

Supplementary Materials for

# **Predicting the level of background current noise in graphene biosensor through a non-covalent functionalization process**

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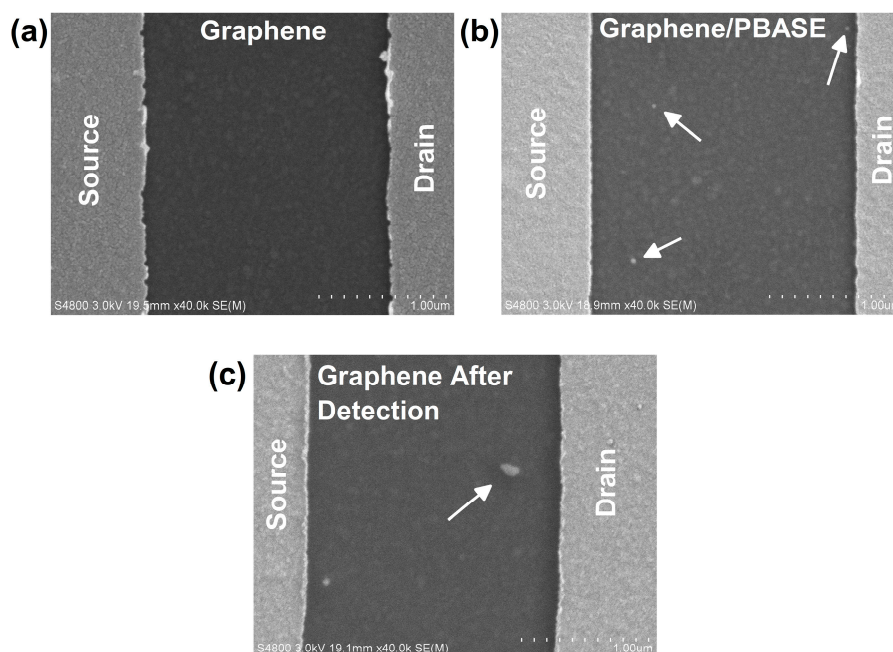
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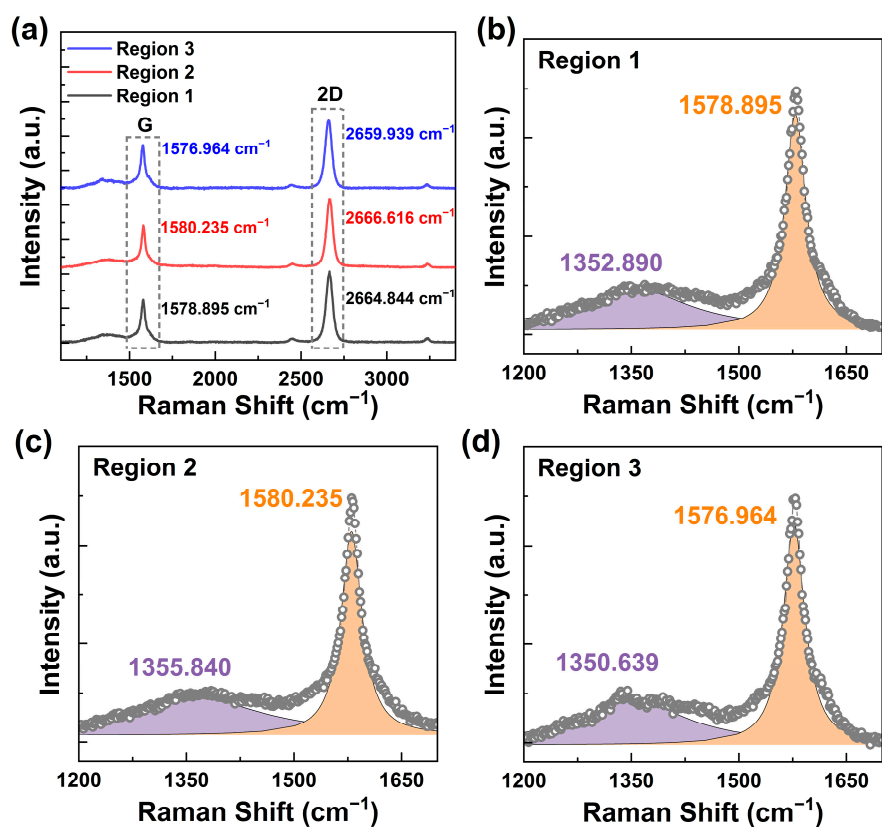
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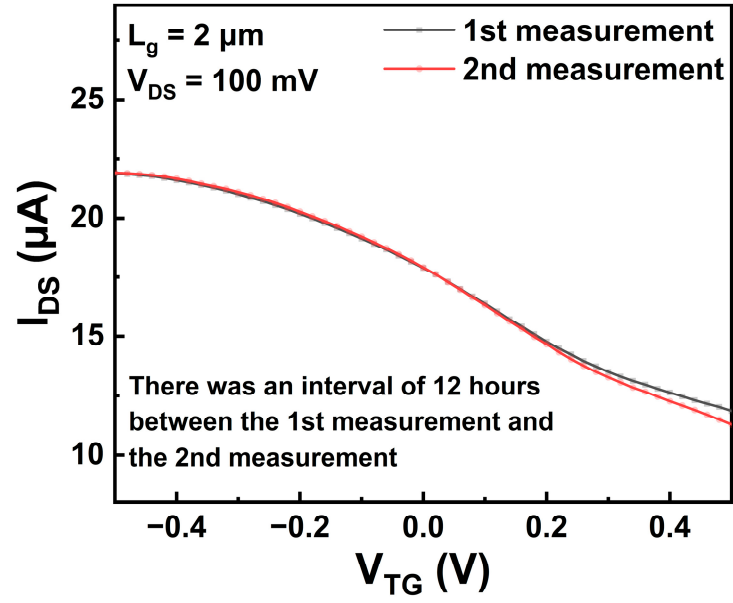
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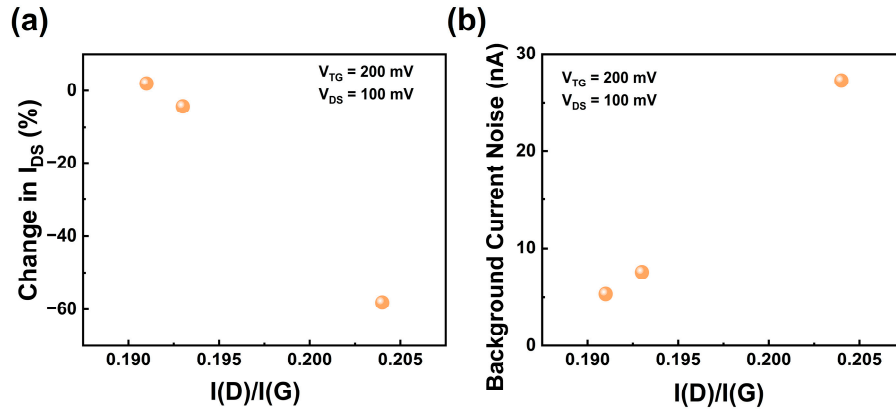
**Figure S1.** The scanning electron microscopy (SEM) images of (a) the graphene channel before the PBASE functionalization, (b) the graphene channel after the PBASE functionalization, and (c) the graphene channel after antigen detection. PBASE: 1-pyrenebutyric acid N-hydroxysuccinimide ester. The arrows in (b) mark the bright spots due to the PBASE adsorption. The arrow in (c) marks the larger bright spot due to the antigen adsorption.



**Figure S2.** (a) The Raman spectra of chemical vapor deposition-grown graphene in different regions. (b-d): the low-frequency regions in the Raman spectra in three different graphene regions: Region 1, Region 2, and Region 3, respectively.



**Figure S3.** Device transfer curves obtained from two electrical measurements performed on the same fabricated biosensor before the PBASE functionalization. There was an interval of 12 hours between the 1st and 2nd measurements.  $V_{TG}$ : gate voltage.  $V_{DS}$ : drain-source voltage.



**Figure S4.** (a) The relationship between the calculated change in the drain-source channel current ( $I_{DS}$ ) of the graphene device before and after the PBASE functionalization and the D to G peak intensity ratio ( $I(D)/I(G)$ ) in Raman spectra. (b) The relationship between the estimated background current noise of the biosensor and the  $I(D)/I(G)$  in Raman spectra.