Supplementary Information

Wearable piezocapacitive pressure sensor with a single layer of silver nanowire-based elastomeric composite electrode

Banseok You,[1,2] Chul Jong Han,[1] Youngmin Kim,[1] Byeong-Kwon Ju,[2*] and Jong-Woong Kim[1*]

[1] Display Materials & Components Research Center, Korea Electronics Technology Institute, Seongnam 463-816, Korea

[2] Display and Nanosystem Laboratory, College of Engineering, Korea University, Seoul 136-713, Korea

[*] B.-K. J.: Tel: +82-2-3290-3237, E-mail address: bkju@korea.ac.kr; J.-W. K.: Tel: +82-31-789-7438, E-mail address: wyjd@keti.re.kr

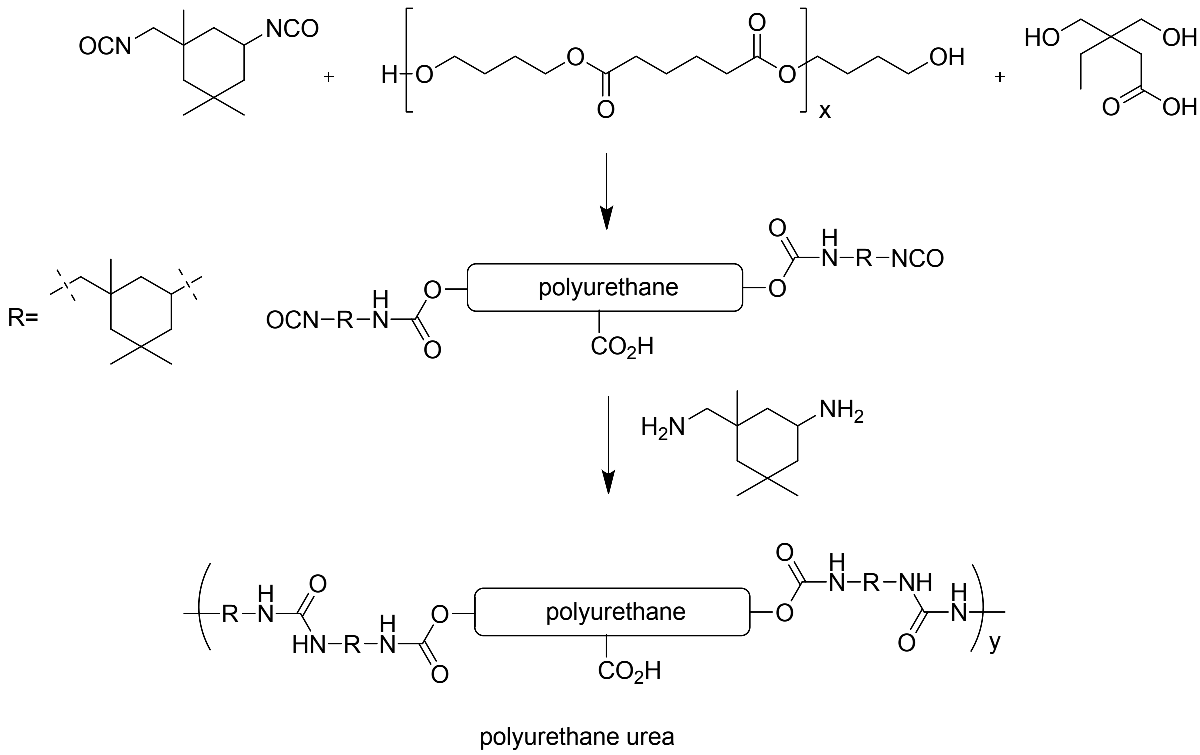

Figure S1. Synthesis of polyurethane urea (PUU).

