

Supporting Information

Encapsulated Stretchable Amphibious Strain Sensors

Shuang Wu, Doyun Kim, Xiaoqi Tang, Martin W. King, Yong Zhu*

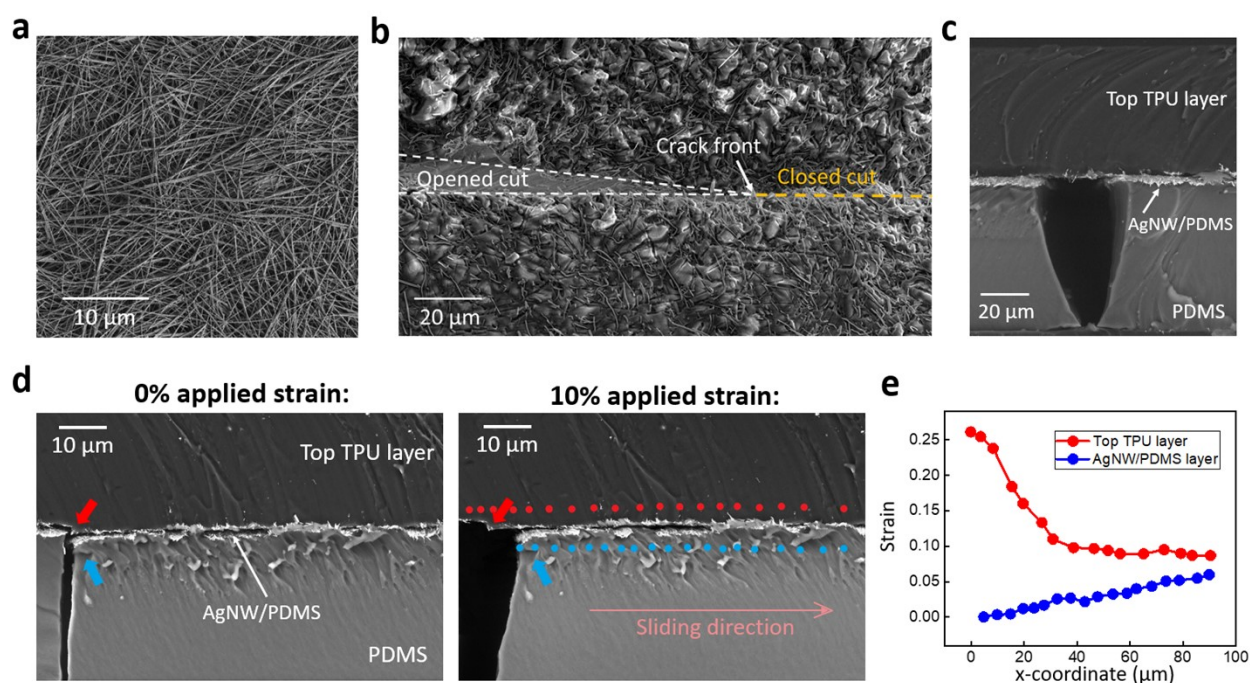


Figure S1. a) SEM image of the synthesized AgNW network. b) SEM image showing the crack front of the AgNW/PDMS composite from the top view. c) SEM image showing the side view of the strain sensor under 20% strain. d) SEM image showing the side view of the AgNW/PDMS composite layer sliding against the top TPU layer with the increase of applied strain. (The blue and red arrows mark the local features before and after sliding) e) Strain distribution in the top TPU layer and the PDMS layer measured by the relative displacement of the red/blue markers in d.

