Electronic Supplementary Information

Transparent Deoxyribonucleic Acid Substrate with High Mechanical Strength for Flexible and Biocompatible Organic Resistive Memory Devices

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Experimental

Materials

Commercially available powdered DNA sodium salt from salmon sperm (lot number EMW1909) with a broad molecular weight, ranging from 300k to 9M, was purchased from Wako (Osaka, Japan) and used without further purification. A 10 mg ml^{-1} of Ag NWs solution suspended in ethanol was purchased from Blue Nano Inc. The diameter and length of Ag NWs were 90±20 nm and 30 nm, respectively.

Cross-linking DNA powder synthesis

DNA powder (1275mg) was dissolved in 1:10 (v/v) acetic acid/ ultrapure water (25ml). The ultrapure water was purified by a Milli-Q system(Millipore, Billerica, MA, USA). The DNA solution was mixed by inversion at room temperature for 2 days to dissolve DNA completely. 2,5-hexanedione (0.310mL) and 2-picoline borane (545mg) were added to the solution. The reaction mixture was mixed at 338 K for 1hr to carry out the cross-linking reaction. The reaction was terminated by adding the cross-linked DNA(DNA-c) of an excess amount of ethanol. The precipitated DNA-c bulk was then washed with 7:3 (v/v) ethanol/ ultrapure water solution and vacuum dried at room temperature for one day.

Characterization

FT-IR spectra of the prepared films were recorded by a DIGILAB FTS-3500GX spectrophotometer. Transmittance spectra were measured by using a UV-VIS-NIR spectrophotometer (Hitachi, U4100). Sample morphology and microstructure were characterized by scanning electron microscopy (SEM; Nova NanoSEM 230) and optical microscopy (Olympus BX53). The sheet resistance was measured according to four point probe technique using a Keithley 2400. Average data were obtained from the analysis of at least 5 devices.

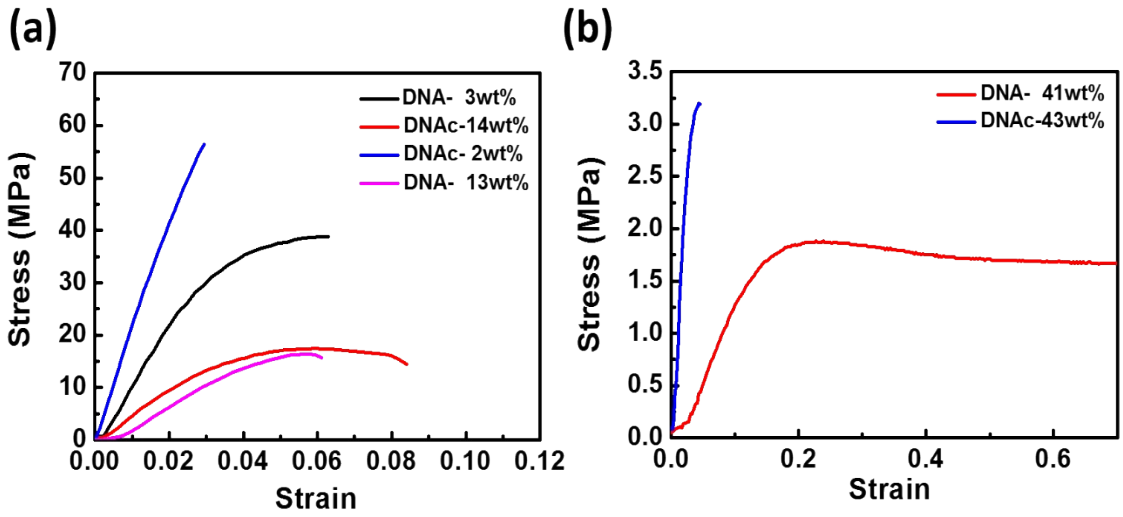

Fig. S1 Stress–strain curves of the DNAc and DNA films. (a) In low water content region, the water content of DNAc films were 2wt% and 14wt%. For DNA films were 3wt%, 13wt%. (b) In high water content region, the water content of DNAc film was 43wt% and DNA film was 42wt%, respectively.(High water content region).The measurements were performed at room temperature with a crosshead speed of 5 mm min^{-1}

