Supporting Information

Flexible TPU Strain Sensors with Tunable Sensitivity and Stretchability via Coupling AgNWs with rGO

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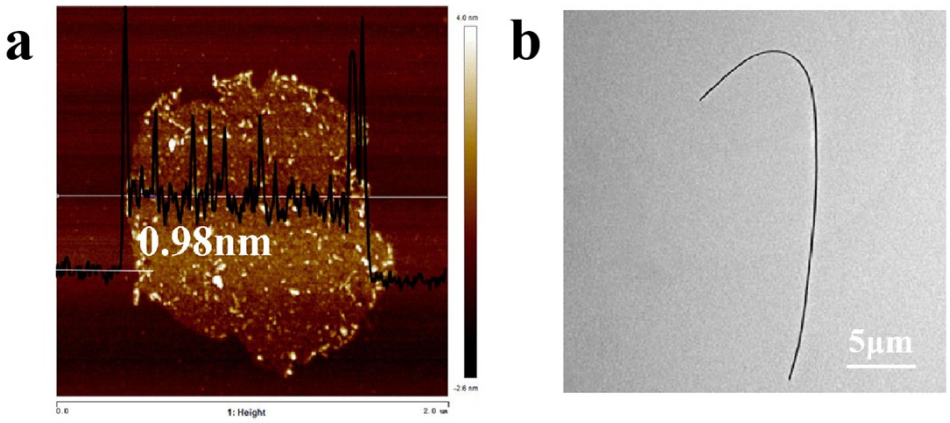

Figure S1 (a) AFM image of a GO sheet. (b) TEM image of a single Ag NW.

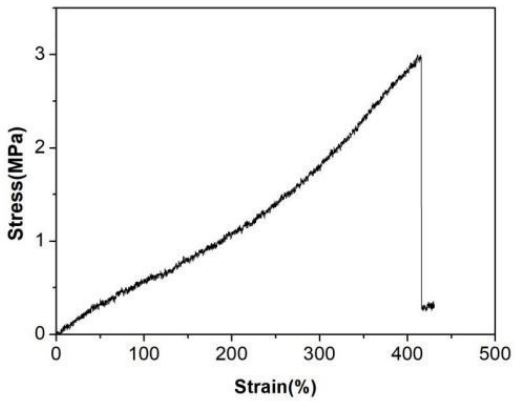

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Figure S2 Stress-strain curve of the pure TPU membrane.

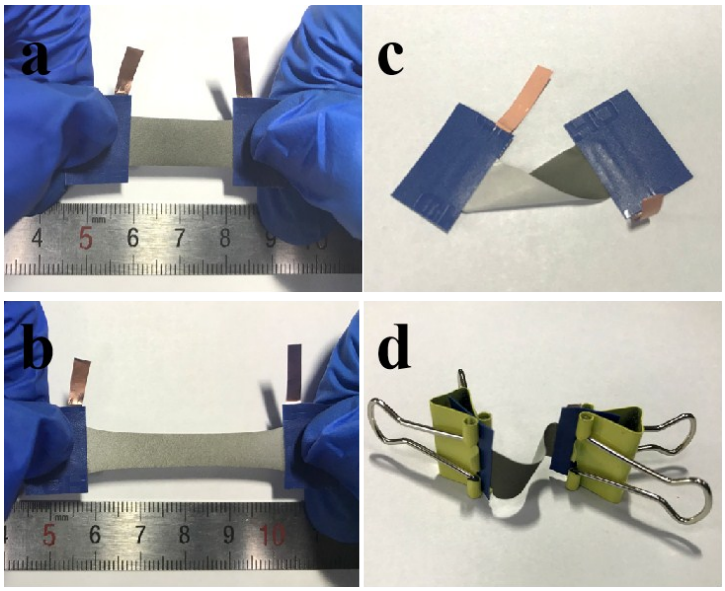

Figure S3 Photographs of the rGO/AgNWs/TPU strain sensor which is (a, b) stretched, (c) twisted and (d) bent.

