Nanotechtonic Strategies for Deformable Electronic and Energy Devices

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Abstract

The emergence of deformable devices is driven by the need of free-form factor for conformable, flexible, stretcable and wearable applications. We employed nanotechtonic inspired strategies to fabricate flexible and stretchable materials and devices by exploiting active responsive coatings and structural modifications. In this talk, I will discuss our recent progress in creating deformable, shapeable, flexible and stretchable wearable electronics and energy devices. Mesh-like metal nanowires on nanocellulose driven by controlled maragoni effects were used to prepare flexible transparent conductors.[1, 2] Chemically modified nanocellulose particles can be prepared and assembled onto textile fibers to convert mechanical energy into electrical power output. The wearable energy scavenger improves water repellency and enhances the efficiency of water flow energy harvesting based on triboelectricity.[3] To realize highly stretchable and transparent energy harvesters, hydrogel ionic conductor can be used as the current collector, allowing them to be mounted onto skin or machine.[4] The use of charge trapping layer serves to enhance the power output for the stretchable and wearable energy harvesters.[5]
On the other hand, we have shown that incorporation of liquid metal particles was effective in bridging the metallic fillers in the elastomeric stretchable conductors, enhancing the stretchability to 1000% strain with mild resistance changes.[6] We extend this strategy into building electrochemical stable stretchable current collector for battery and realized a stretchable full cell battery with ionic liquid electrolyte.[7] Additional nanotechtonic strategies will be illustrated for actuators and sensing applications.

References

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