Supplementary Information

Transparent ITO mechanical crack-based pressure and strain sensor

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**Fig. S1. Fabrication of the ITO crack sensor.** (a) ITO layer is deposited by sputtering on PET substrate. (b) Strain of 2% is applied to generate cracks on the surface.
Fig. S2. SEM images of crack opening. (a) SEM image of the crack on the ITO layer with no external tension. (b) SEM image of the crack on the ITO layer with strain of 2%.
Fig. S3. AFM image of the crack on the ITO deposited PDMS film. The height of the crack is about 1,045 nm.
Fig. S4. The graph for loading/unloading tests with the ITO mechanical crack-based sensor with various strains.
Fig. S5. A marathon test of the ITO crack sensor by repeating loading/unloading process about 5,000 cycles at strain from 0% to 2%. (a) A final normalized resistance of a marathon test at a certain period (about 500 cycles). (b) Loading/unloading test after 5,000 cyclic tests.
Fig. S6. (a) Strain-dependent gauge factor by taking the derivative of $R/R_0$ with respect to strains from 0% to 2%. (b) Local gauge factor $\frac{d\ln(R)}{d\varepsilon}$ versus strains from 0% to 2%.
Fig. S7. Loading curves from the ITO crack sensor depending on scanning speeds. The scanning speeds of 0.1 mm/min and 10 mm/min.
Fig. S8. Pressure and strain sensors depending on the sensor frame structure. (a) Photo image of acrylic frame for strain sensing mode. (b) Photo image of acrylic frame for pressure sensing mode. (c) Resistance change on the strain sensing mode with vertical pressure (0.15 kPa). (d) Resistance change on the pressure sensing mode with vertical pressure (0.15 kPa).
**Fig. S9. Fabrication of the multi-pixel array pressure sensor.** (a) ITO layer is deposited by a sputter on a PET substrate through a shadow mask. (b) Thin Ag metal layer (about 13 nm) is deposited on the ITO layer coated with the PET film by a thermal evaporator through an electrode path shadow mask. (c) A PDMS with 4 by 4 square hole is attached on the ITO layer coated with the PET film. (d) The edges of each pixel facing each other were cut.
Fig. S10. Normalized resistance changes versus discrete pressure on the multi-pixel array pressure sensor. (a) A response of normalized resistance of 0.176 kPa. (b) A response of normalized resistance of 0.12 kPa.