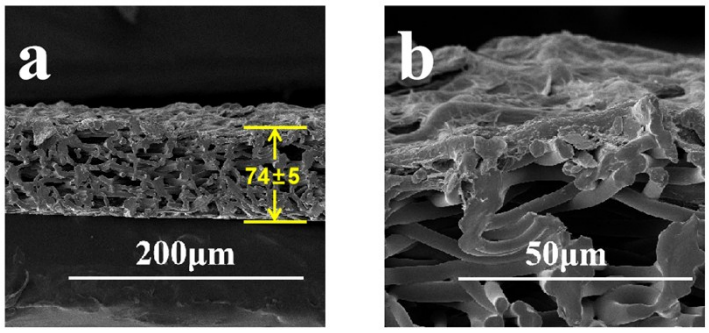

Figure S4 Morphology of cross section of rGO/AgNWs/TPU strain sensor at diverse magnifications.

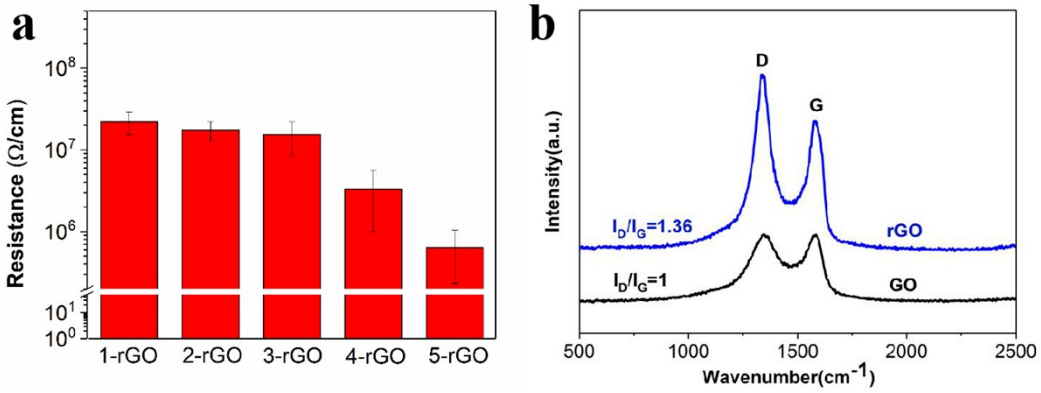

Figure S5 (a)Initial resistance of rGO/TPU strain sensors. (b) Raman spectra of GO and rGO.

Raman spectra are employed to evaluate the reduction of GO. During the process of oxidating graphene, the defects of the crystalline structure of graphene increase and thus lower the conductivity, evidenced by the I_D/I_G ration (~ 1). The enhanced I_D/I_G ration (~1.36) of rGO indicates that GO is reduced by sodium ascorbate solution, which means the improved conductivity owing to the repaired defects.

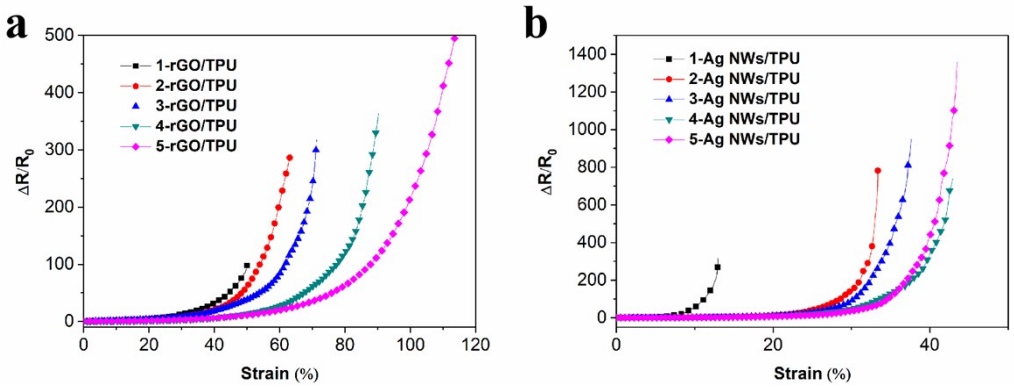

Figure S6 The relative resistance-strain curve of (a) X-rGO/TPU and (b) Y-AgNWs/TPU.

