# Plasma Surface Modification of Graphene Sheet with Enhanced Pressure Sensing Performance

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The concept of piezoresistive effect in graphene has been previously implemented in the many kinds of graphene-based pressure sensors [1-3]. However, poor sensing capabilities of the sensors with small gauge factors, resulting from limited modified electronic bands remains a major problem for their practical use [4]. In this paper, we address the sensing problem by enhancing piezoresistive effect in the graphene sheet using a straightforward $NH_3$/Ar plasma surface modification. The changes in the graphene in terms of its morphology, structure, chemical composition, and electrical properties before and after the surface modification were investigated in detail. The electromechanical characterization demonstrated that plasma-modified graphene sheet (PGS) exhibits a significant increase in sensitivity by one order of magnitude compared to graphene sheet (GS) with a minimum detection of ~15.0 Pa. The plasma-doping introduced nitrogen (N) atoms inside the graphene structure and was found to play a significant role in enhancing the pressure sensing performance. This was due to the synergistic effect from the formation of the geometrical effect as well as the modulation of the graphene bandgap. The high sensitivity and good robustness demonstrated by the fabricated pressure sensor with the PGS suggest a promising route for simple, low-cost, and ultra-high resolution flexible sensors.

## References

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## Figures

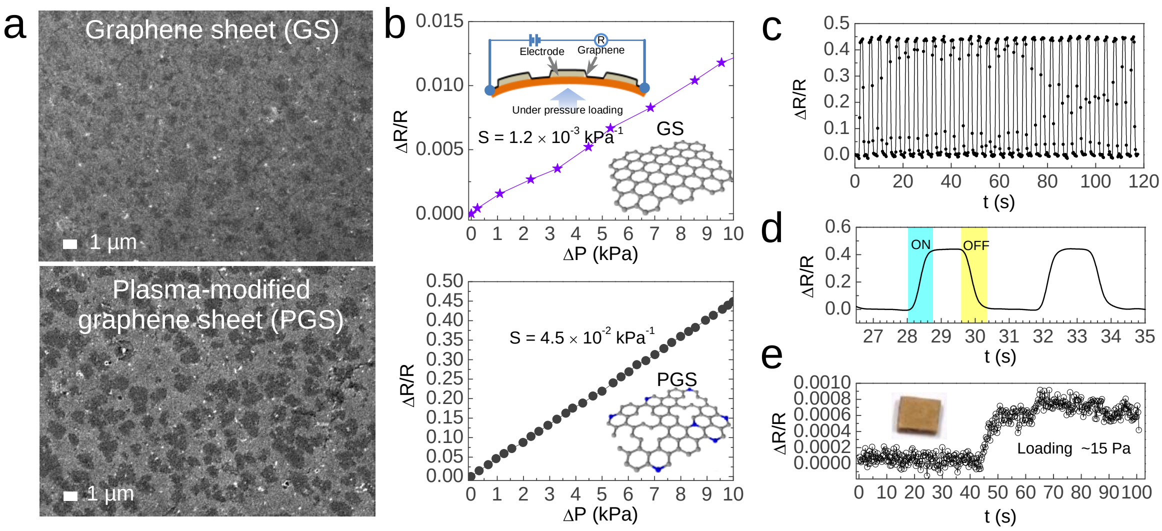


**Figure 1** (***a***) FESEM images of graphene sheet (GS) and plasma-modified graphene sheet (PGS). (***b***) Relative change in resistance of fabricated pressure sensor incorporated with GS and PGS in response to applied differential pressure. (***c-d***) Multi-cycle test of repeated loading and unloading and the response and recovery time at ~10 kPa. (***e***) Real-time response to the application of a piece of paperboard with a weight of 38.5 mg loaded on the 0.25 $cm^2$ back surface of sensor (corresponding to ~15.0 Pa)