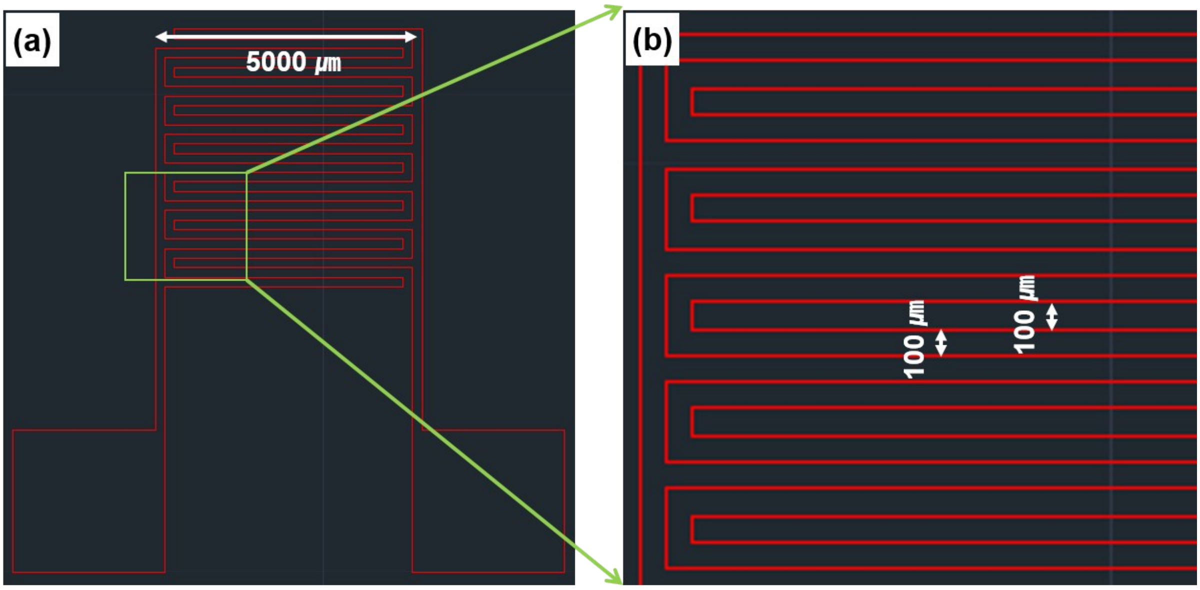

Figure S2. A tandem compound electrode pattern designed in this study: (a) a view of the whole sensor and (b) an enlarged view.

