# Supporting Information

# Stretchable and Healable Conductive Elastomer Based on PEDOT:PSS/Natural Rubber for Self-powered Temperature and Strain Sensing

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**Supporting information-1. Preparation process of PEDOT:PSS-NR film**

**Prepare dispersion solution of each component of vulcanizing agent.**

Take the preparation of 50% sulfur dispersion as an example. Weigh 10 g sulfur powder, 10% casein 4 ml, 11.5% $HN_3 \cdot H_2O$ 1 ml, ionized water 6 ml, and ball grinding beads with bulk volume of 50 ml in 150 ml ball milling for 8 h at rotate speed of 500 r/min, and 50% sulfur dispersion was prepared. Meanwhile, 50% zinc oxide dispersion and 50% zinc diethyldithiocarbamate dispersion were prepared.

**Pre-vulcanized of natural rubber latex compound formulation**

| Ingredients | Parts by weight (wet) |
|---|---|
| Natural rubber latex (54%) | 190 |
| Sulfur dispersion (50%) | 3.0 |
| Zinc oxide (50%) | 0.4 |
| Zinc diethyldithiocarbamate dispersion (50%) | 2.0 |
| Potassium hydroxide solution (10%) | 2.5 |
| Potassium laurate solution (20%) | 1.3 |

Table 1. Formulation of latex compounds.

**Supporting information-2. Photographic image of solution blending and PEDOT:PSS-NR composite film**

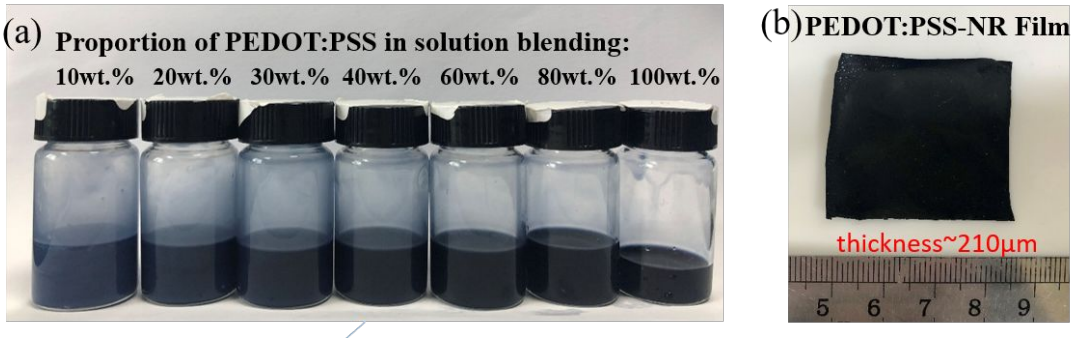


Fig. S1. Photographic image of (a) solution blending containing various proportion of PEDOT:PSS, and (b)PEDOT:PSS-NR composite film

