Self-powered skin-mountable soft electronics

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Printing technologies have garnered significant attention for the development of customized soft electronics due to their advantages, including non-vacuum, low-temperature, and non-contact processing. In this presentation, I will discuss our recent work on printing solid-state elastic conductors into self-supporting three-dimensional (3D) geometries, which enhance the design versatility of soft electronics, enabling the creation of complex, multifunctional, and customized human-machine interfaces. Our omnidirectional printing strategies result in superior viscoelastic properties that ensure the structural integrity of printed features, while their pseudoplastic and lubrication behaviors simultaneously enable high printing stability. Freestanding, filamentary, and out-of-plane 3D geometries of intrinsically stretchable conductors are directly written, achieving a minimum feature size of <80 μm and excellent stretchability of >150%. To demonstrate the feasibility of our approach, we present skin-mountable electronics that visualize temperature on a matrix-type stretchable display using omnidirectionally printed elastic interconnects. Additionally, I will introduce our recent efforts to develop high-performance soft thermoelectric generators (TEGs), which enhance energy conversion efficiency while conforming to the 3D surfaces of heat sources. The softening of TEGs allows for conformal contact with arbitrarily shaped heat sources, particularly on the human body, offering the potential to create self-powered, skin-mountable applications.