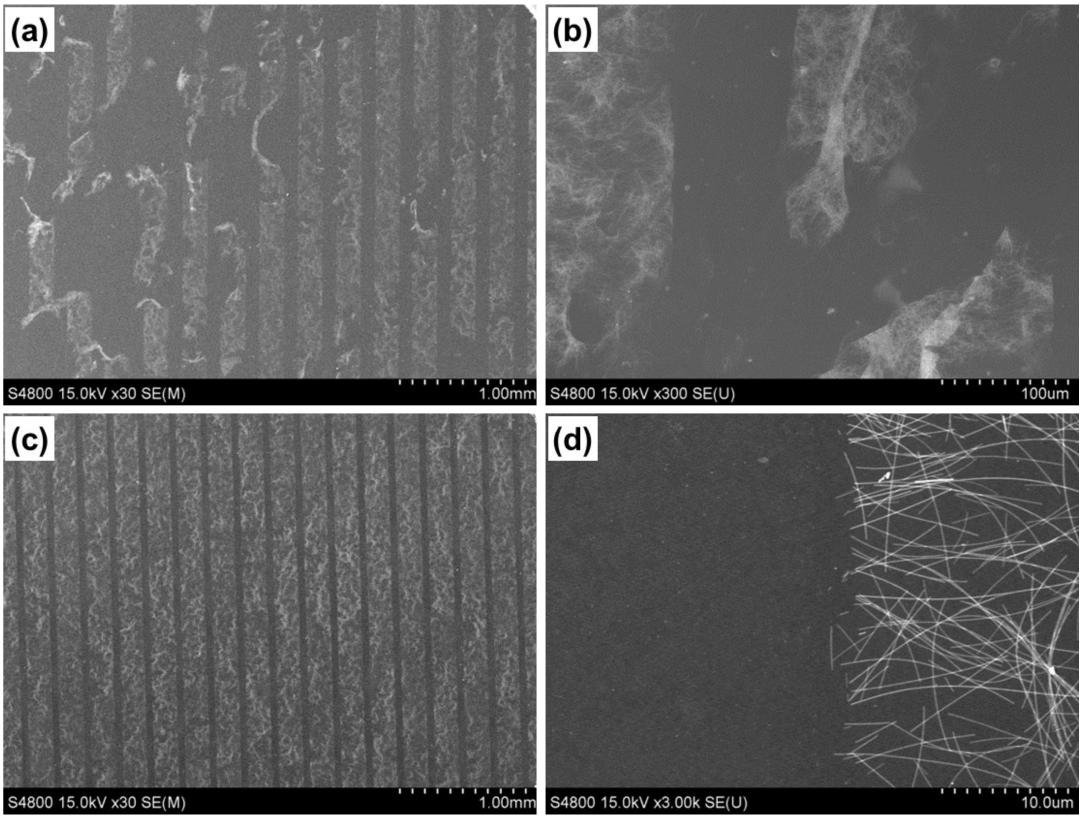

Figure S3. SEM micrographs of AgNWs patterned on a Kapton: (a)-(b) patterned AgNWs without employing IPL treatment and (c)-(d) patterned AgNWs after IPL treatments.

The employment of IPL treatments enhanced the adhesion between the AgNWs and Kapton, so that the nanowires could be more strictly patterned after the treatments as shown in Figure S3c and S3d.