**Supporting information-3. Result of characterization**

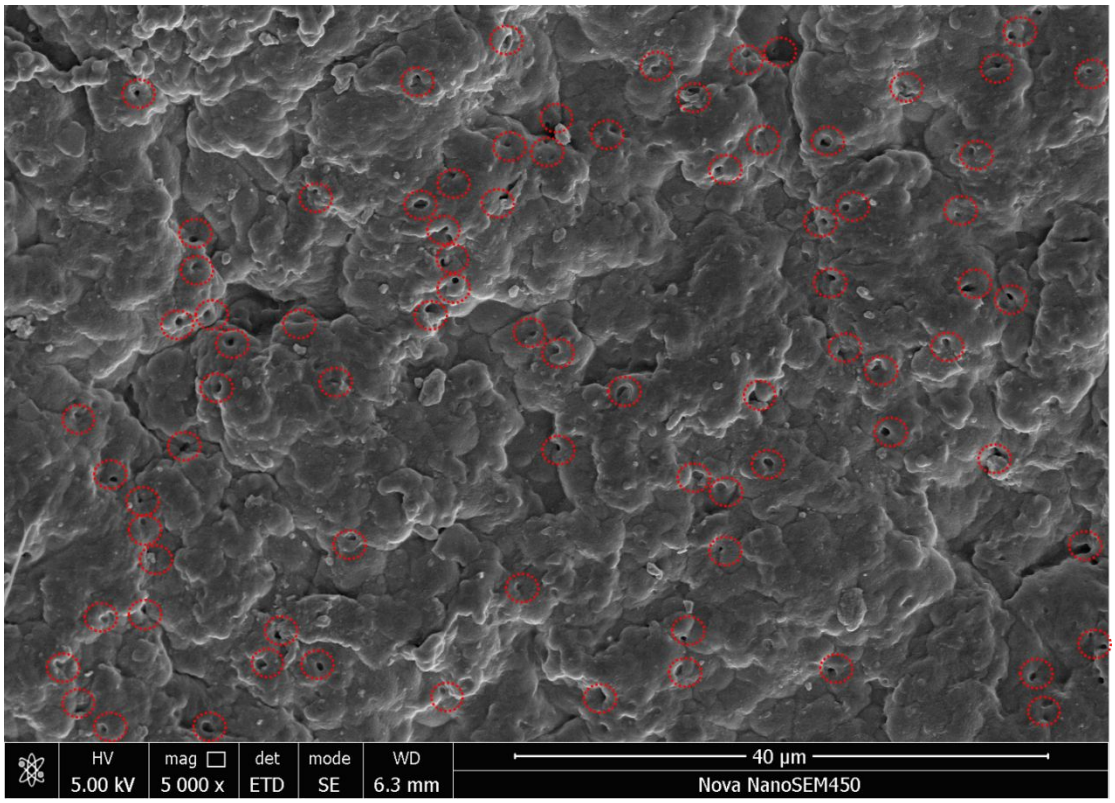


Fig.S2. SEM images of the surface EG post treatment 10wt.%PEDOT:PSS-NR film.(The red circle is the location of voids after post treatment )

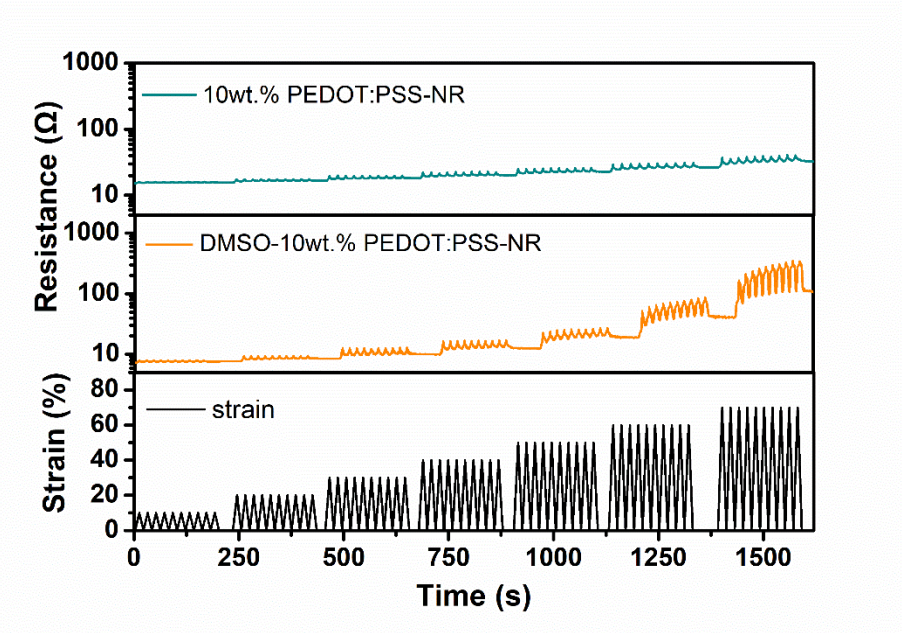


Fig.S3. Resistance response of 10%PEDOT:PSS-NR and DMSO-10%PEDOT:PSS-NR samples to cyclic stretching under different strains.

