Supporting Information

Aligned Flexible Conductive Fibrous Networks for Highly Sensitive, Ultrastretchable and Wearable Strain Sensors

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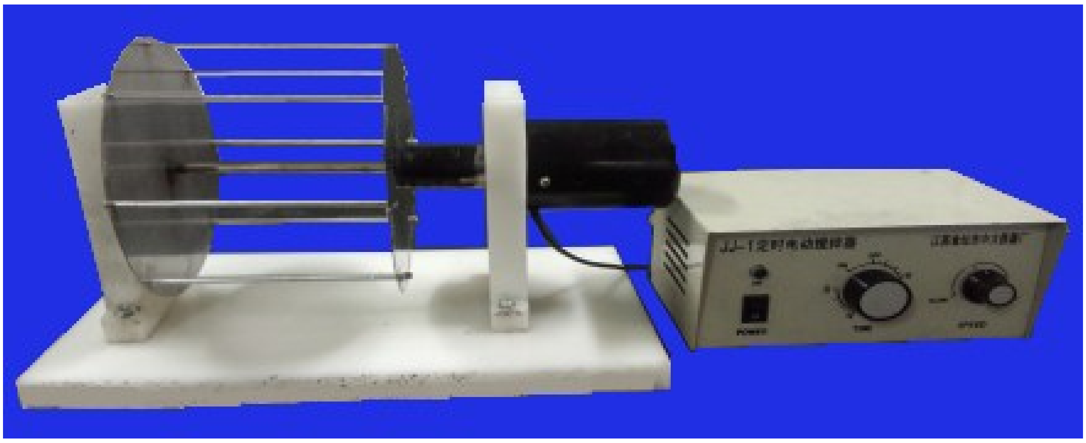

Fig. S1 Electrostatic spinning collector.

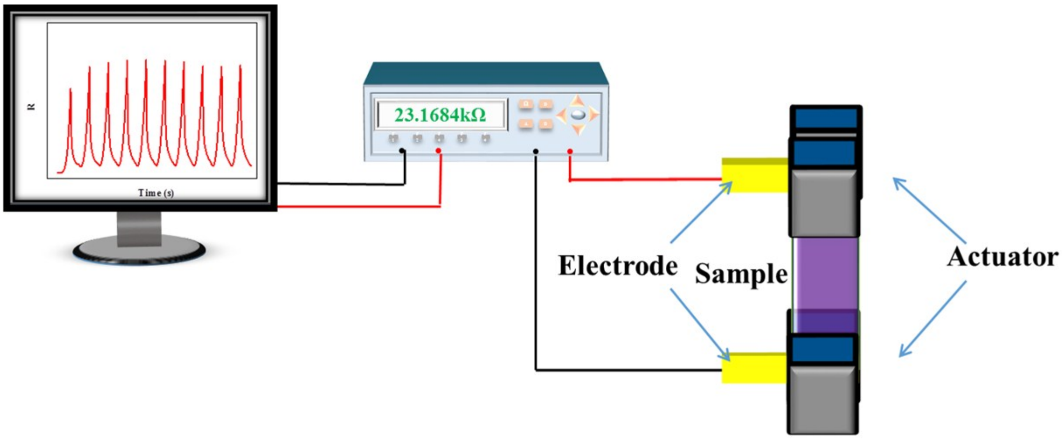

Fig. S2 Experimental setup for the strain sensing tests.

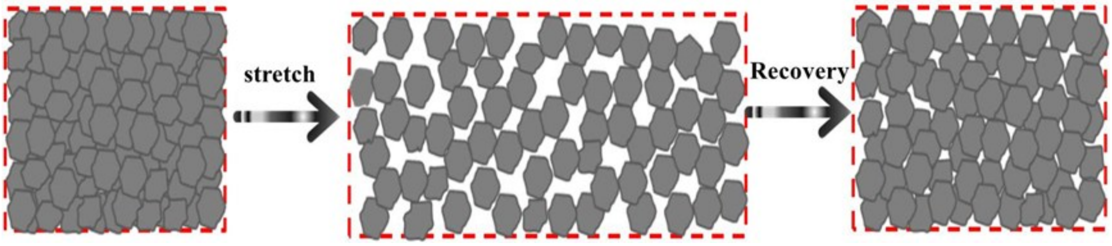

Fig. S3 Schematic illustration of the sensing mechanism for conductive RGO networks on the surface of TPU fibers.