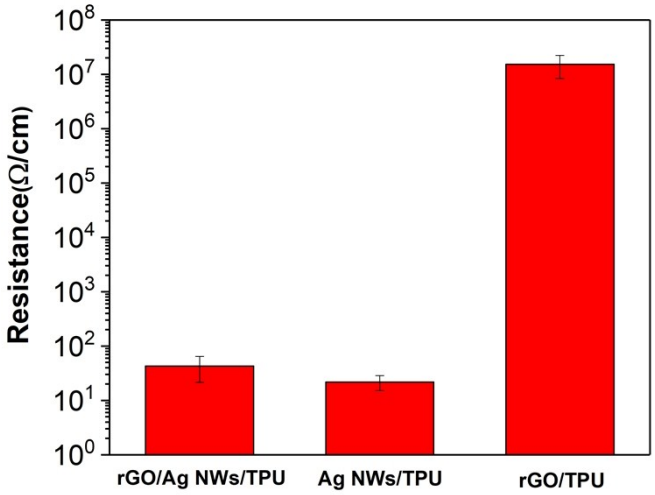

Figure S7 Initial resistance of 3-rGO/3-AgNWs/TPU, 3-AgNWs/TPU and 3-rGO/TPU strain sensors.

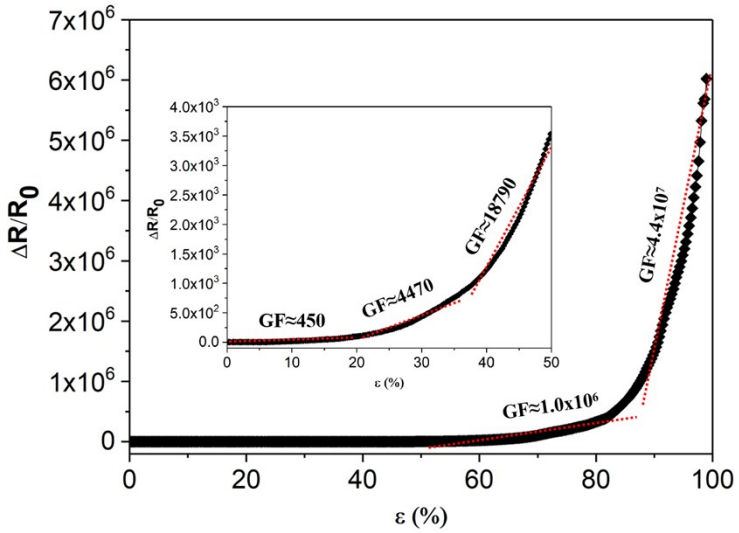

Figure S8 Typical relative resistance change ($\Delta R/R_0$)-strain curve of 1-rGO/5-AgNWs/TPU strain sensor.

