Wearable High-Dielectric-Constant Polymers with Core-shell Liquid Metal Inclusions for Biomechanical Energy Harvesting and Self-powered User Interface

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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
- Good sensitivity in low pressure region
Potential Applications:
- Wearable electronics

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