Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

Conductive Chromotropic Fiber Filament Sensors with Ultrahigh Stretchability for Wearable Sensing Textiles Toward 3D Optical Motion Capture†

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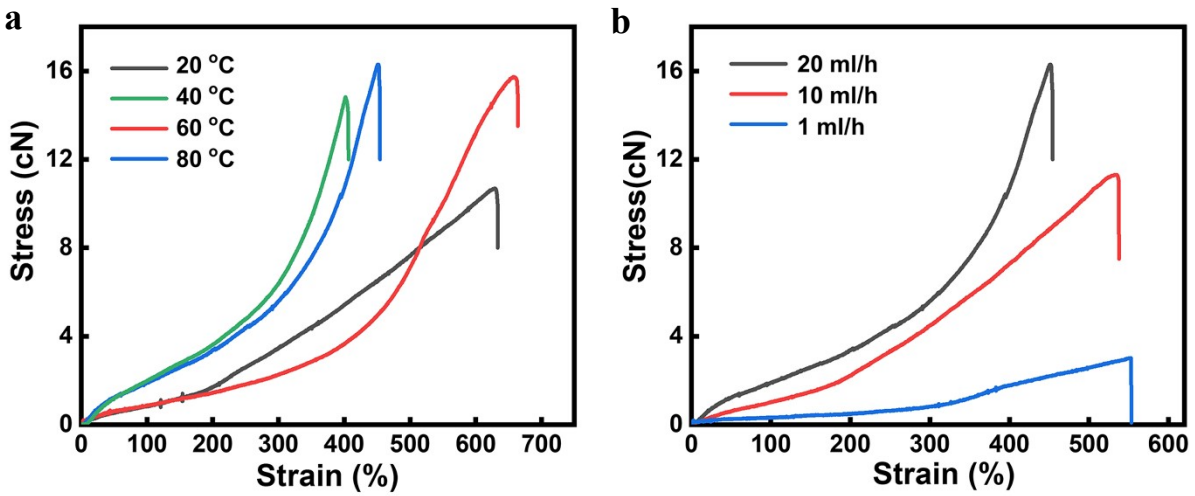


Fig. S1 Tensile properties at break of the pure Ecoflex fibers that were fabricated (a) at different coagulation bath temperatures or (**b**) with different extrusion speeds at a constant coagulation bath temperature of 80 ℃.

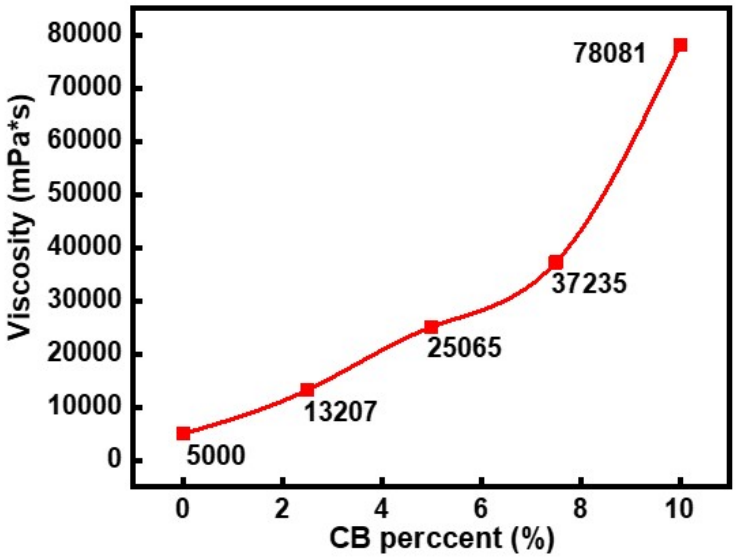


Fig. S2 Mixed viscosity of the as-prepared spinning solution with different CB doping amount. With the increase of CB content, the mixing viscosity of spinning solution increased in a polynomial form.