For the conductive fibrous networks, RGO possessing ultrathin structure and excellent electrical characteristic was tightly assembled on the TPU fibers' surface, forming the conductive pathways. These structural features closely resemble those of fish scale shape. The construction of fibrous networks provided carriers for RGO, and supplied the construction of conductive paths with macro pathways. When the strain sensor was subjected to a tensile strain, the overlapping area between RGO nanosheets decreased, leading to the destruction of conductive pathways and the increase in resistance. After unloading the tensile strain, the contact between RGO could be recovered, enabling the repeatability of this process. This mechanism has also been reported in previous literatures.[1-4]

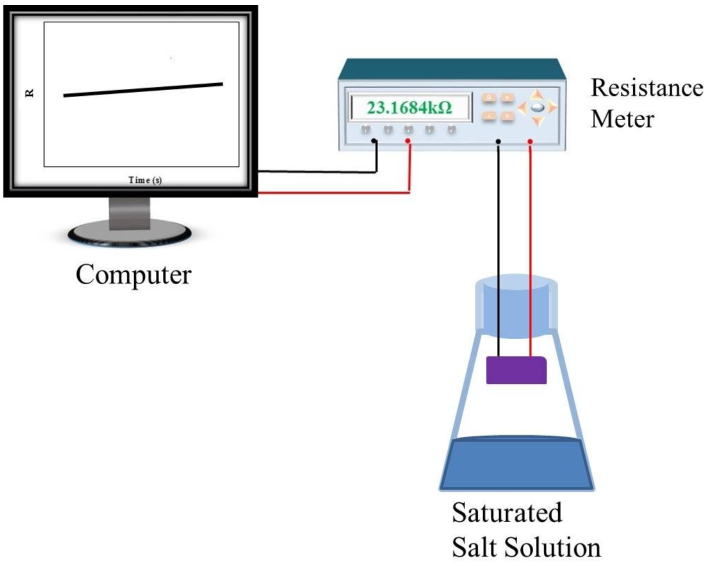

Fig. S4 Experimental setup for the humidity sensing tests.

A schematic diagram of the experimental setup for exposure of relative humidity (RH) is shown in Fig. S4. Humidity sensitive properties of the sensors were investigated by recording their electrical response towards different RH. The experiment was conducted at an external temperature of 25 ^{o}C. The different humidities were supplied by various saturated salt solutions in their equilibrium states (LiCl for 11% RH, CH_3COOK for 23% RH, K_2CO_3 for 43% RH, $Mg(NO_3)_2$ for 52% RH, $CuCl_2$ for 67% RH, NaCl for 75% RH and KCl for 86% RH.) During humidity sensing test, the resistance was recorded online by monitoring the electrical signal response of the composite in the humidity sources supplied by saturated salt solutions based on their equilibrium states.[5,6] The humidity sensitivity of the composites is evaluated by the normalized change of resistance ($\Delta R/R_0$, R_0 is the original resistance of the sample, ΔR is the resistance change towards R_0).

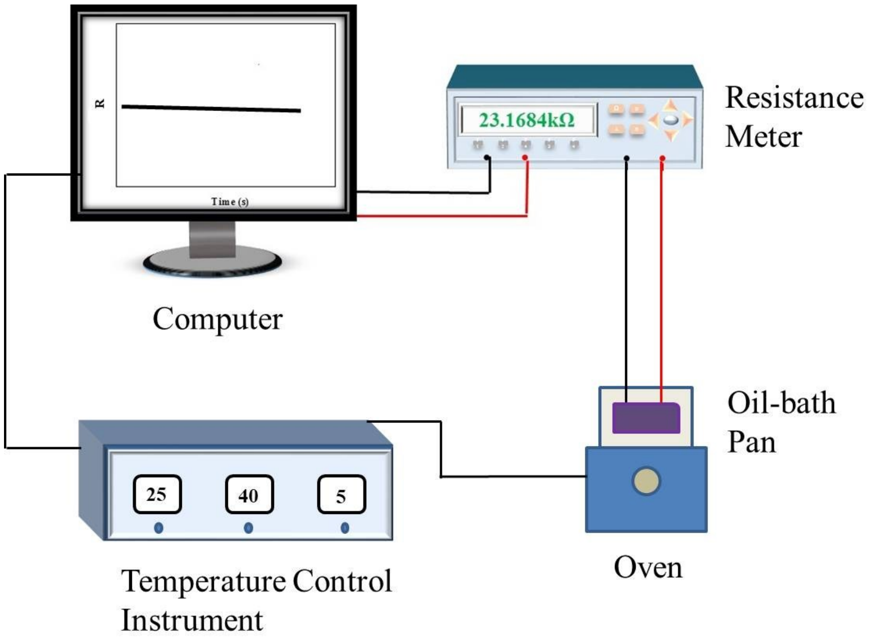

Fig. S5 Experimental setup for the temperature sensing tests.

A schematic diagram of the experimental setup for temperature sensing is shown in Fig. S5. The composite was immersed in a silicone oil bath of a temperature-controlled device to avoid external disturbance. Then the composite was heated from 10 ^{o}C to 40 ^{o}C at a rate of 2 ^{o}C/min. During temperature sensing test, the digital resistance meter and the temperature-controlled device were coupled with a computer to record the temperature sensing behaviors online.[6-9] The temperature sensitivity of the composites is evaluated by the normalized change of electrical resistance ($\Delta R/R_0$, R_0 is the original resistance of the sample, ΔR is the resistance change towards R_0).

References

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