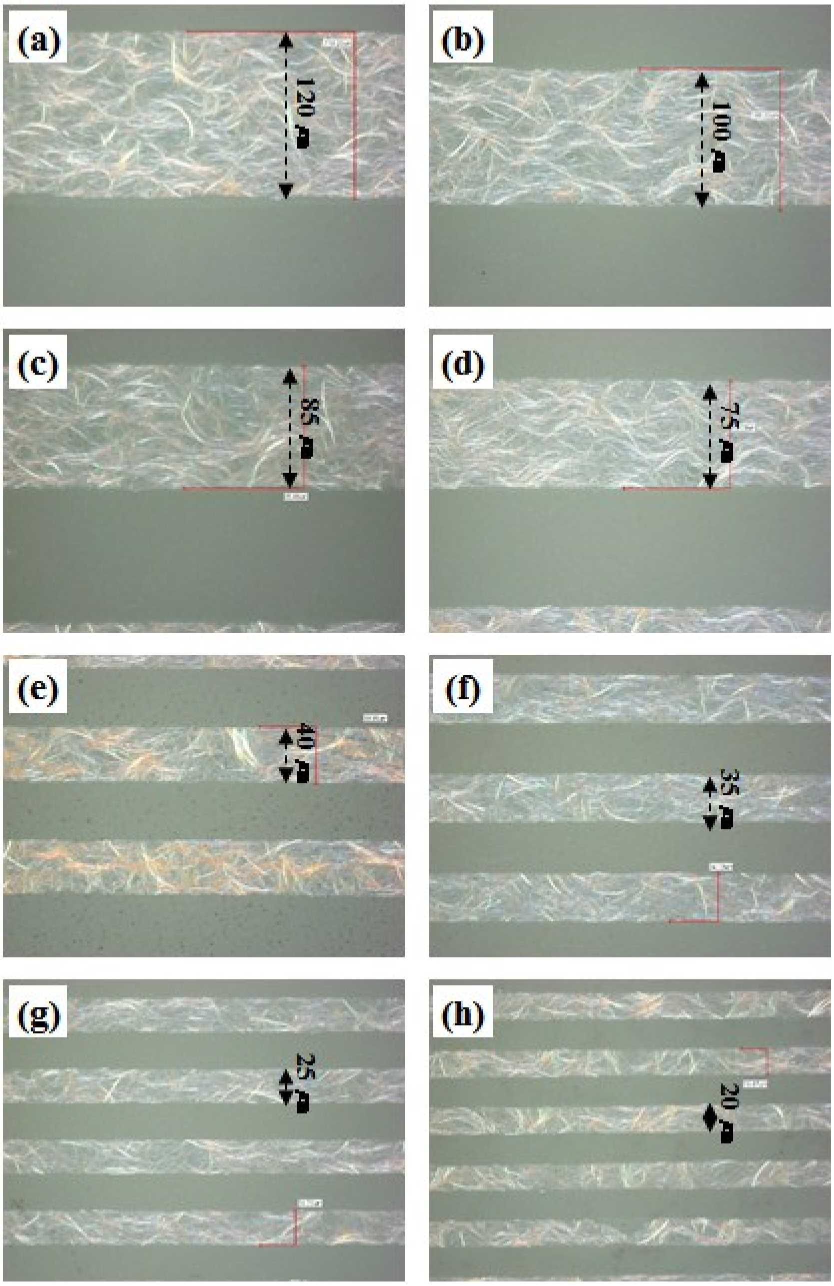

Figure S4. AgNW circuits patterned with decreasing line width: (a) 120 µm, (b) 100 µm, (c) 85 µm, (d) 75 µm, (e) 40 µm, (f) 35 µm, (g) 25 µm, and (h) 20 µm.

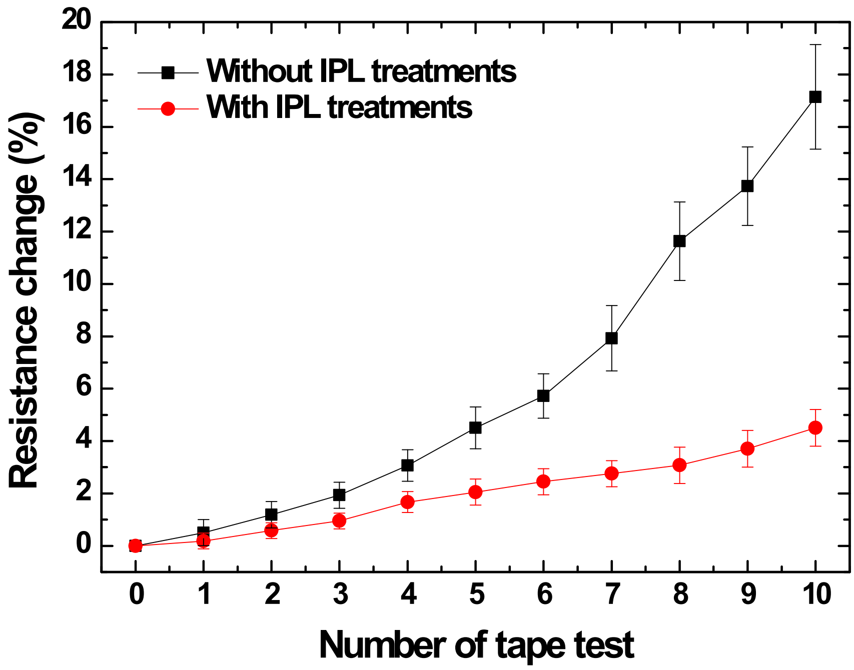

Figure S5. Effect of tape testing number on the resistance change of the AgNWs/PUU/PDMS electrodes (IPL treated and untreated samples).

