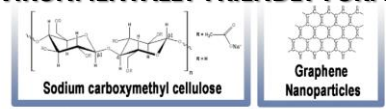


Ink Preparation

ENVIRONMENTALLY FRIENDLY FORMULATION



Sodium carboxymethyl cellulose Graphene Nanoparticles

Water + Ethanol (1:1)

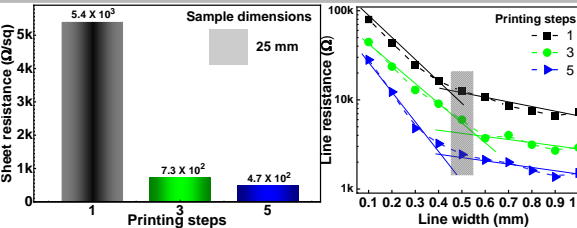
100 T mesh Dried at 100 °C

INK PREPARATION
2000 rpm for 1h

SCREEN PRINTING
Film processing

Low cost and easy to process

Electrical performance



Sheet resistance (Ω/sq)

Sample dimensions: 25 mm

Printing steps: 1, 3, 5

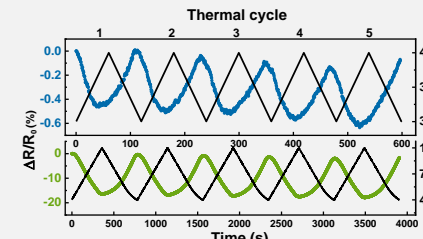
Line resistance (Ω)

Line width (mm)

- Sheet resistance of **470 Ω/sq** for 5 printing steps
- Line resistance stabilizes for **line width > 0.5 mm**

Temperature sensor

Thermal cycle



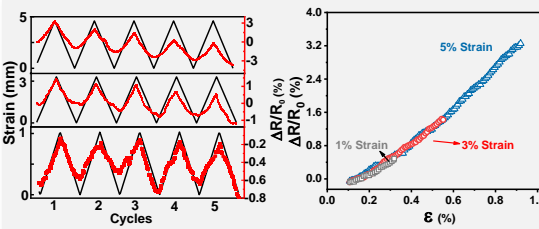
$\Delta R/R_0$ (%)

Temperature ($^{\circ}\text{C}$)

Time (s)

- Work in temperatures up to **100 °C**
- Maximum thermoresistive sensitivity of **$S = -0.27\text{ }^{\circ}\text{C}^{-1}$**

Deformation sensor



Strain (mm)

Cycles

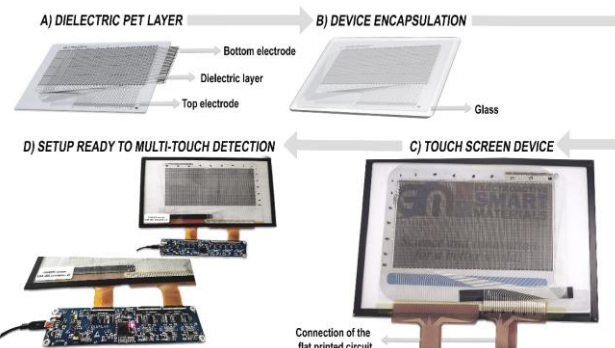
$\Delta R/R_0$ (%)

ϵ (%)

4-point-bending experiments for 1, 3 and 5 mm of deformation

- Gauge factor between **2 and 5**
- Gauge factor **< 2** = change in resistance is attributed to variations in the **intrinsic properties of the material**

8-inch multi-touch sensor



A) DIELECTRIC PET LAYER B) DEVICE ENCAPSULATION

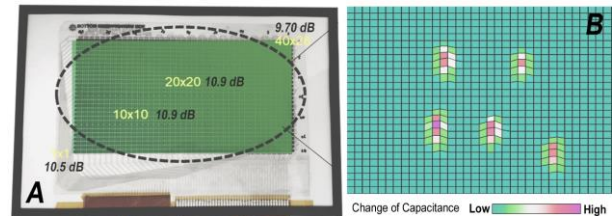
Bottom electrode Dielectric layer Top electrode Glass

D) SETUP READY TO MULTI-TOUCH DETECTION C) TOUCH SCREEN DEVICE

Connection of the flat printed circuit

40 columns × 28 rows screen-printed flexible touchscreen

Multi-touch capabilities and fast signal processing



Change of Capacitance Low High

Signal-to-noise ratio (SNR) is between 9.7 to 10.9 across the sensor

CONCLUSIONS

- Conductive graphene **water-based ink** was developed
- Functional piezo, thermo-resistive sensors and large touch sensor was created**