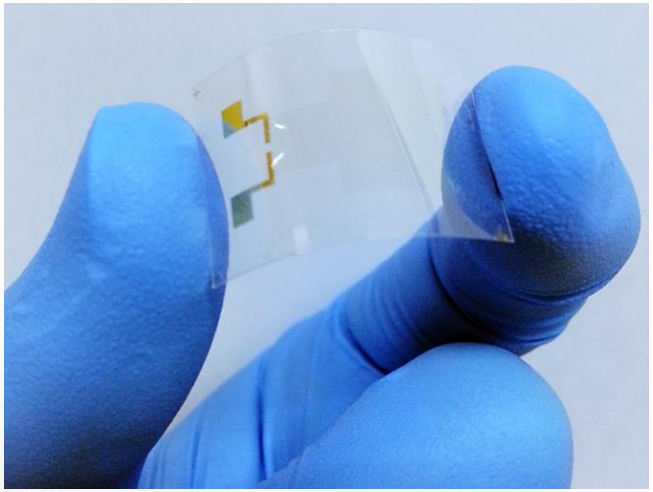
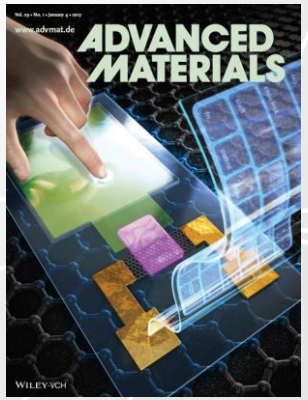
Research Results

Graphene Tribotronics for Electronic Skin and Touch Screen Applications



Adv. Mater., 29, 1603544 (2017)