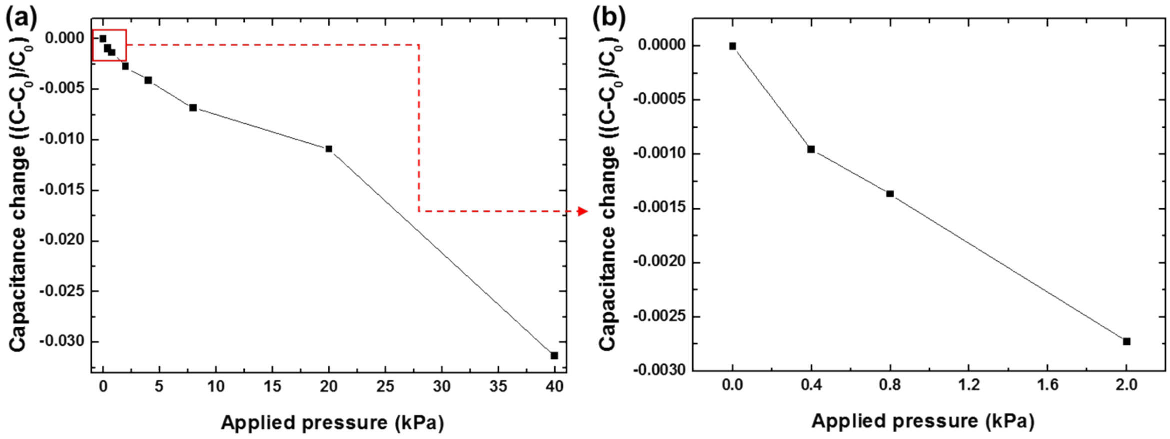

Figure S6. Measured capacitance change with increasing applied pressure: (a) Pressure was ranged from 0 to 40 kPa and (b) from 0 to 2.0 kPa.

Figure S6 shows that the capacitance changed even with a very subtle applied pressure. The pressing object was an 8 mm diameter aluminum cylinder coated with an insulation layer. This high sensitivity was originated from an instant electromagnetic coupling between the parallel electrodes and the aluminum cylinder, followed by continuous deformation of the electrodes, enabled by the softness of the supporting substrate.

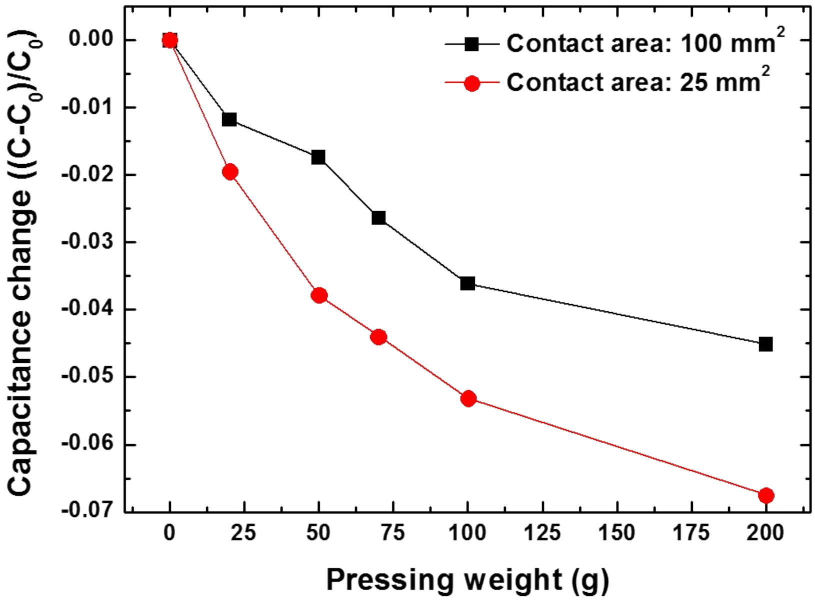

Figure S7. Capacitance change with increasing pressing weight. Two contact areas between pressing object and sensor were employed: 100 and 25 mm^2.