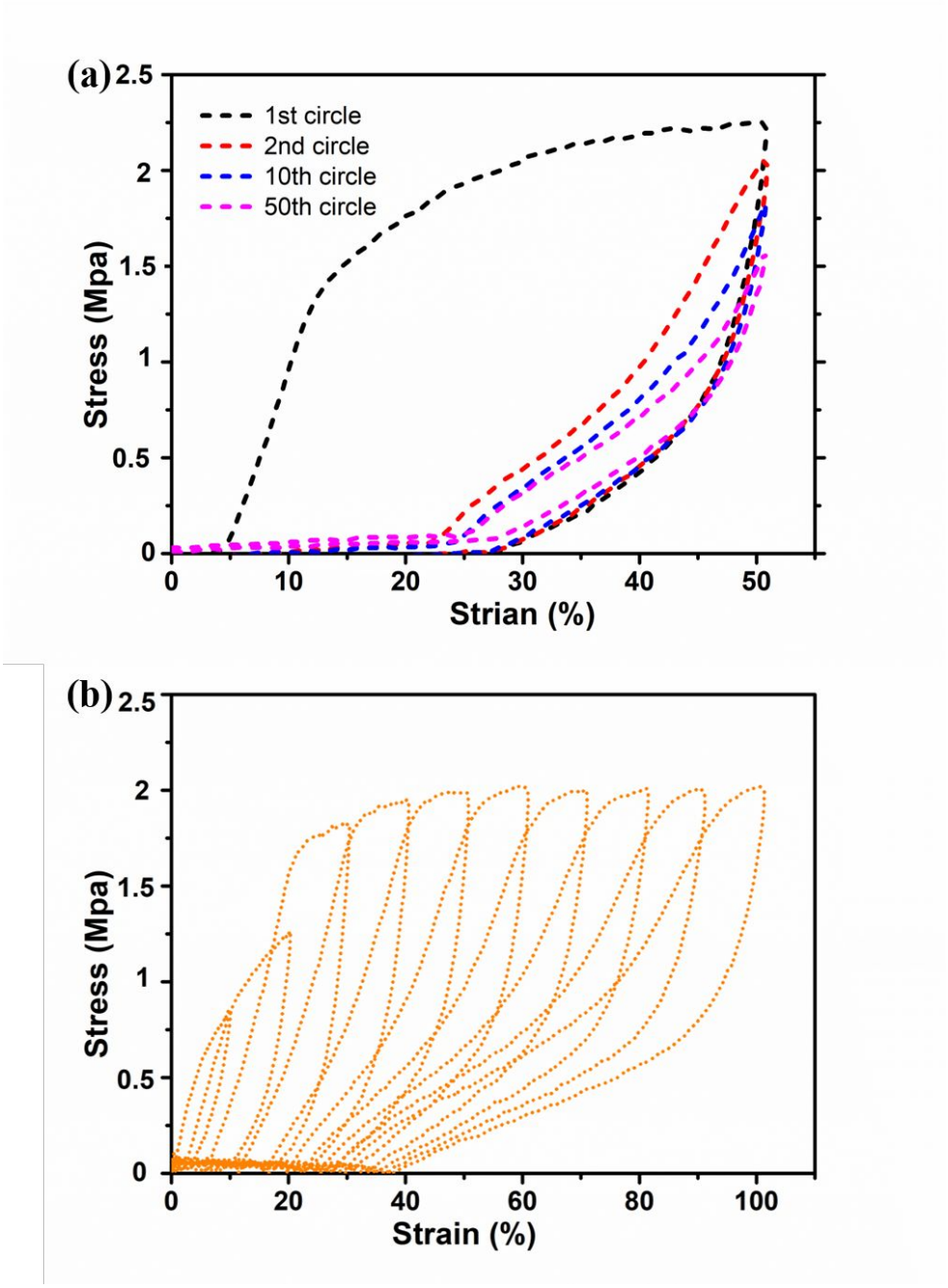


Fig.S4. Tensile recovery curve of DMSO post treated 10wt.% PEDOT:PSS-NR film: (a) recovery curve after 50 cycles of stretching, (b) Recovery curves at different strain (only one circle).