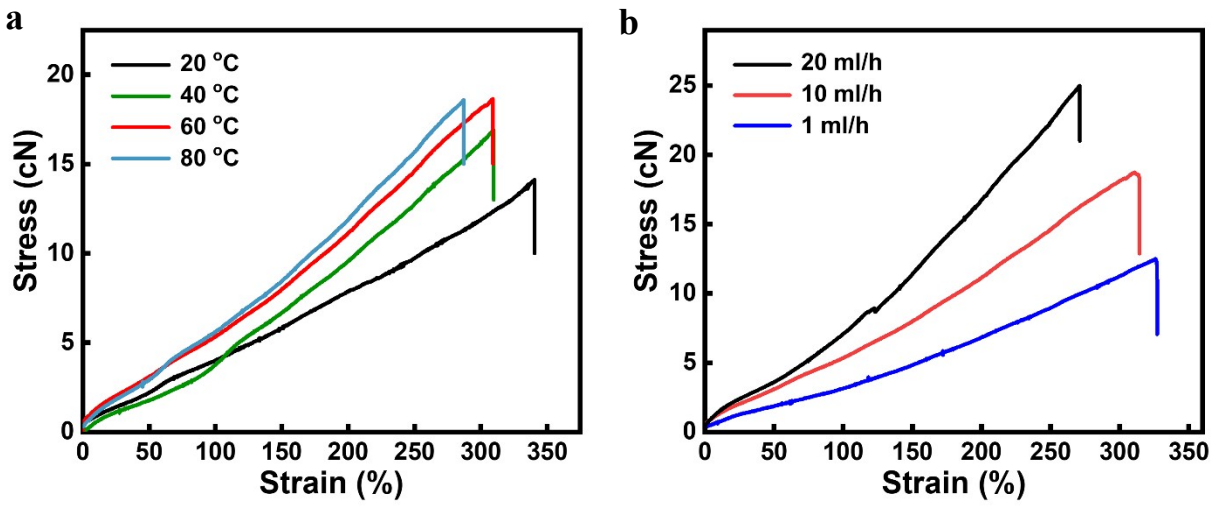


Fig. S3 Tensile properties at break of the composite Ecoflex/CB fibers with7.5 wt.% of CB NPs that fabricated (**a**) at different coagulation bath temperatures or (**b**) with different extrusion speeds at a constant coagulation bath temperature of 60 ℃.

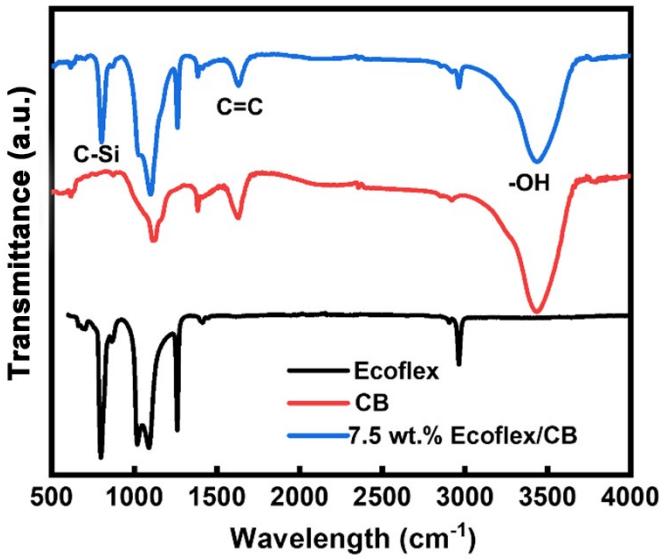


Fig. S4 FTIR spectra of the as-fabricated pure Ecoflex fibers, CB NPs, and the composite Ecoflex/CB fibers with7.5 wt.% of CB NPs.

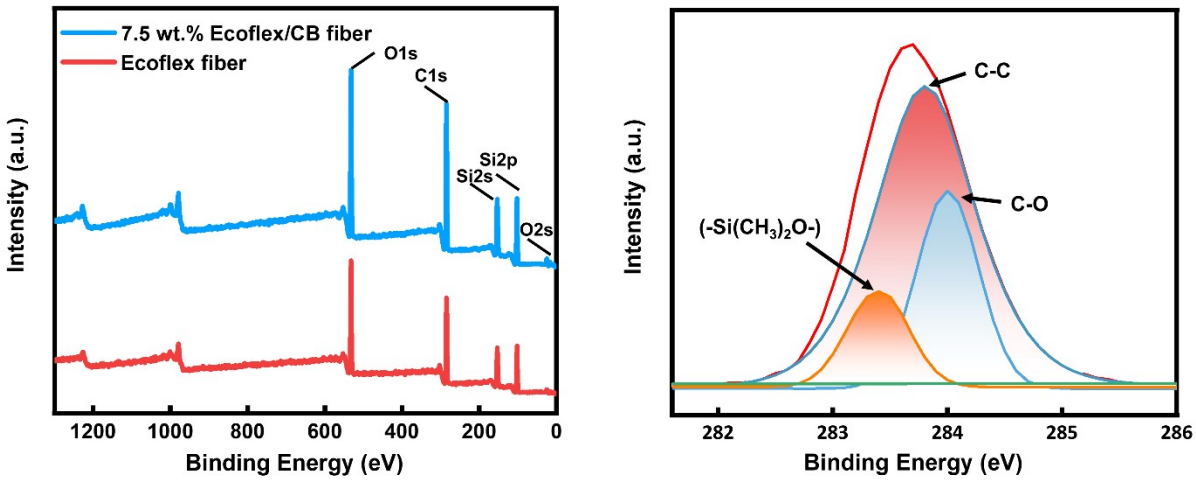


Fig. S5 XPS spectra of the as-fabricated pure Ecoflex fibers and the composite Ecoflex/CB fibers with7.5 wt.% of CB NPs, and C 1s in the pure Ecoflex fibers.