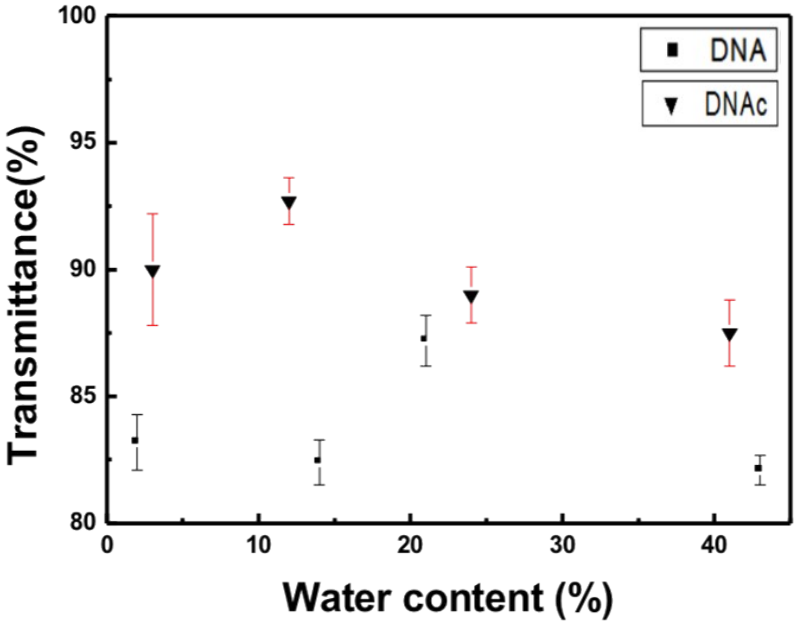

Fig.S2 (a) Transmittance at 550nm vs. Water content plot of DNA and DNAc films.

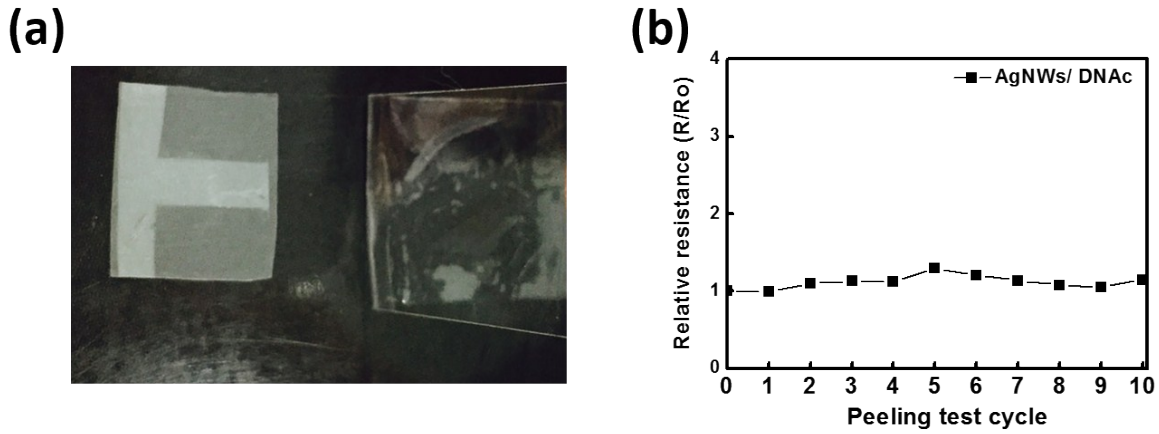

Fig.S3 The adhesion test of the AgNWs to DNAc surface monitored using the taping test. (a) Optical images of 3M scotch tape peel T-shape AgNWs/ DNAc films. (b) Variation of the sheet resistance of AgNWs/ DNAc film as a function of peeling time.