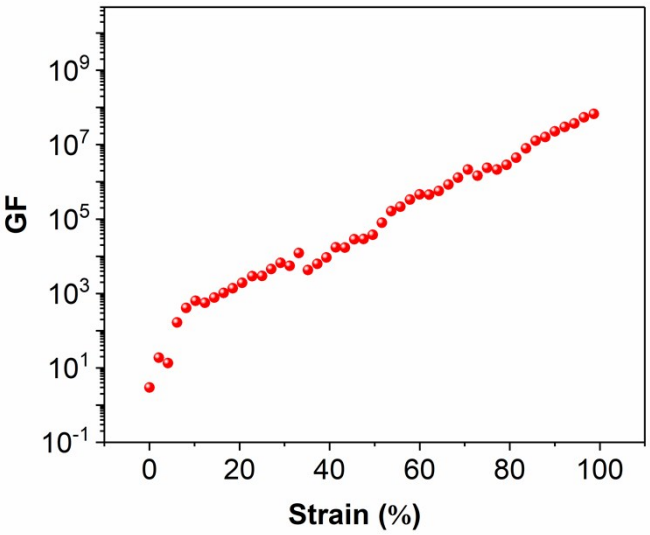

Figure S9 GF of the 1-rGO/5-AgNWs/TPU strain sensor versus strain.

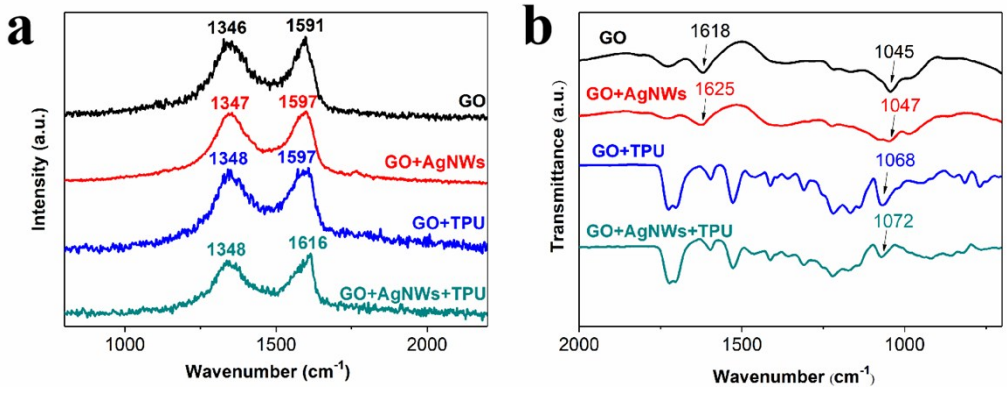

Figure S10 (a) Raman spectra and (b) FTIR spectra of GO, GO/AgNWs, GO/TPU and GO/AgNWs/TPU composites.

Raman spectra and FTIR spectra of GO, GO/AgNWs, GO/TPU and GO/AgNWs/TPU composites reveal the interaction between GO and AgNWs or GO and TPU. Raman spectra of GO/AgNWs, GO/TPU and GO/AgNWs/TPU composites exhibit blue shift of G band compared with that of GO, which confirms the hydrogen bonding influences the G band of GO. The peaks of GO/AgNWs, GO/TPU and GO/AgNWs/TPU composites in FTIR spectra also show shift, which demonstrates the C=C and C-O on GO sheets are affected by the hydrogen bonding.[1, 2]

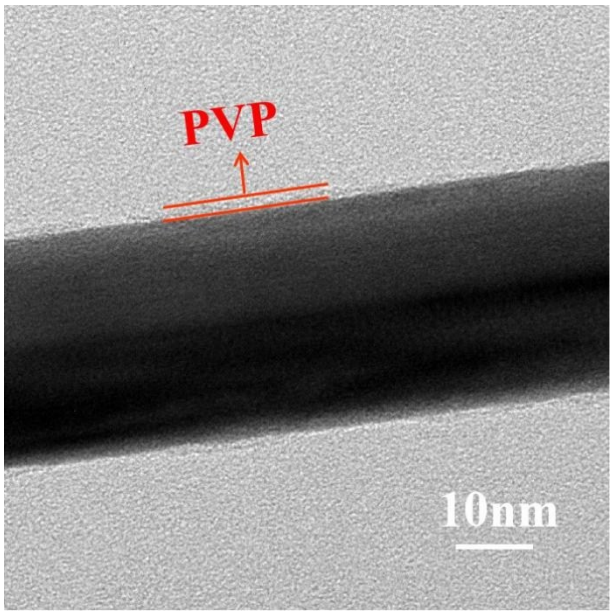

Figure S11 TEM image of AgNWs showing a thin PVP layer on the surface.

