Supporting Information

Heterogeneous Structured Tough Conductive Gel Fibers for Stable and High-Performance Wearable Strain Sensors

Tao Chen, Peiling Wei, Guoyin Chen, Hongmei Liu, Innocent T. Mugaanire, Kai Hou* and Meifang Zhu**

State Key Laboratory for Modification of Chemical Fibers and Polymer Materials, College of Materials Science and Engineering, Donghua University, Shanghai, 201620, China

***Characterizations*:**

The rheological measurements were performed on MCR 302 rheometer (Anton Paar, Germany). The diameter of parallel plate is 25 mm. Dynamic time sweep measurements carried on 30 minutes at 22 °C, with oscillatory deformation of amplitude set at 1% and the angular frequency set at 6.28 rad/s.

The cytocompatibility of gel fibers was tested with L929 cells. The cell culture media were supplemented with 10% FBS and 1% streptomycin/penicillin. In detail, freeze-dried gel fibers were ground into powders, then dispersed in DMEM to form solutions with a concentration of 0.6 mg/ml. Such gel fibers dispersions were sterilized by filtration (220 μm, Thermo Scientific) before the test. L929 cells were seeded on the 96-well plates (2000

cells/well) with growth media of DMEM and 100 μL of above gel fibers solutions were added in sample group, while 100 μL of DMEM was added in the control group. Afterwards, the 96-well plate were placed in a humidified incubator (with 5% CO2) at 37°C for 1 day and 3 days of cultivation, respectively. Then, the cell viability was measured by CCK-8 assay. Briefly, the growth media in each well of the plates was refreshed by new media with addition of 10 μL of CCK-8 solution. L929 cells were incubated for another 1 h. Then, the living cell concentration in each well of the plates was finally quantified using a microplate reader (Thermo Scientific) by measuring the optical absorbance at 450 nm. Live/dead reagent (Ethidium homodimer-1 (0.5 μM) and Calcein AM (0.25 μM)) (Molecular Probes) were pipetted to the 96-well plated for 45 min. Subsequently, cell viability of corresponding gel fibers and the control group was observed on an inverted fluorescence microscope (DMi8, Leica) equipped with a CCD camera.

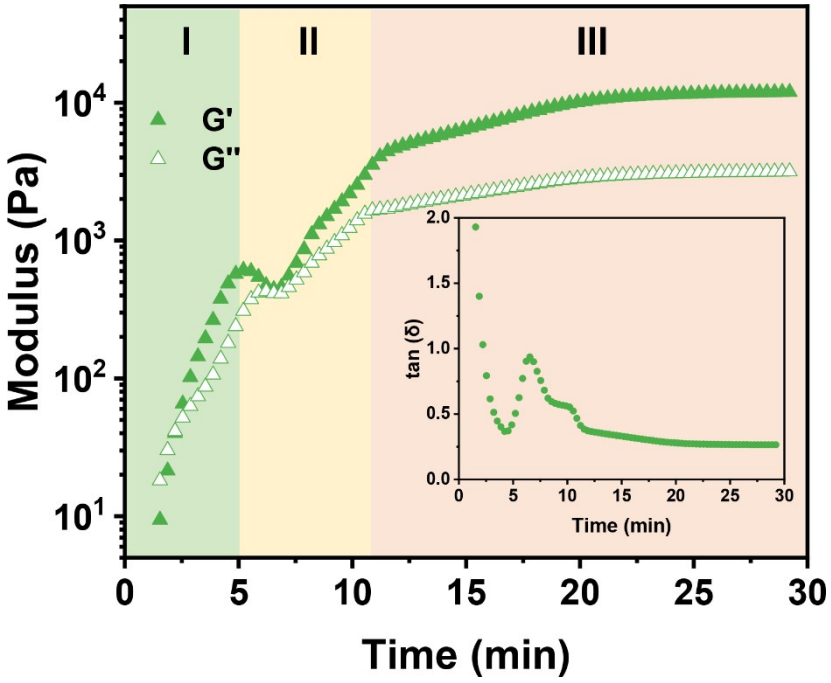

Fig. S1. Time-dependent modulus (G′ and G″) and loss factor (tan (δ)) for gelation process of precursor solution about PMON nanocomposite gel. (I: polymerization period in mold; II: extrusion period with post-stretching process; III: fiber forming period with continuous polymerization)