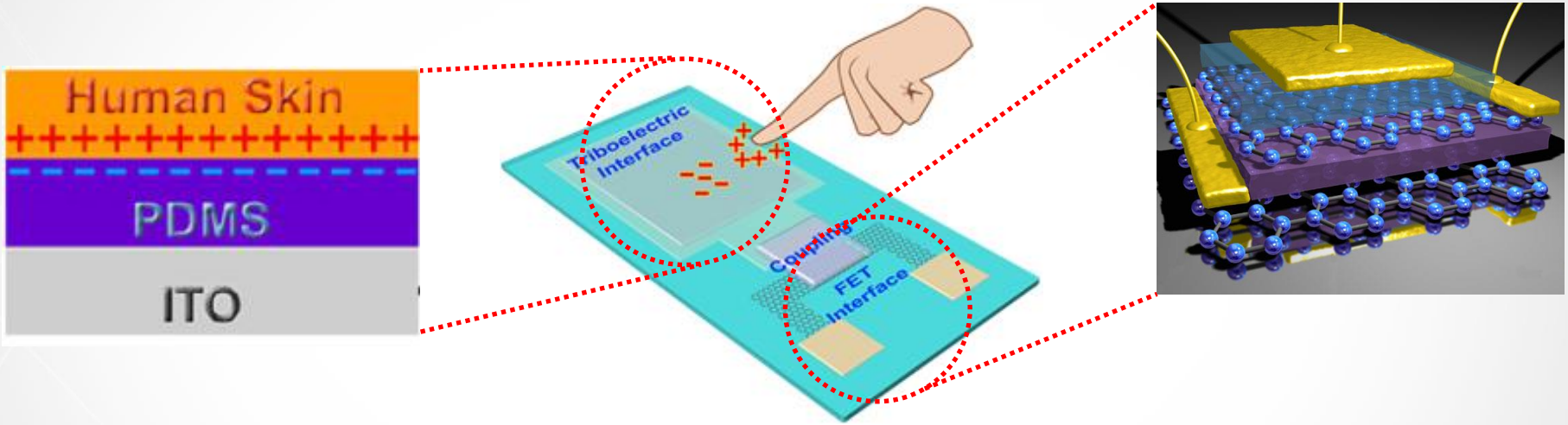


selected as a back cover

Graphene tribotronics for electronic skin and touch screen applications

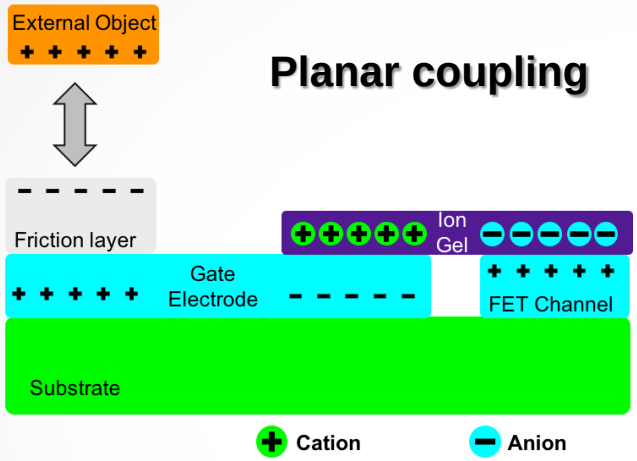
Triboelectric Generator
+
Graphene FET

Tribotronics tactile sensor



- Utilizing potential of contact as for the gate bias of FET → No additional external gate bias needed to operate the device (Standby power consumption prevention)
- Utilizing the triboelectrification between two different materials → It is possible to sensing conductor and insulator

