Electrical Conductive Materials templated from elastic rubber paltforms

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Abstract

A highly stretchable and conductive three-dimensional (3D) micro-wrinkled reduced graphene oxide (MWrGO) film was fabricated using a novel thermo-mechanical shrinking method from elastic rubber materials. This 3D rGO architecture not only increases the specific area for more electrons to pass through but also bestows stretchability to the conductive pathway. The structural change of micro-wrinkles during the deformation had been monitored by an in-situ straining microscopy. The electrical conductivity of the samples remained fairly stable and stayed above 25 S/cm under low deformation (no more than 30 % strain) for up to 500 mechanical stretching-release cycles. The isotropic MWrGO/PDMS composite can be stretched bi-axially. This MWrGO based stretchable composite with stable electrical properties and long life span could form a new platform for stretchable electronics.

The thickness of wrinkled GO films can be precisely controlled ranging from 0.7 to 1.7 μm to provide tailored conductivity. When the wrinkles are well formed, the MWrGO/PDMS composites can maintain the stable electrical conductivity up to 1000 stretching-release cycles under 10 % strain, providing an ideal MWrGO structure as the component of stretchable conductors. The micro-wrinkled reduced graphene oxide (MWrGO) films are superhydrophobic and superoleophilic due to their unique structure. The oil absorption performance of GO films was examined on three oils with distinguishing viscosity. While the water contact angle of MWrGO surface is all over 150°, the oil can easily spread on the surface of MWrGO.

Therefore, this novel micro-wrinkled graphene material templated from rubber platforms has presented great potential to be applied in various industries.