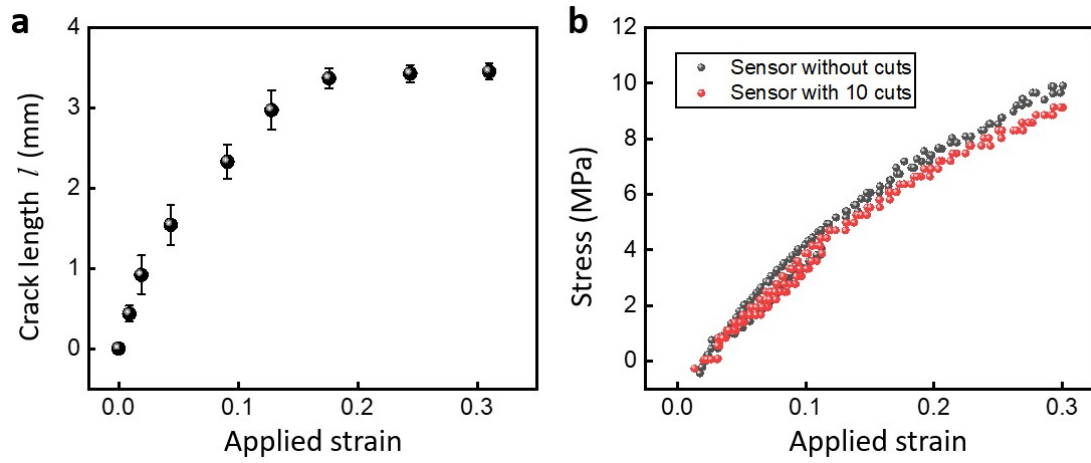


Figure S2. a) The crack propagation in the cut length direction with respect to applied strain on the sensor ($p/w=0.2$, $l_c/w=0.9$). b) The stress strain curve of the sensors without and with 10 cuts ($p/w=0.2$, $l_c/w=0.9$).

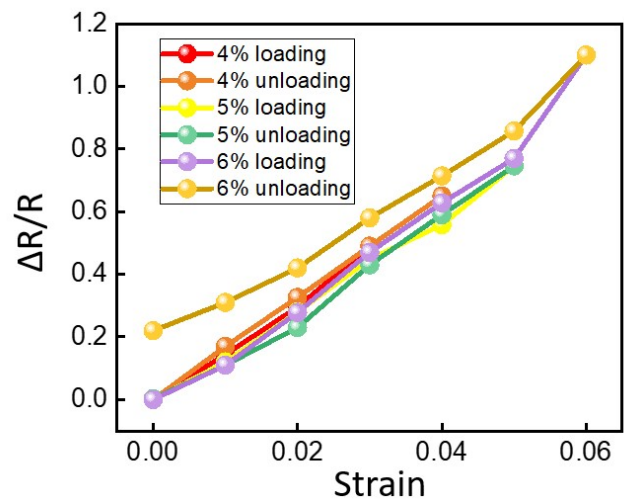


Figure S3. Resistance change of the AgNW/PDMS composite under cyclic loading of 3%, 5% and 6% respectively.