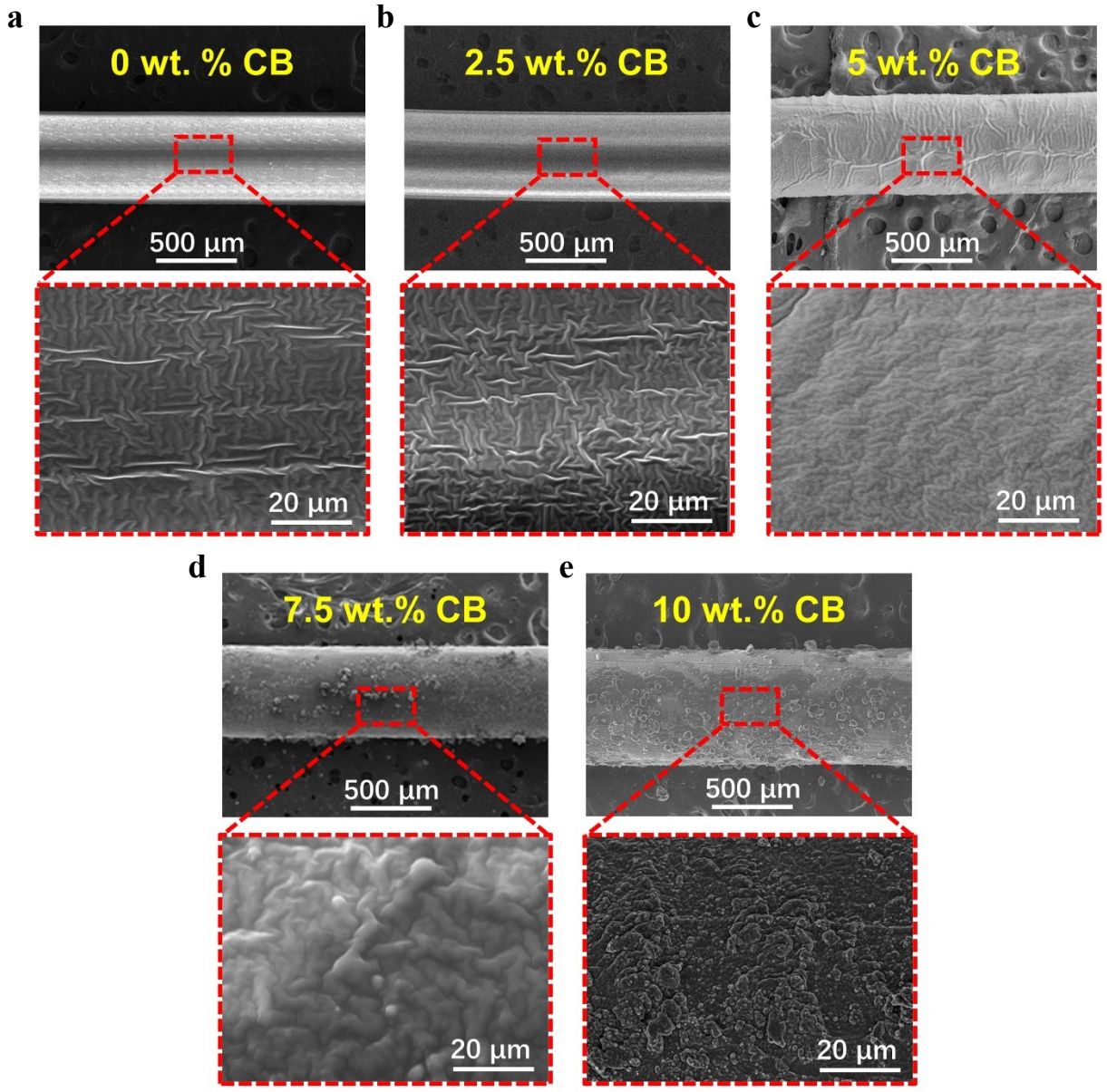


Fig. S6 SEM images with two different magnifications of the as-fabricated composite fibers that contained different contents of CB NPs. (**a**) 0 wt.%, (**b**) 2.5 wt.%, (**c**) 5 wt.%, (**d**) 7.5 wt.%, (**e**) 10 wt.%.

