PURDUE INNOVATES | Office of Technology Commercialization

Wearable High-κ Polymers with Core–Shell Liquid Metal for Energy Harvesting and Self-Powered Interfaces

A highly deformable polymer incorporating core-shell liquid metal inclusions significantly boosts energy harvesting efficiency for self-powered wearable electronics and user interfaces.

Deformable energy devices capable of efficiently scavenging mechanical signals enable the promise of self-powered micro-/nano-systems. An assortment of technologies has been developed to transform the otherwise wasted ambient mechanical energy into electrical power through mechanisms such as electrostatic, piezoelectric, and recently, triboelectric processes. Triboelectric nanogenerators (TENG) could efficiently harvest mechanical energy for power electronics and sensors. The secondary-phase additive materials used for dielectric engineering in TENGS are exclusively solid type with limited deformability. The rigid nature of these materials result in issues such as undesirable stress concentrations and layer delamination, leading to deteriorated bulk deformability and long-term durability.

Researchers at Purdue University have developed a wearable high-dielectric-constant polymer with core-shell liquid metal inclusions for biomechanical energy harvesting and self-powered user interface. The liquid-metal-inclusion based TENG (LMI-TENG) consists of a layer of liquid metal embedded functional silicone sandwiched between two Ecoflex layers. Compared to LMI-TENG devices with 0 wt% liquid metal particles (LMP), the output performance of LMI-TENG with 50 wt% LMP is boosted with an enhancement of 300%. Experimentation has demonstrated potential application in human-integrated technology. LMI-TENG enables the high performance of TENGs with more desirable deformability.

Advantages:

-Increased deformability

Technology ID

2019-WU-68431

Category

Energy & Power Systems/Energy Storage

Materials Science & Nanotechnology/Nanomaterials & Nanostructures

Authors

Shengjie Gao

Wenzhuo Wu

Further information

Aaron Taggart

adtaggart@prf.org

View online

-Good sensitivity in low pressure region

Potential Applications:

-Wearable electronics

TRL: 3

Intellectual Property:

Provisional-Patent, 2018-11-26, United States | Utility Patent, 2019-10-07, United States

Keywords: liquid metal inclusion TENG, LMI-TENG, biomechanical energy harvesting, self-powered user interface, wearable high-dielectric-constant polymer, core-shell liquid metal, triboelectric nanogenerator, TENG, wearable electronics, deformable energy devices