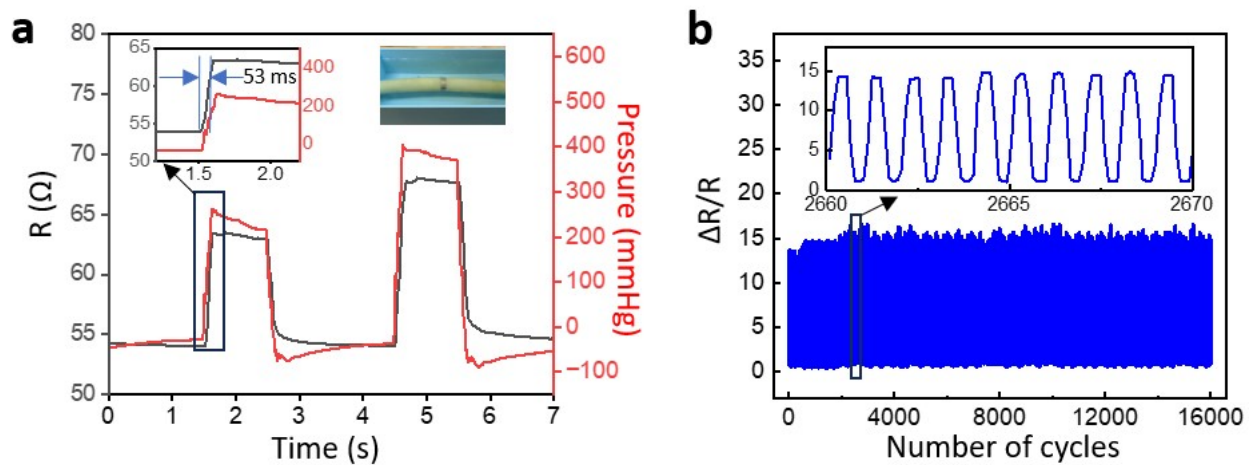


Figure S4. a) The response time of the strain sensor captured with the sensor wrapped around a pressurized rubber tube. b) Sensor response to 16,000 cycles of 30% applied strain. The inset figure shows 10 cycles.

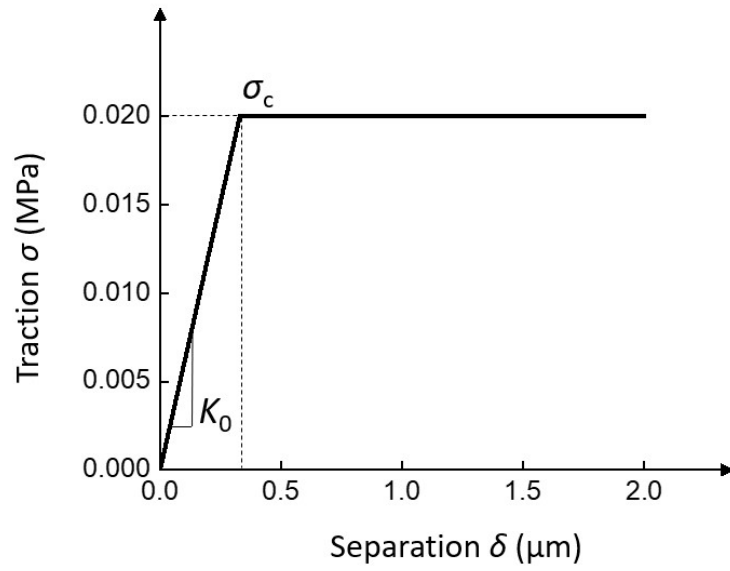


Figure S5. Traction separation law applied to the interface between the top TPU layer and the AgNW/PDMS layer.

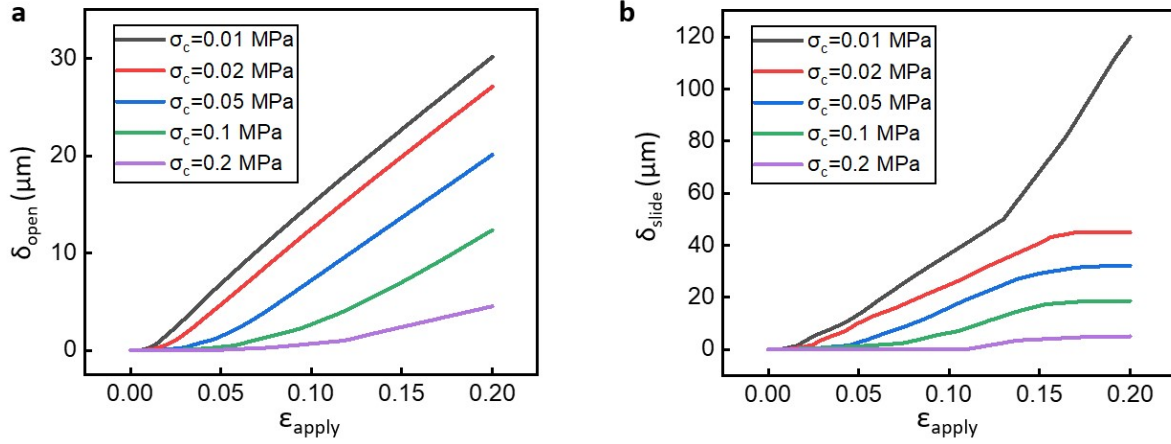


Figure S6. a) b) Cut opening distance δ_{open} and the length of sliding area δ_{slide} with applied strain with different interfacial strength σ_c .