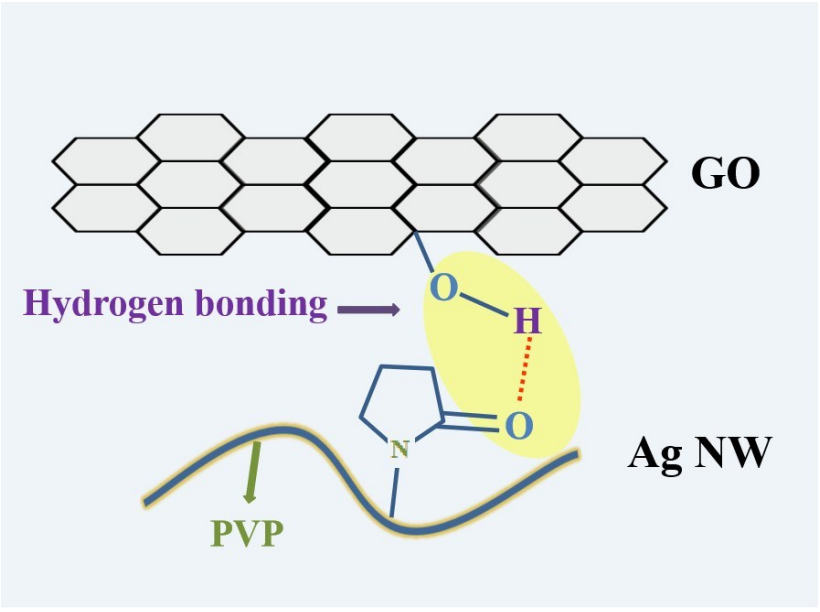

Figure S12 Illustration of the hydrogen bonding between AgNWs and GO.

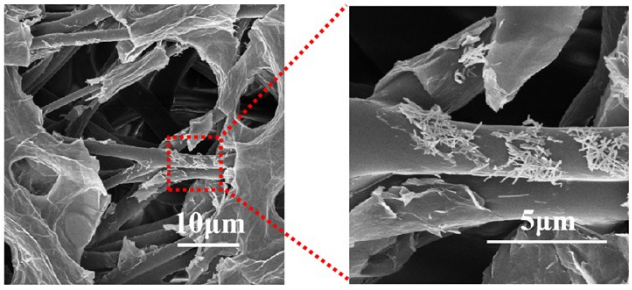

Figure S13 SEM images of rGO/AgNWs/TPU strain sensors in stage Ⅲ at different magnification.

Table S1 Parameters obtained from nonlinear fitting for the strain sensor 1-rGO/5-AgNWs/TPU.

ε	α	β	γ	λ
0-50%	32.0382	-59.3581	60.2606	-14.7234
50%-90%	-25.2291	179.6806	-254.3429	116.1028
90%-100%	-1143.2172	3700.4291	-3973.6655	1395.6578

Table S2 Parameters obtained from nonlinear fitting for the strain sensor 1-rGO/TPU

ε	α	β	γ	λ
0-50%	7.8232	2.5365	-15.4159	24.3160

Table S3 Parameters obtained from nonlinear fitting for the strain sensor 5-AgNWs/TPU

ε	α	β	γ	λ
0-43%	-2.9846	83.5578	-180.5360	199.8871

References

1. S. Liu, M. Tian, B. Yan, Y. Yao, L. Zhang, T. Nishi and N. Ning, *Polymer*, 2014, **56**, 375-384.
2. A. Li, C. Zhang and Y.F. Zhang, *Compos. Pt. A-Appl. Sci. Manuf.*, 2017, **101**, 108-114.