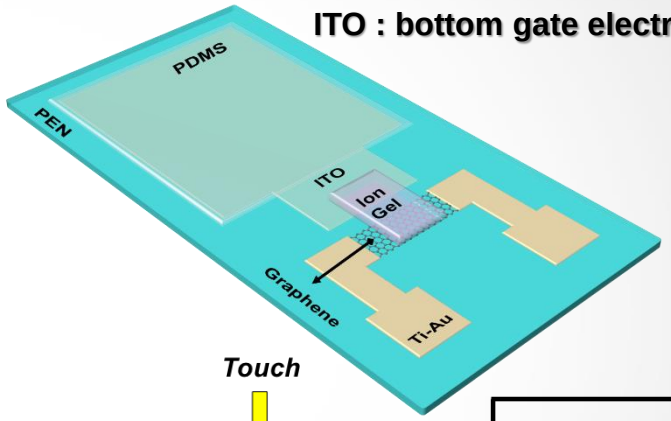
Device structure

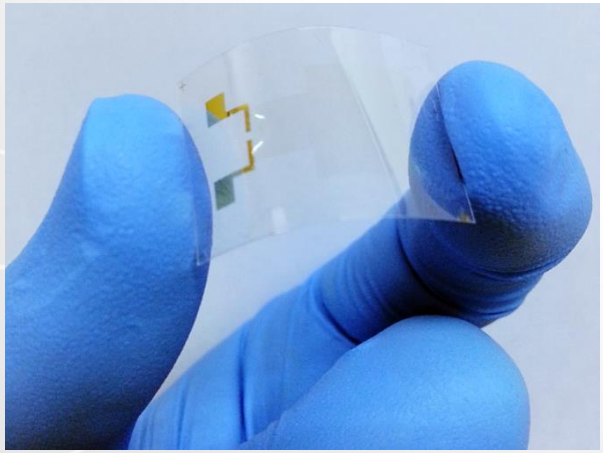


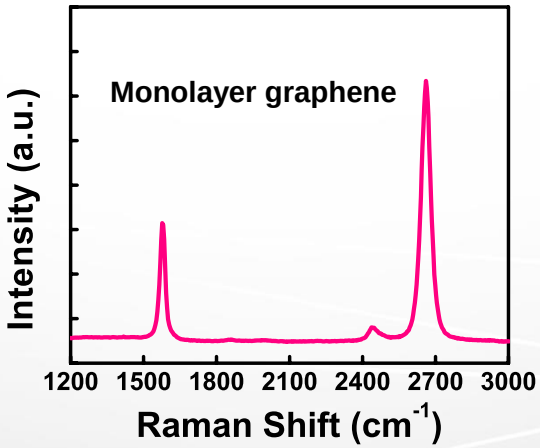
PDMS : friction layer

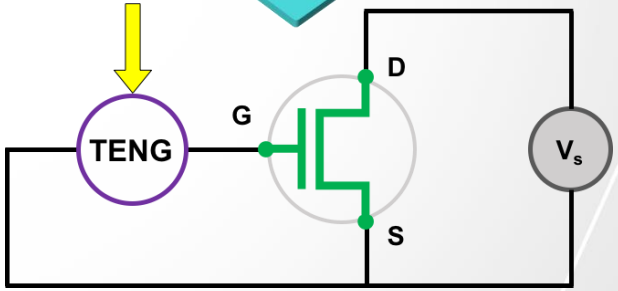
Ion gel : gate dielectric

ITO : bottom gate electrode



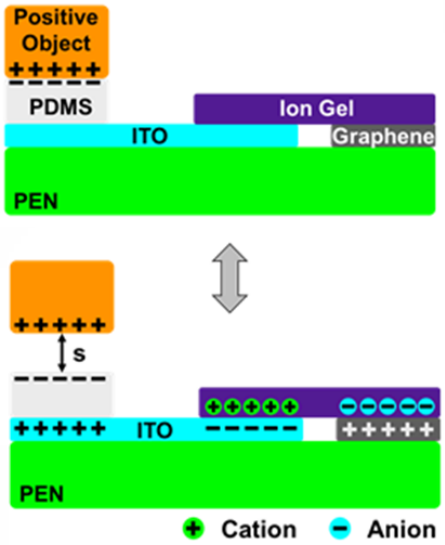


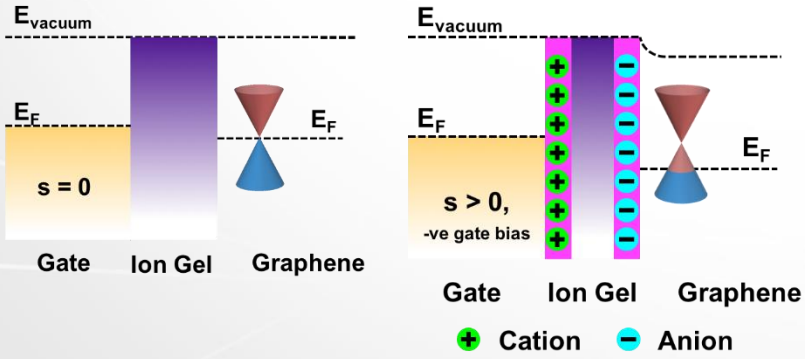




Working Mechanism

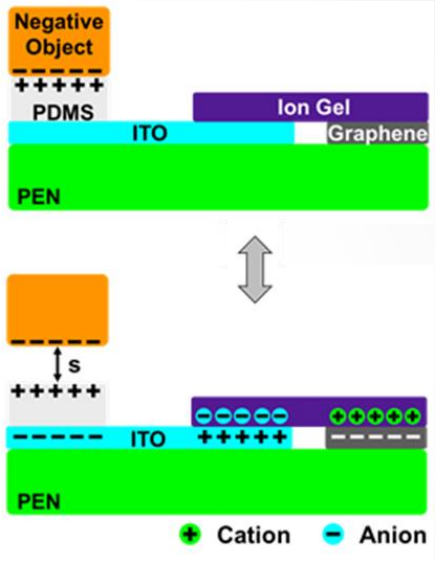
a

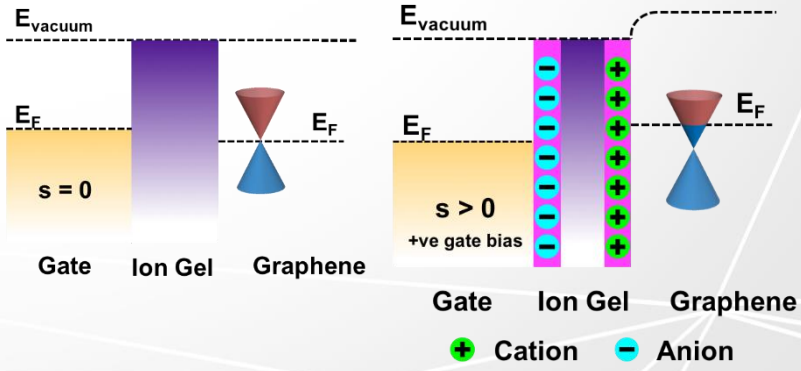




- Cations migrate to the ITO-graphene interface in order to screen the negative charges
- Anions migrate to the graphene-ion gel interface and accumulate holes in the graphene channel

b





- Positive potential is applied to the ion gel dielectric
- Electrons are accumulated in the graphene channel