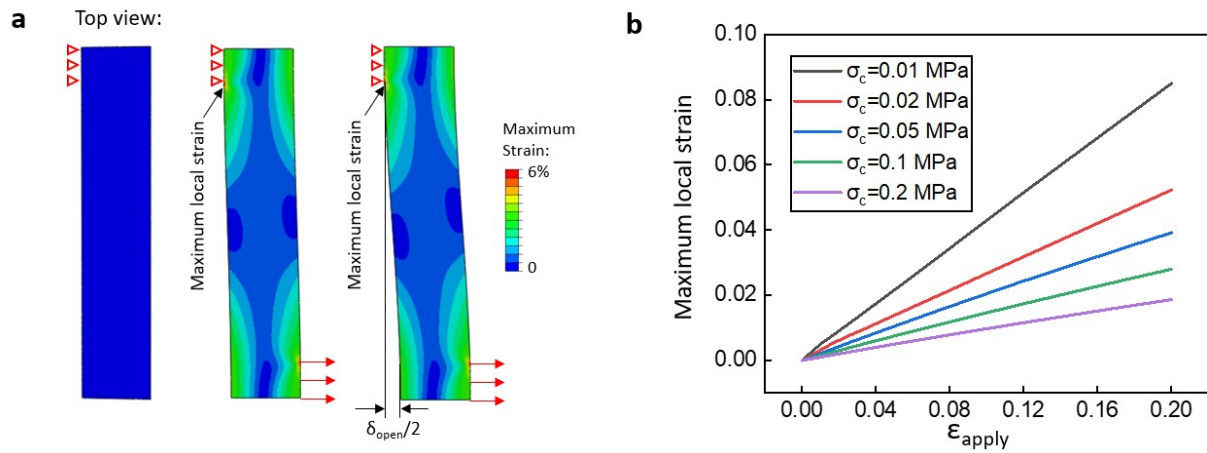


Figure S7. a) Finite element analysis on one unit of the AgNW/PDMS showing the maximum strain at the crack tip. b) The maximum strain at the crack tip with respect to the cut opening distance δ_{open} .

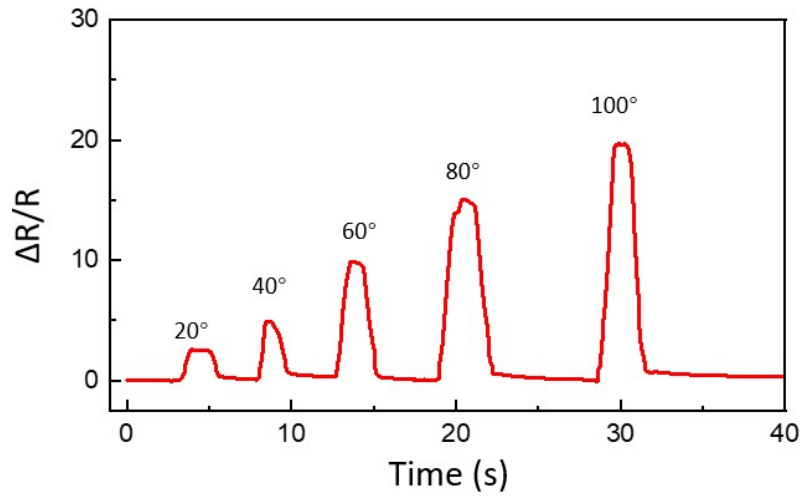


Figure S8. Calibration of the strain sensors attached to the finger joints of the underwater gloves.

