Electro-mechano responsive elastomers for pressure and strain sensing

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Stretchable conductive composites (SCCs) have been widely used as interconnects and sensors in wearable devices and stretchable electronics due to their tunable electromechanical properties and intrinsically high stretchability compared to solid metals. Under mechanical deformation, the conductive filler network in the matrix shifts to change the conductive pathway among particles, thus changing the electrical conductivity of the composite. Most conventional SCCs exhibit a negative piezoconductive effect, i.e. the conductivity decreases under tensile strain. Recently, we pioneered a family of unconventional SCCs showing a positive piezoconductive effect, where their conductivity can drastically increase upon stretching.[1] Harnessing this unique property, we further developed various electro-mechano responsive fusible alloy SCCs (FASCCs) exhibiting variable and tunable piezoconductivity, strain sensitivity, anisotropy, and even stiffness.[2-5] These FASCCs have enabled applications in pressure, strain, and tactile sensing, as well as in robotics and reusable electronics. This presentation will outline our latest advancements in the fundamental research of FASCCs and their innovative application development. We envisage that the extraordinary properties of FASCCs will bring substantial advancements in wearable sensors, resilient robotic systems, intelligent instruments, and flexible electronics.

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