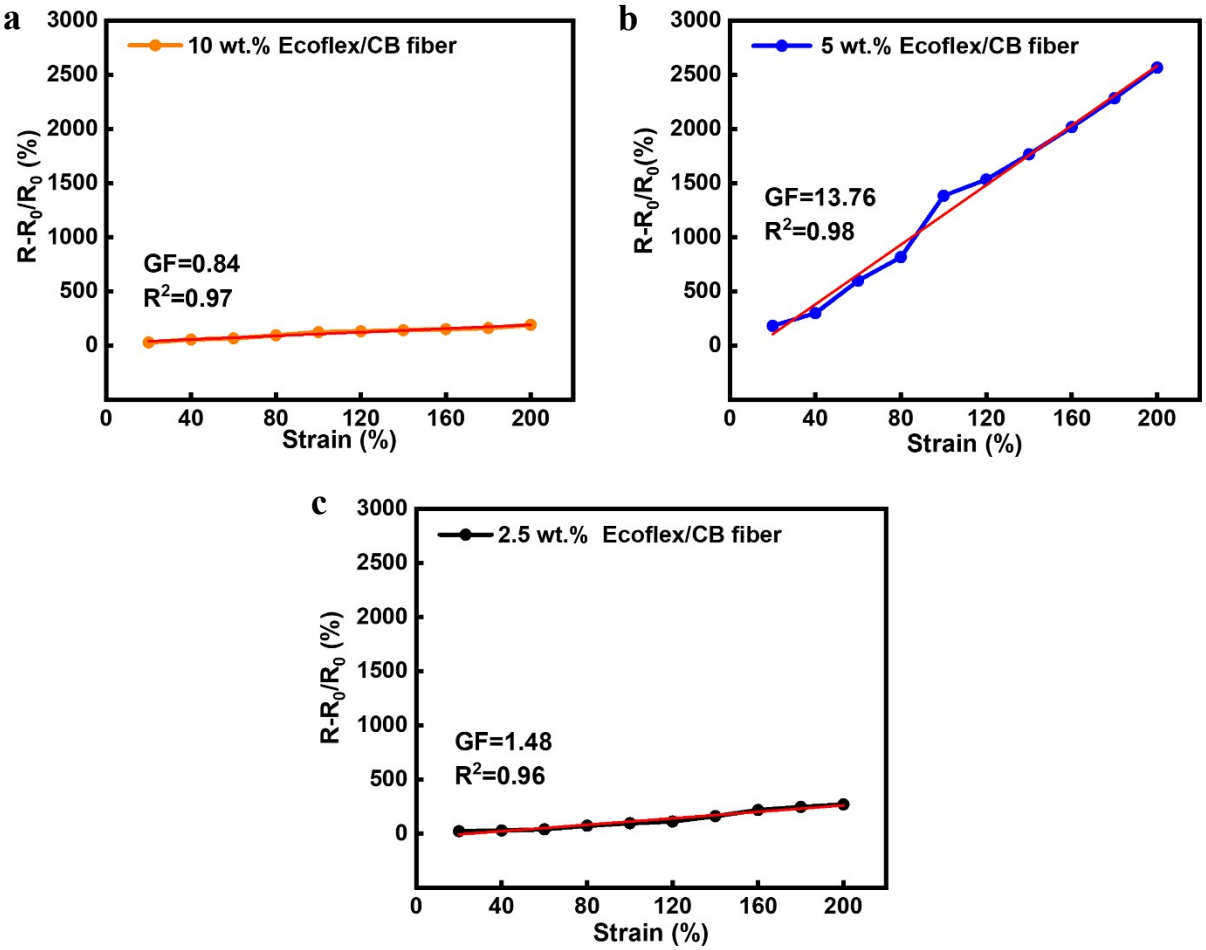


Figure S7. The resistance change rate (GF) of the as-fabricated different composite fibers during stretching and their linear regression correlation coefficient (R^2). The contents of CB NPs in the composite fibers are (**a**) 10 wt.%, (**b**) 5 wt.%, (**c**) 2.5 wt.%. The value of GF can be calculated by $GF=(R-R_0)*L/R_0*\Delta L$.

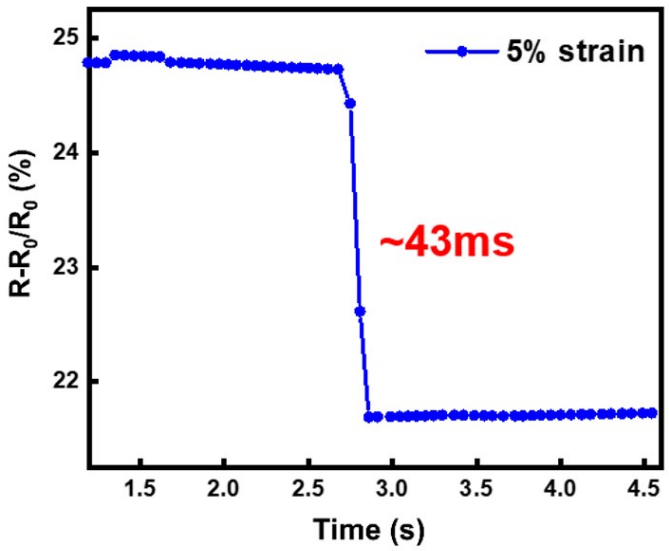


Fig. S8 The electrical signal obtained by applying a quasi-release step strain of 5% at a speed of 40 mm/s showing a fast response time of 43 ms.

Fig. S9 Resistance change rate of the composite Ecoflex/CB fiber sensors with 7.5 wt.% of CB NPs under different stretching degrees.

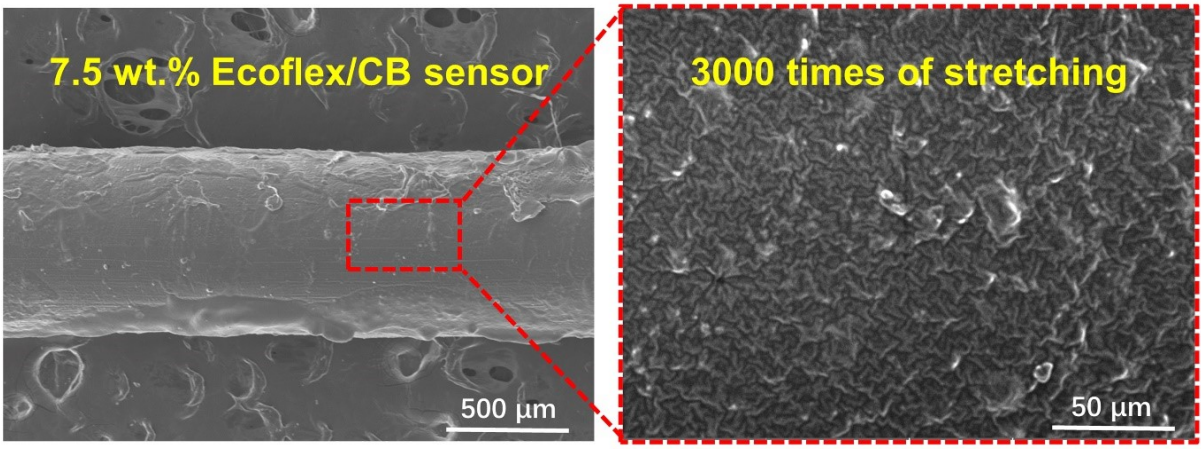


Fig. S10 Different magnification SEM images of the composite Ecoflex/CB fiber sensors with 7.5 wt.% of CB NPs after 3000 times of stretching.