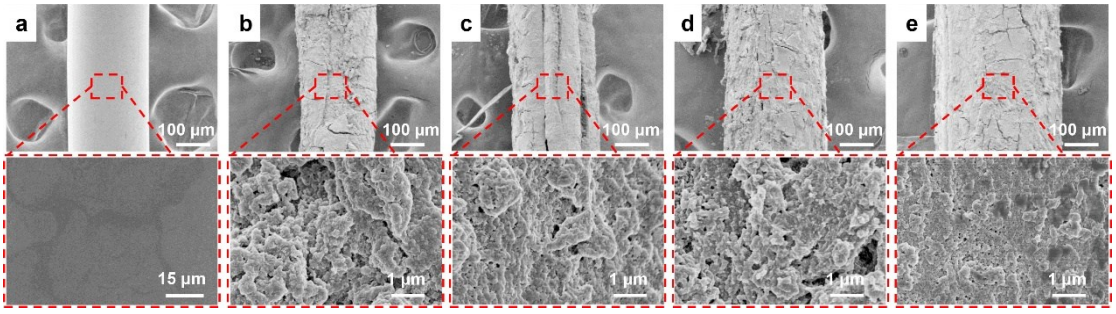

Fig. S2. SEM images of (a) PMON gel fiber, (b) PANI-2/PMON, (c) PANI-4/PMON, (d) PANI-6/PMON and (e) PANI-8/PMON hybrid gel fibers.

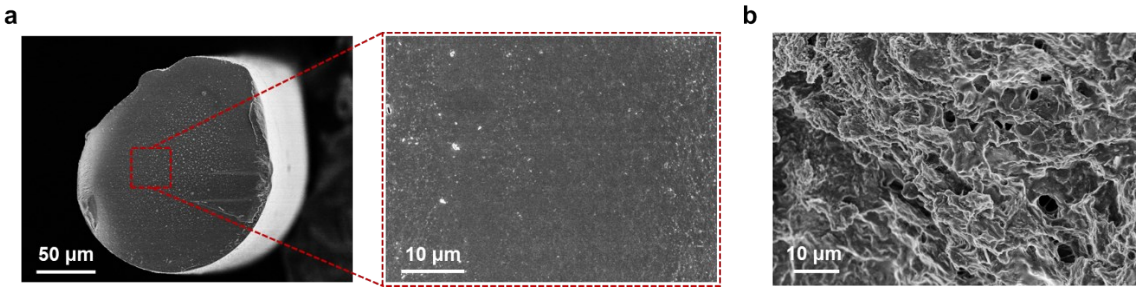

Fig. S3. Cross-sectional image of (a) PMON gel fibre and (b) PANI-6/PMON hybrid gel fibre

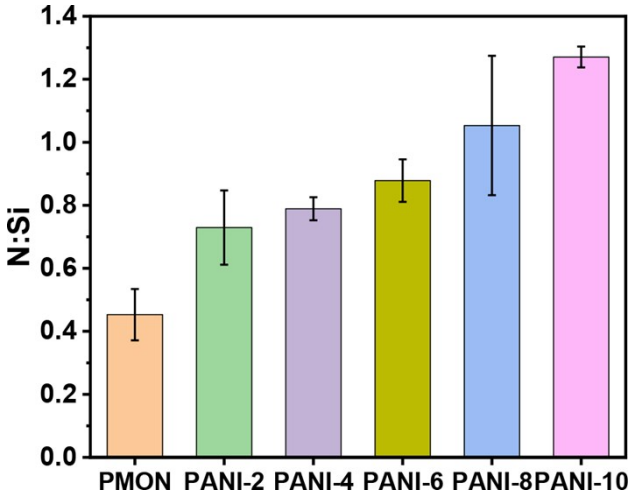

Fig. S4. Calculated atomic ratio of nitrogen (N) to silicon (Si) from EDS of PMON and PANI-n/PMON gel fibers.