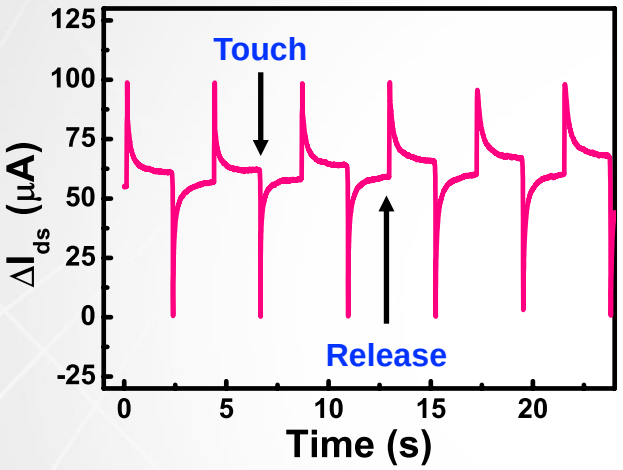
Graphene Tribotronics for Touch Screen Applications

Touch Response

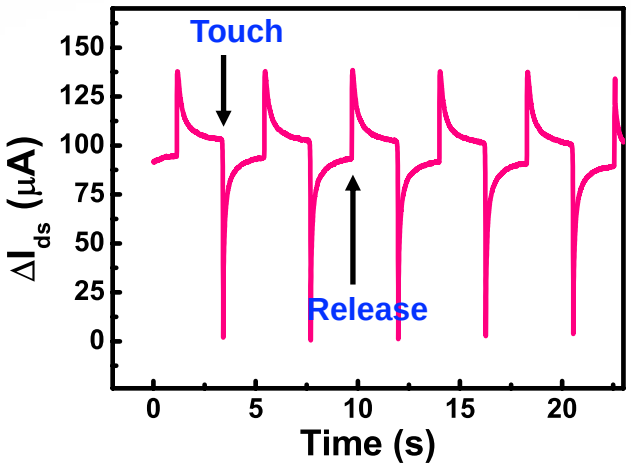
with a force of 2.9 N

V_{ds} = 0.5 V

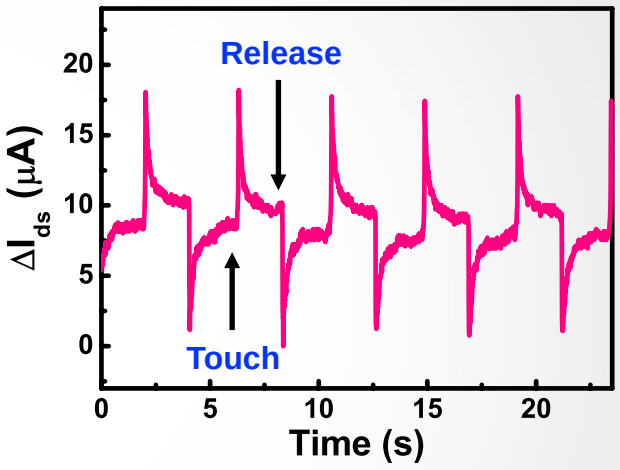
- Al

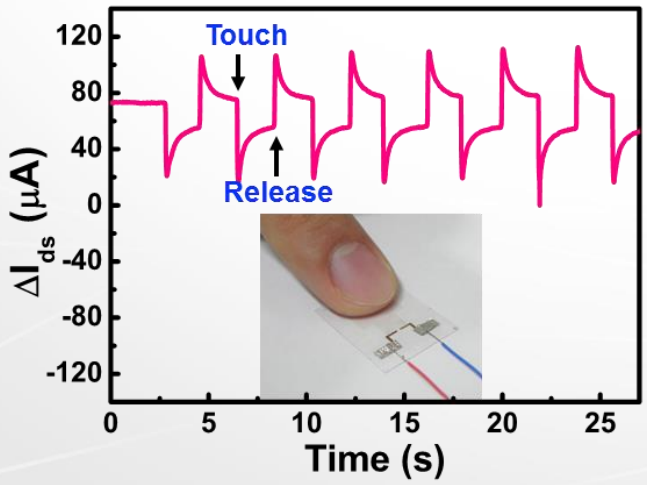


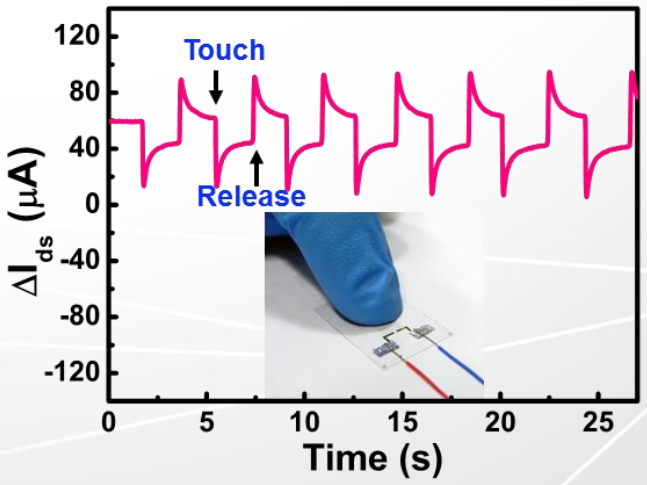
- Nylon



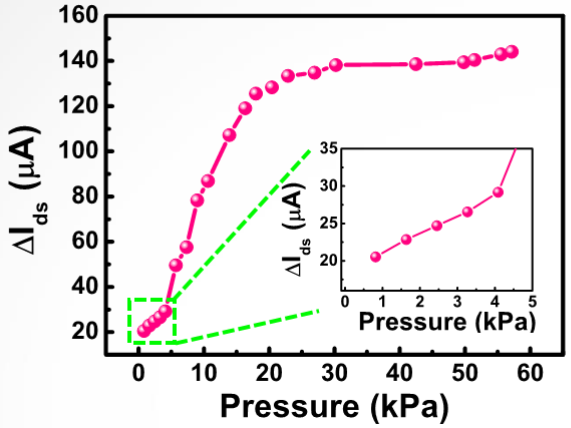
- PTFE