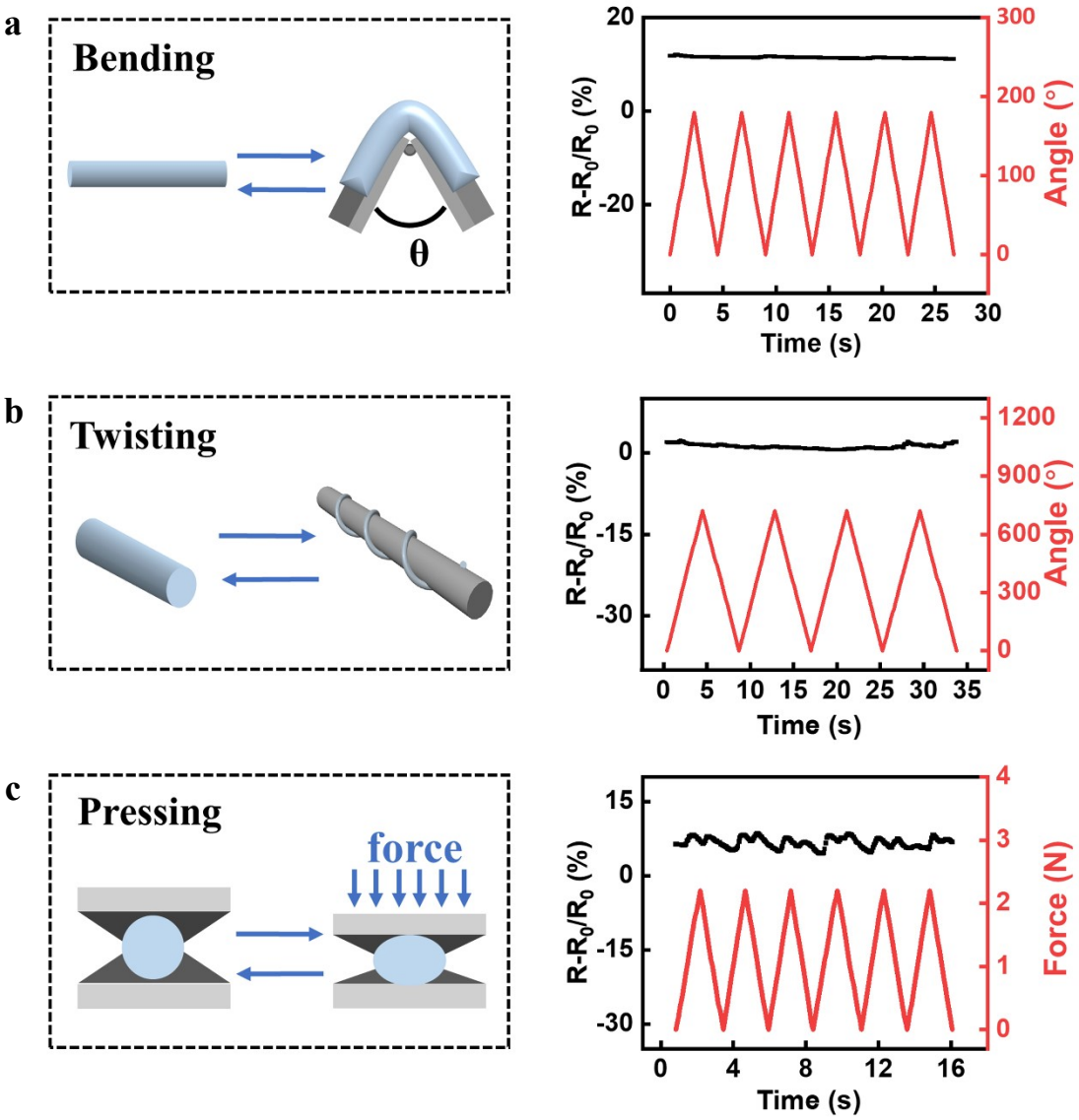


Fig. S11 The relative electrical changes of the composite Ecoflex/CB fiber sensors with 7.5 wt.% of CB NPs under (**a**) bending, (**b**) torsion and (**c**) pressurization. The stable performance under these three different conditions indicated that the sensors had anti-interference performance to mechanical stimulation.

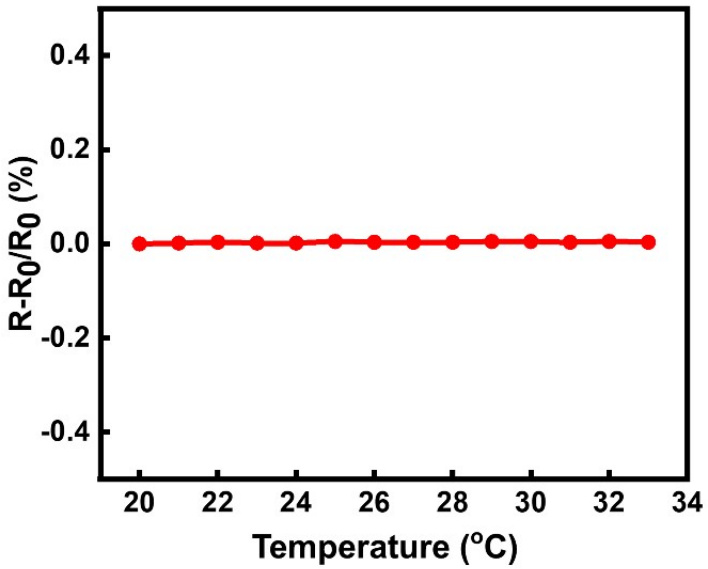


Fig. S12 The composite Ti@Ecoflex/CB fiber sensors with 7.5 wt.% of CB NPs show strong resistance stability in the working temperature range of 18-33 °C.