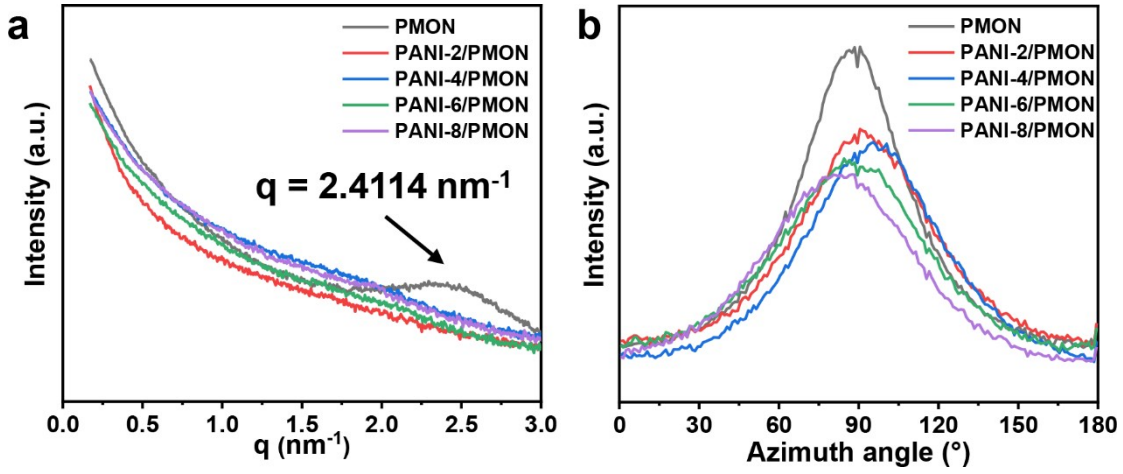

Fig. S5. Microstructural characterization of gel fibers: (a) SAXS profiles and (b) corresponding azimuth integral of the PMON gel fiber and PANI-n/PMON hybrid gel fibers.

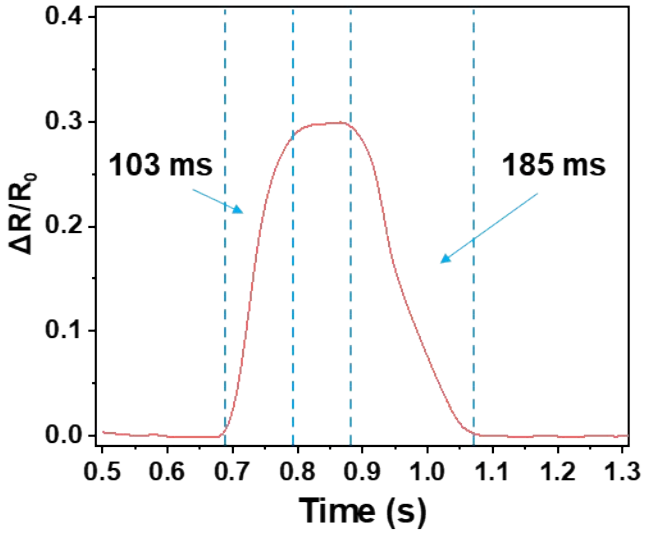

Fig. S6. The response time of the PANI-6/PMON hybrid gel fibre strain sensor.

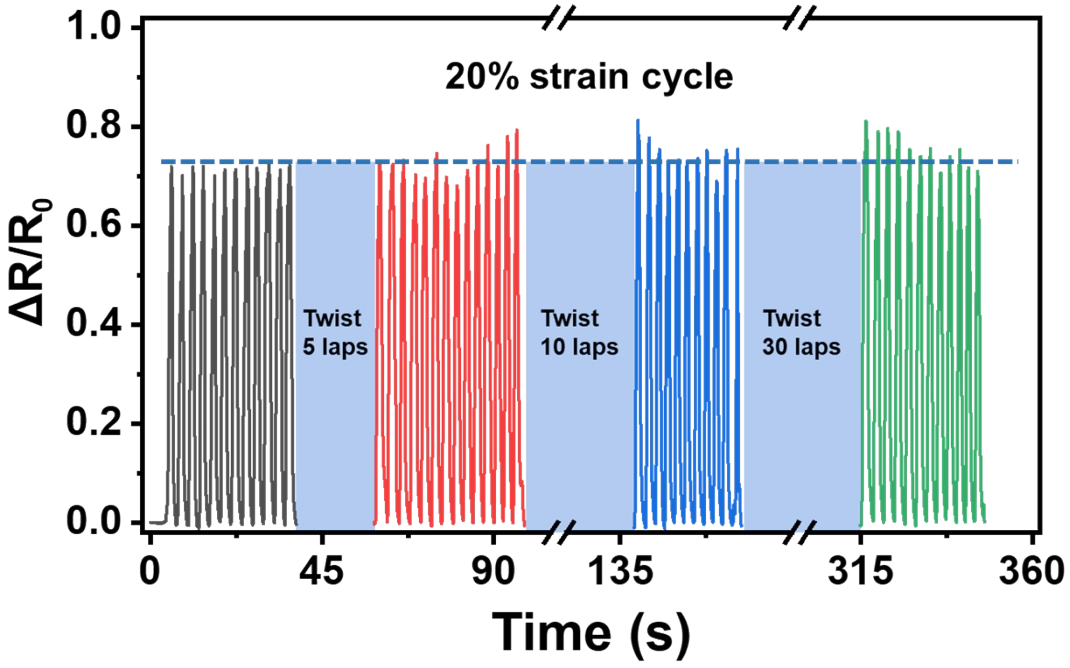

Fig. S7. Real-time relative resistance variation of the 10 cm long hybrid gel fibre with and without twisting under same 20% strain.

