[1] Soft Matter Physics, Institute of Experimental Physics, Johannes Kepler University, A-4040 Linz, Austria; martin.kaltenbrunner@jku.at

[2] LIT Soft Materials Lab, Johannes Kepler University, A-4040 Linz, Austria

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Abstract: Nature inspires a large set of bio-mimetic systems ranging from soft robotic actuators to perceptive electronic skins that enhance and support our life. The growing demand on assistive, medical and bioelectronic technologies however raises concerns on the ecological footprint of these emerging platforms, as they are often designed for a defined, limited operational lifetime. Introducing a key feature essential to nature - biodegradability - will enable soft electronic and robotic devices that reduce (electronic) waste and are paramount for a sustainable future. We here introduce materials and methods such as tough yet biodegradable materials for soft systems that facilitate a broad range of applications, from transient wearable electronics to metabolizable soft robots. These embodiments are highly stretchable, are able to heal and are resistant to dehydration. Our forms of soft electronics and robots are built from resilient bio-gels with tunable, extreme mechanical properties that uniquely combine performance and durability with degradability. They are engineered for long-term operation in ambient conditions without fatigue, but fully degrade after use through biological triggers. Electronic skins that measure pressure, strain, temperature and humidity serve as human-friendly on-skin interfaces or equip robotic systems with sensory feedback. Such advances in the synthesis of biodegradable, mechanically tough and stable gels that do not compromise in performance when compared to their non-degradable counterparts may bring bionic soft systems a step closer to nature and enable human-friendly technologies with reduced ecological footprint.

Keywords: soft sensors, soft electronics, sustainable materials, extreme mechanics, soft robotics