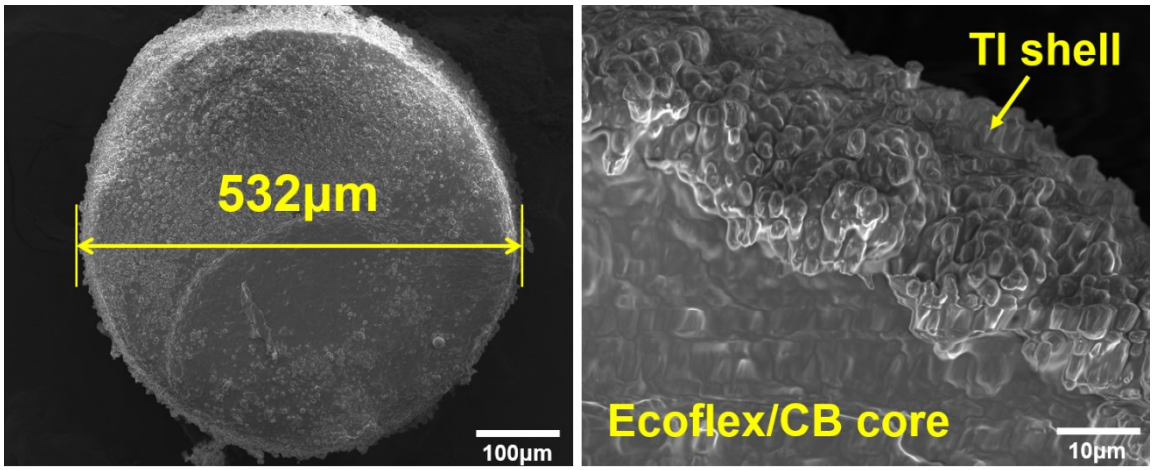


Fig. S13 The diameter of TI@Ecoflex/CB fiber filament sensor was 532 μm with the microstructure of TI shell and Ecoflex/CB core.

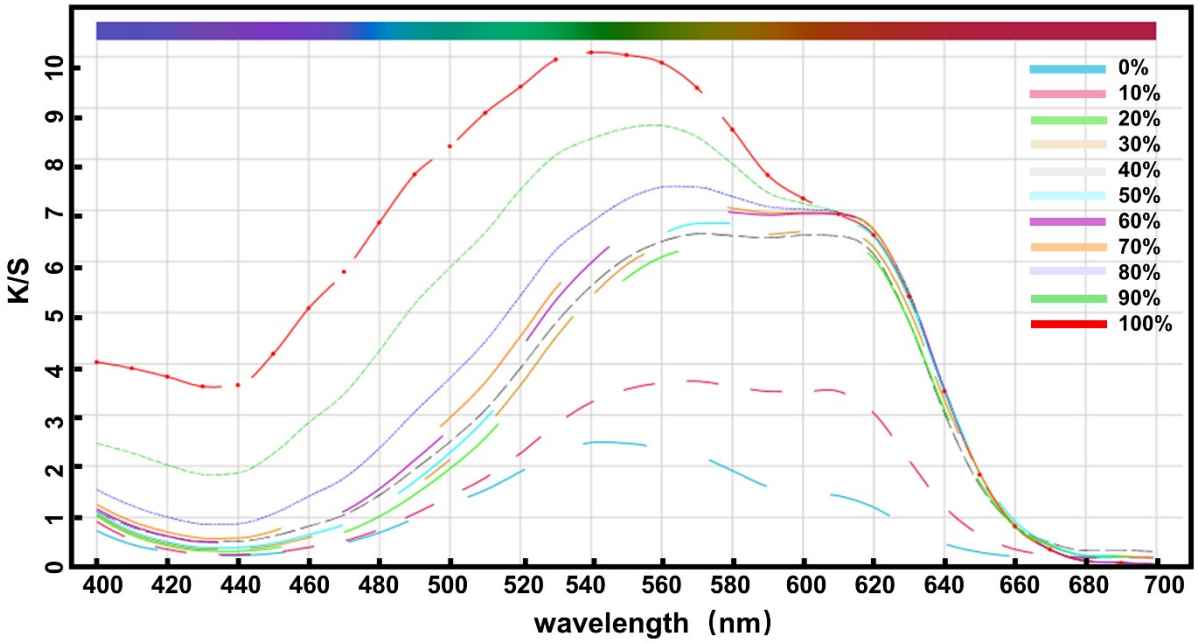
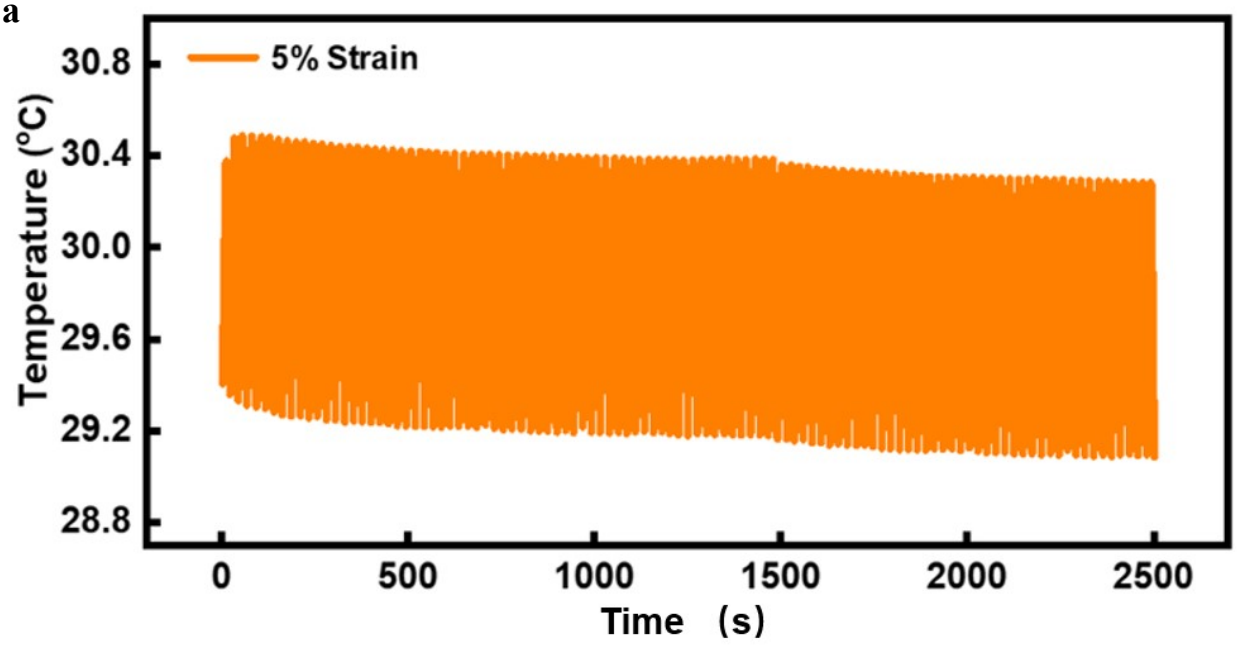