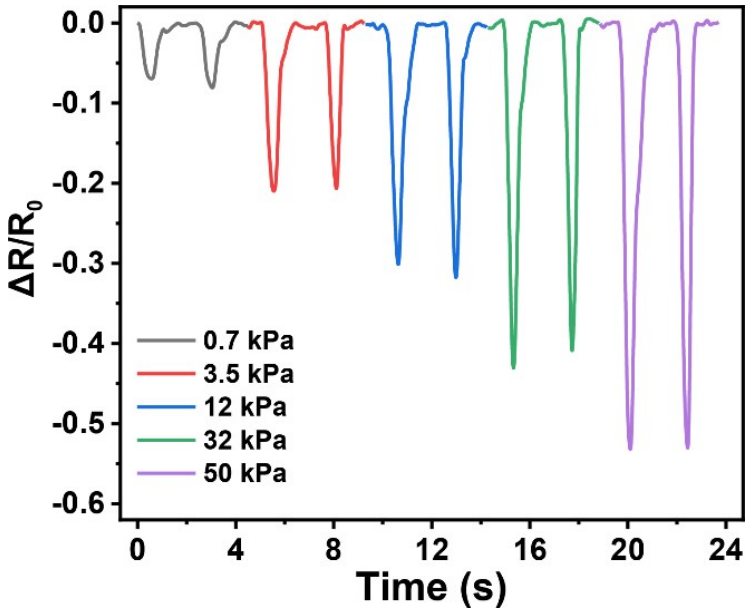

Fig. S8. Real-time relative resistance variation of the hybrid gel fibre under diverse Pressures

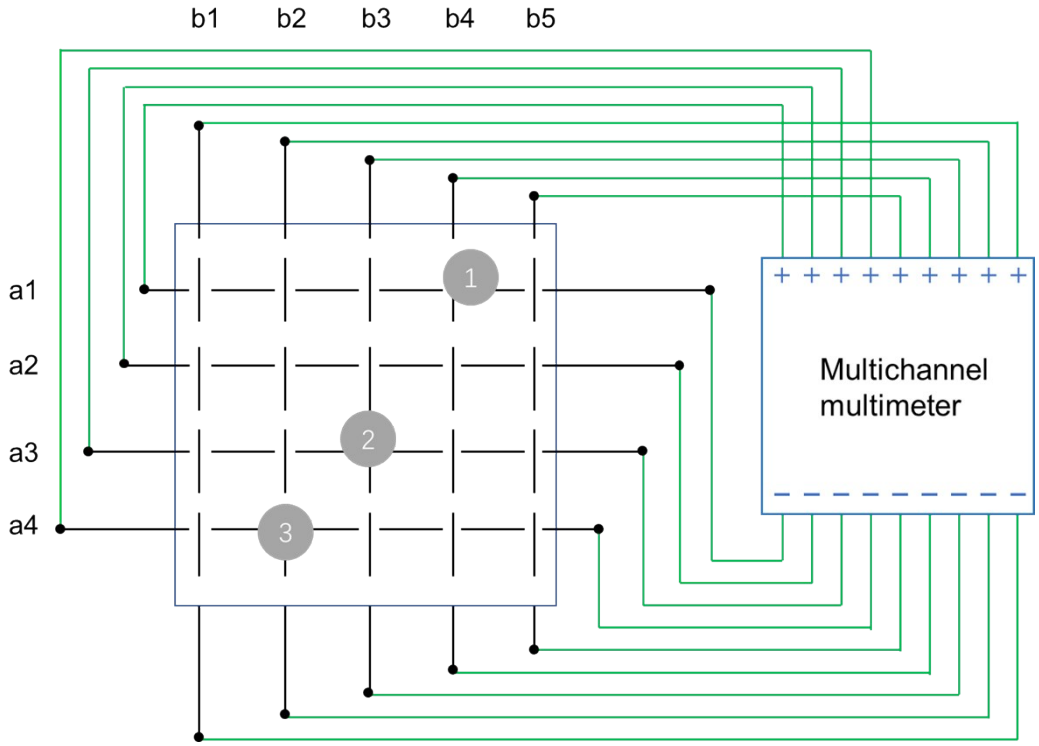

Fig. S9. Equivalent circuit diagram of sensing array and the three locations where the 50g weight is placed (black lines and green lines represent hybrid gel fibres and copper wires respectively).