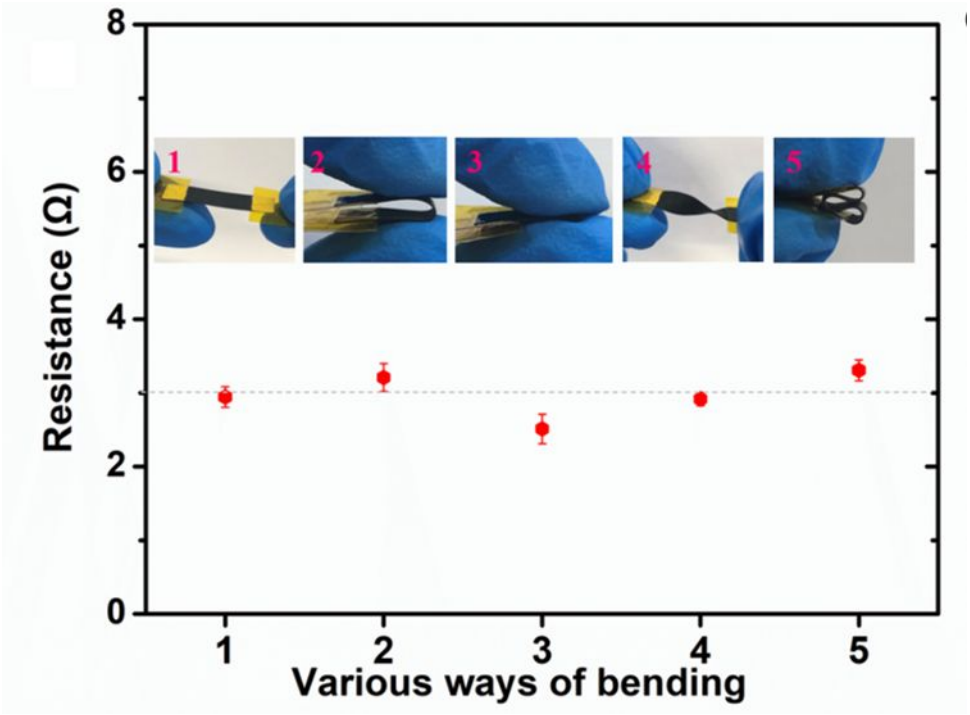


Fig.S5. Resistance of 10wt.% DMSO-PEDOT:PSS-NR sample under different bending conditions.

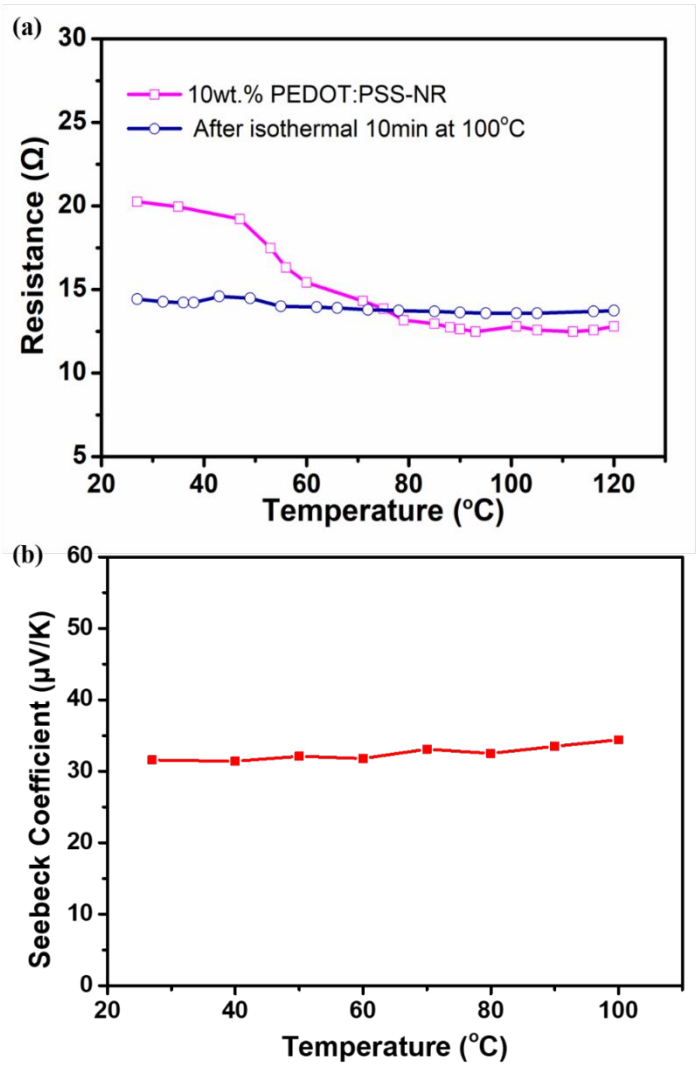


Fig.S6. (a) The influence of temperature on resistance of 10wt.%PEDOT:PSS film, (b) The influence of temperature on seebeck coefficient of 10wt.%PEDOT:PSS film.

As shown in Fig.S6(a), the resistance of the received 10wt.%PEDOT:PSS-NR sample decreases slightly as the temperature increases. This is because the humidity of the material will affect the electrical conductivity of PEDOT:PSS. After isothermal at 100 °C for 10 minutes, the resistance value of the sample tends to be stable. So, in this work, all samples should be kept dry before characterization.