Fig. S14 K/S curve of the composite Ti@Ecoflex/CB fiber sensors with 7.5 wt.% of CB NPs under strain changes from 0% to 100% at an ambient temperature of 16 °C.

a



b

Fig. S15. Temperature of the composite Ti@Ecoflex/CB fiber sensors with 7.5 wt.% of CB NPs with 5% cyclic strain applied at an ambient temperature of 16 °C and 3000 cycles (**a**), and 50% stretching exhibits the same color at different ambient temperatures (**b**).

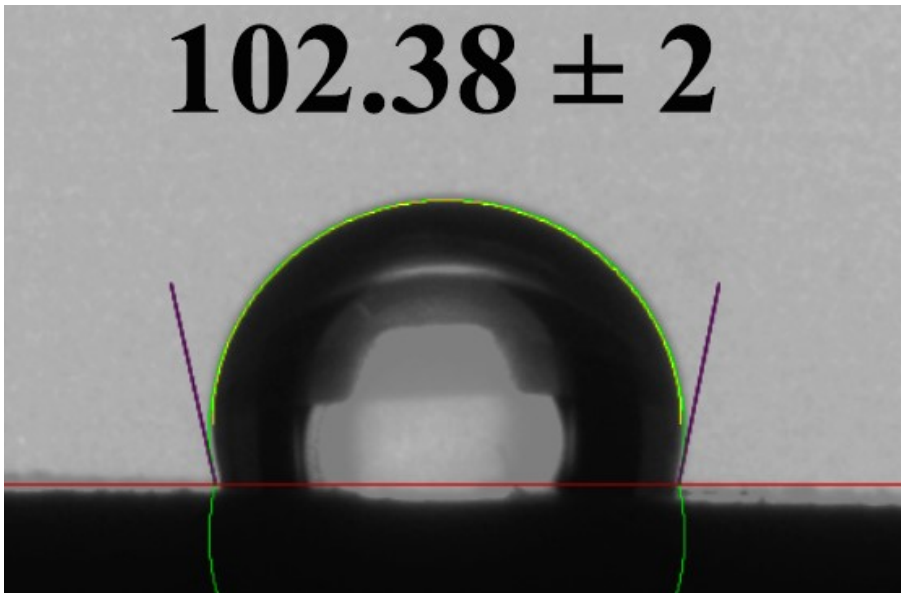


Fig. S16 The contact angle of the composite Ti@Ecoflex/CB fiber sensors with 7.5 wt.% of CB NPs,exhibiting extreme hydrophobicity.