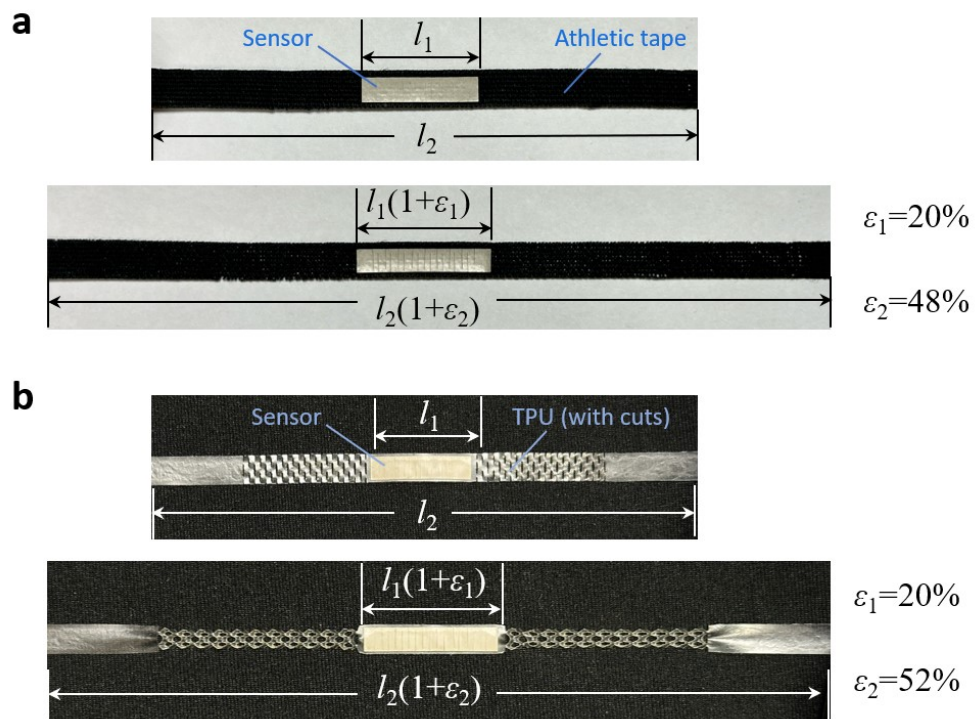


Figure S9. Integration of the amphibious strain sensor on **a)** athletic tape and **b)** TPU (with kirigami cut design) to increase the stretchability.

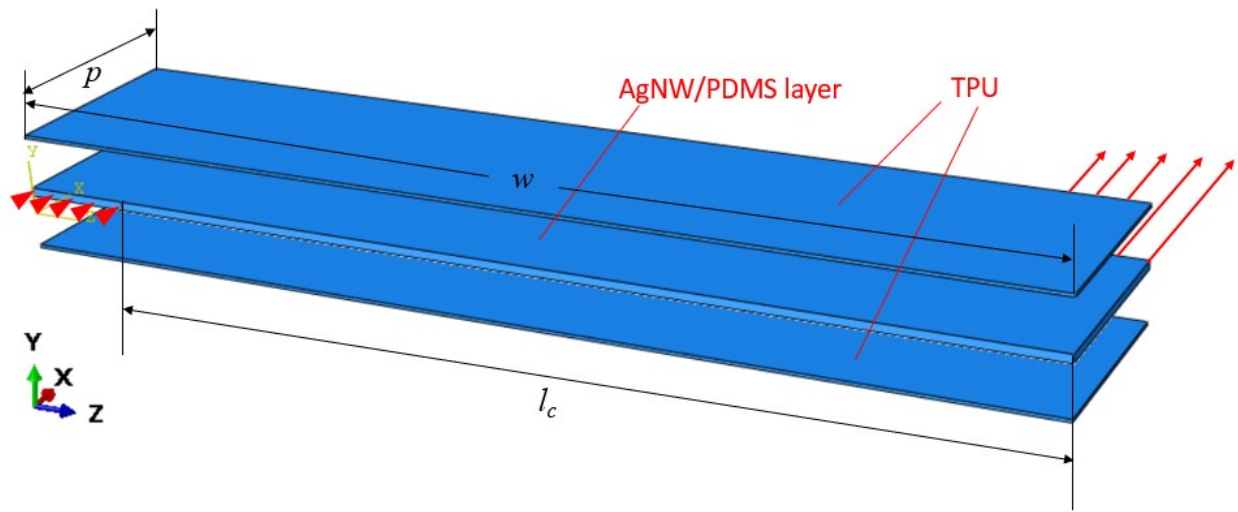


Figure S10. Exploded view of the FEA model showing the sandwich structure of the sensors.