Air-Stable Polymer-Capped Graphene Hall-Sensor

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Protecting CVD graphene from ambient exposure, provides an excellent platform for high quality graphene-based air stable electrical devices for different technological applications[1]. Polymethyl methacrylate (PMMA) is a commonly used capping layer for protecting graphene-based devices from environmental exposure[2,3]. Here, we show PMMA-capped, air-stable, and highly sensitive CVD graphene-based Hall-sensors. Detailed characterizations, including electrical and magnetic transport measurements at room temperature (RT), are performed to assess the quality of the PMMA/graphene Hall sensors. We find that as-fabricated back-gated PMMA/graphene Hall-sensors maintain, after 15 days in air, a current related RT sensitivity (S_I) up to ~ 2422 $VA^{-1}T^{-1}$, with low residual carrier density of (n^*) ~ 2.11×10^{11} cm^{-2}, and hole and electron mobility (μ) of ~ 7554 $cm^2V^{-1}s^{-1}$ and ~ 6600 $cm^2V^{-1}s^{-1}$, respectively. Furthermore, the minimum magnetic field (B_{min}) of the PMMA/graphene Hall-sensor was observed to be around ~ 2.0×10^{-3} $T/Hz^{0.5}$ after 15 days of ambient exposure. The overall performance of PMMA/graphene Hall-sensors shows minimal degradation (i.e., <7%) after 15 days of air exposure. This study contributes to the achievement of air-stable and highly-sensitive CVD graphene Hall sensors on wafer scale[4].

References

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Figures

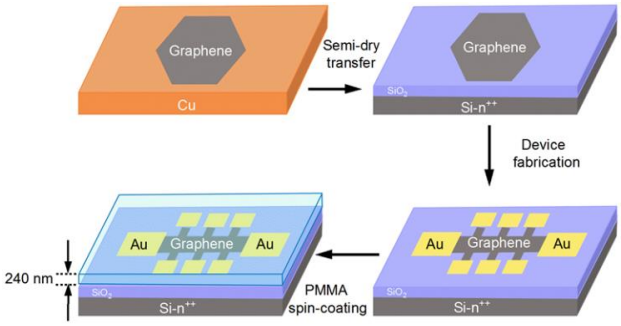

Figure 1: Schematics of graphene transfer and PMMA/graphene Hall-sensor fabrication process.

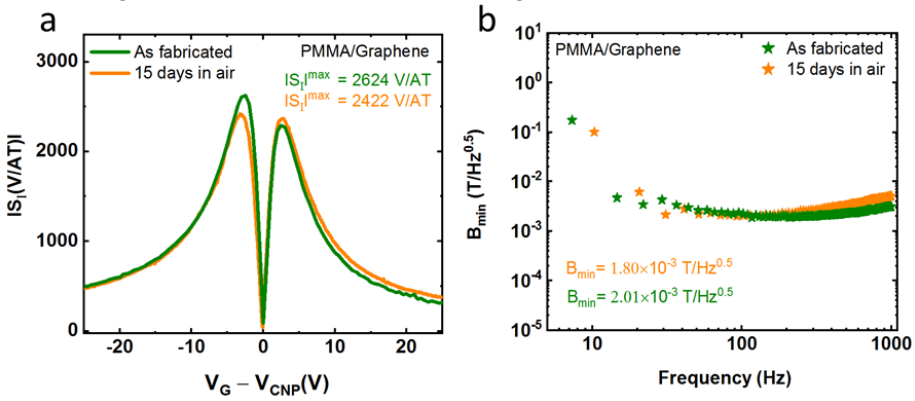

Figure 2: (a) Current related sensitivity $|S_I|$ vs gate voltage and (b) minimum magnetic field (B_{min}) vs frequency of as fabricated PMMA/graphene Hall-sensor and after 15 days of air exposure.

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