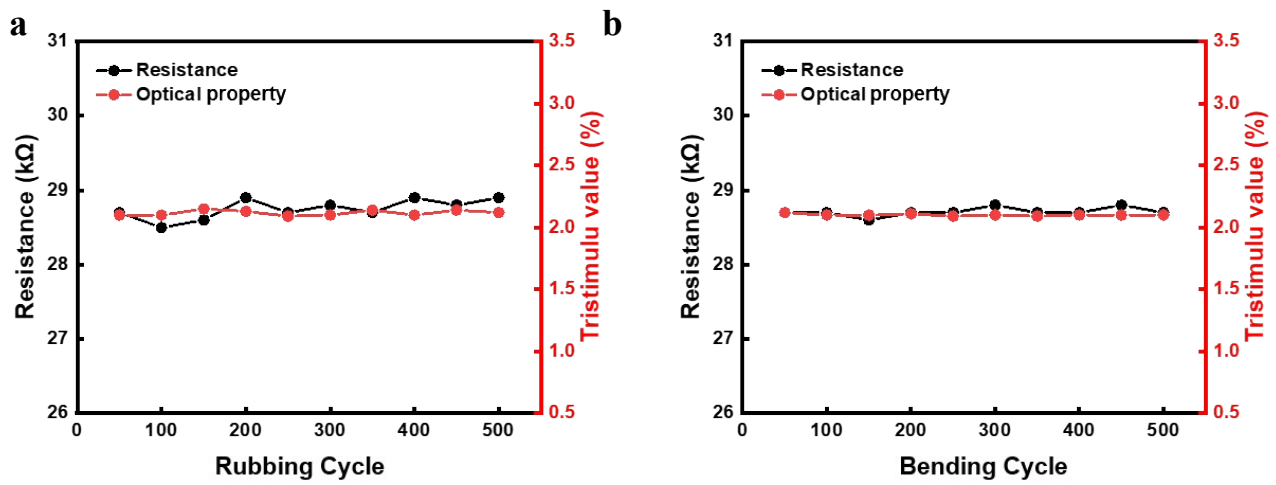


Fig. S17 The stability test of TI@Ecoflex/CB fiber sensors under rubbing (**a**) and bending (**b**) at the wavelength of 540 nm for tristimulu value.

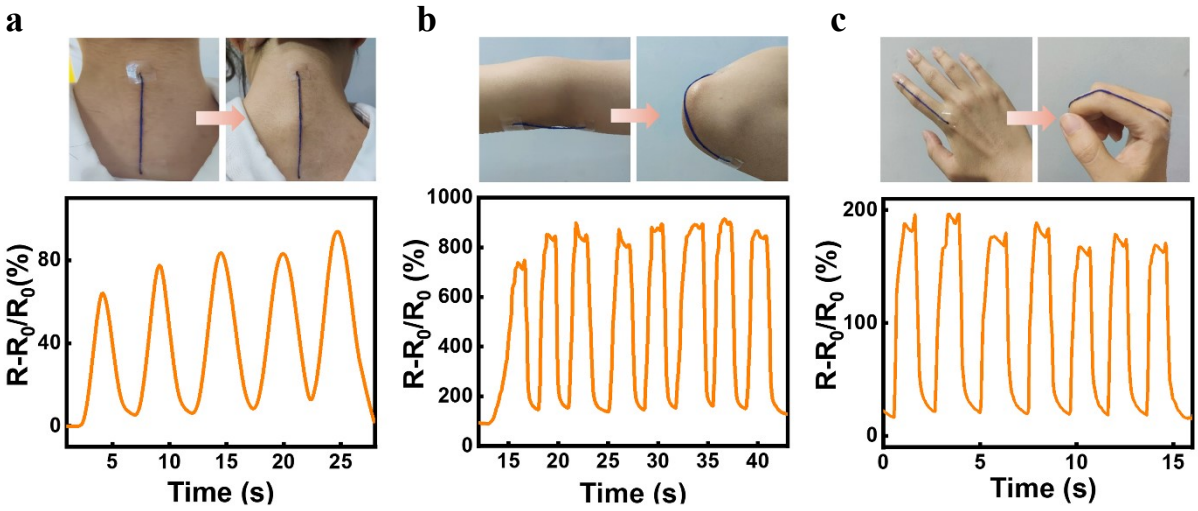


Fig. S18 Resistance change diagram of the composite Ti@Ecoflex/CB fiber sensors with 7.5 wt.% of CB NPs for (**a**) cervical vertebra bending test, (**b**) elbow joint bending test and (**c**) finger joint bending test.

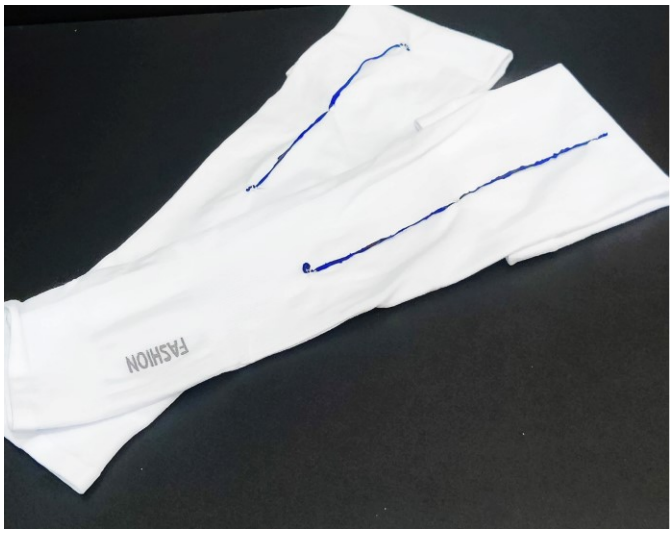


Fig. S19 A wearable intelligent sensing arm guard model for 3D motion capture prepared in this paper.

Movie S1: Wet-spinning process for the continuous fabrication of Ecoflex/CB fibers.

Movie S2: Demonstration of the color changes of the composite Ti@Ecoflex/CB fiber sensors with 7.5 wt.% of CB NPs during strain variations from 0% to 100%.

Movie S3: Dynamic capture of badminton players' motion by the composite Ti@Ecoflex/CB fiber sensors with 7.5 wt.% of CB NPs.