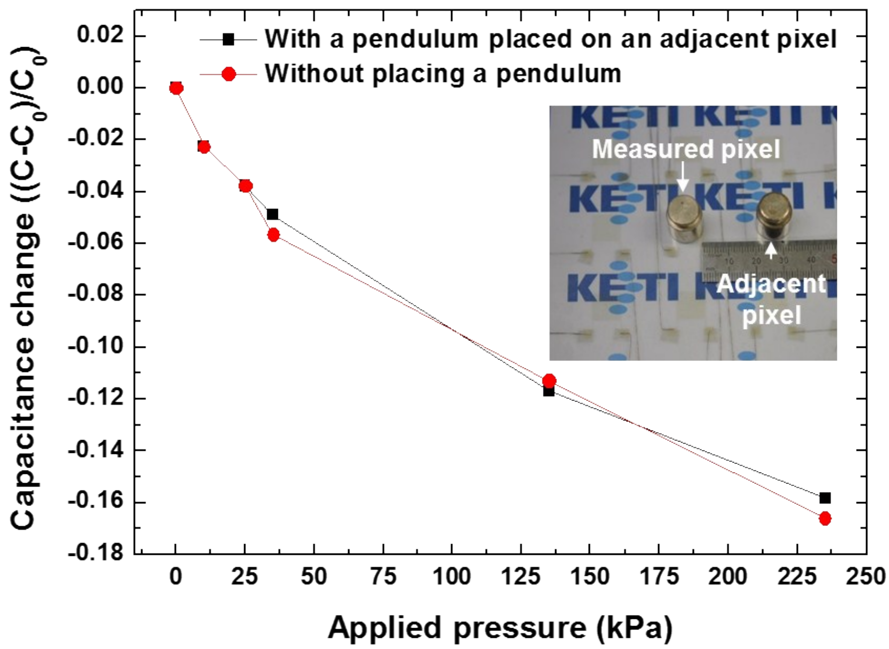

Figure S8. Measured capacitance change with and without employing a pendulum placed on an adjacent pixel to make parasitic capacitances.

The effect of adjacent pixel deformation on the capacitance change of a neighboring pixel was investigated as shown in Figure S8. For this, we placed a pendulum (in weight of 50 g) on a pixel, and then measured the capacitance change of a neighboring pixel with applying pressure.

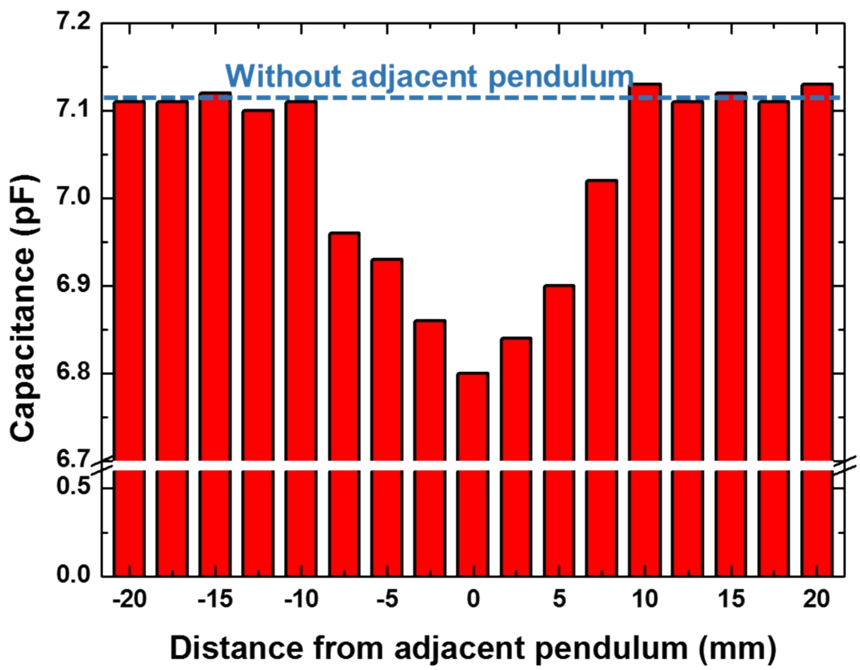

Figure S9. Measured capacitance of a pixel with employing an adjacent pendulum to make parasitic capacitances. X axis implies the distance from the adjacent pendulum.

We also investigated the effect of distance from the adjacent pendulum on the capacitance change of a neighboring pixel as shown in Figure S9. From the figure, it is known that the capacitance change was being affected by decreasing the distance to smaller than 10 mm. This result was not varied by application of current to the adjacent pixels, implying that the mechanical deformation was more dominant factor than the capacitive fringing field, affecting crosstalk between adjacent pixels.