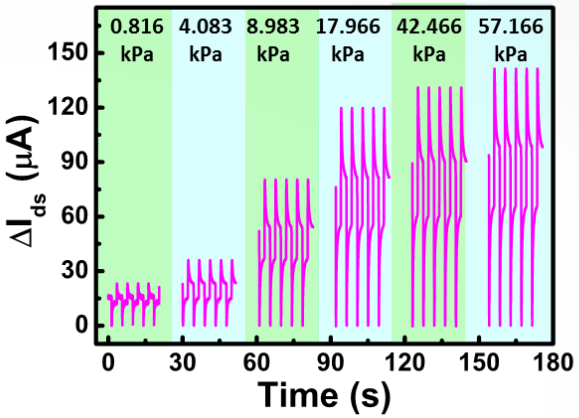




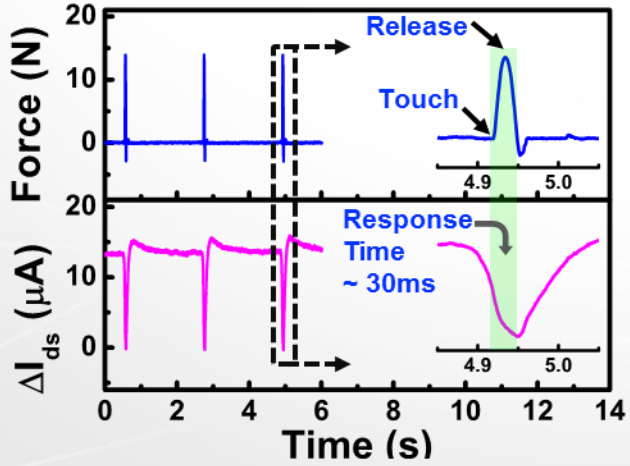


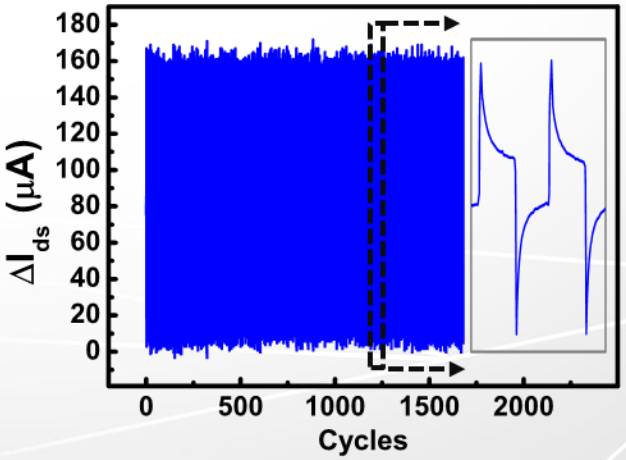
Touch Response and Stability





- Tribotronic touch sensor can detect touch stimuli as low as < 1 kPa
- Saturation in the current modulation at pressures in excess of ≈ 20 kPa is due to saturation in the triboelectric charges





Sensor Array