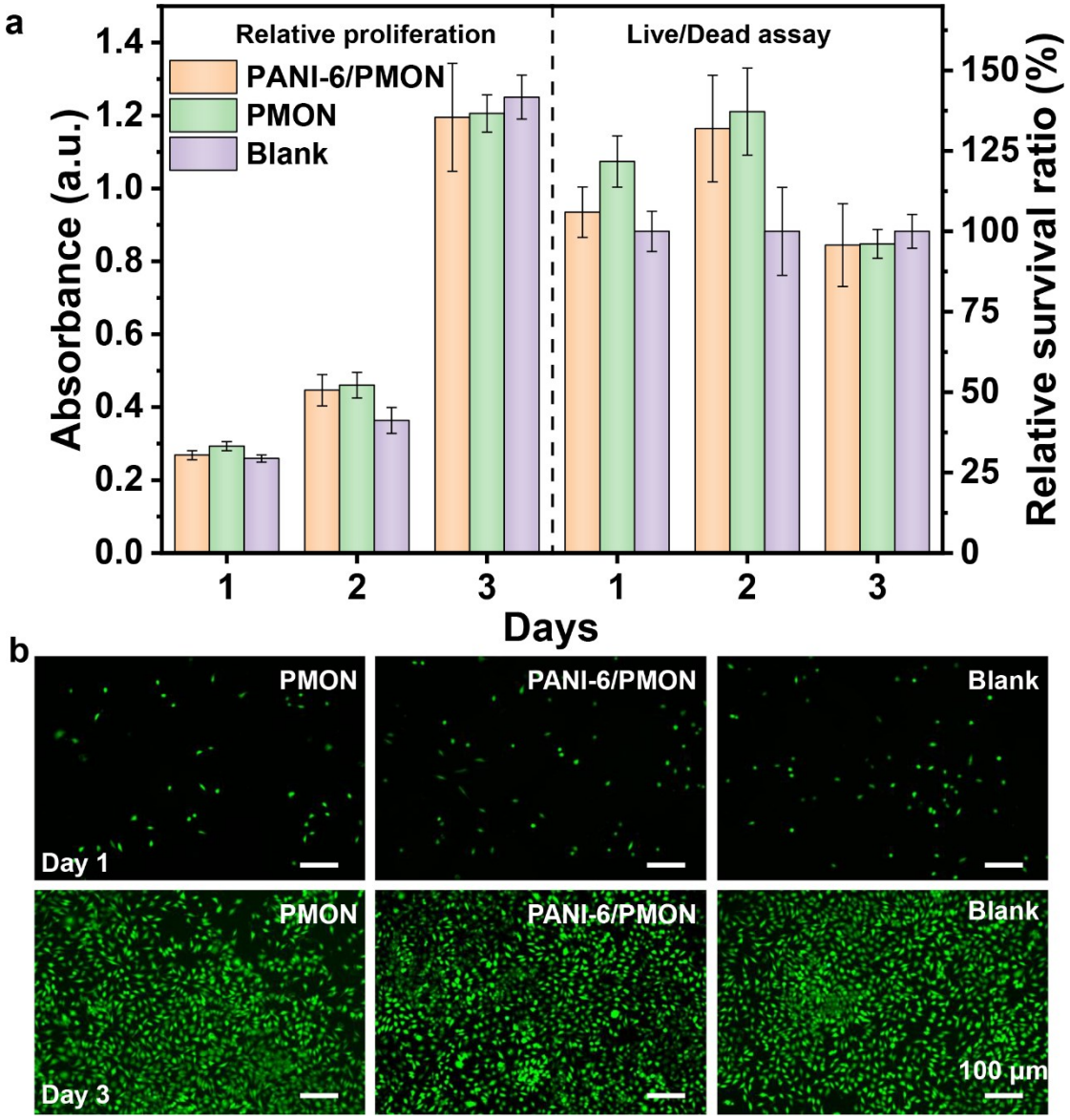

Fig. S10. (a) Relative proliferation and live/dead assay of L929 cells on PMON gel fiber and (b) cell fluorescence micrograph of PANI-6/PMON hybrid gel fiber compared to blank at 1 and 3 days, where live cells are in green, dead cells in red.