

Supplementary Material

**Sensing Ability and Formation Criterion of Fluid Supported Lipid  
Bilayer Coated Graphene Field-Effect Transistors**

Shu-Kai Hu, Fang-Yen Lo, Chih-Chen Hsieh, and Ling Chao\*

Department of Chemical Engineering, National Taiwan University, Taipei, Taiwan

**The derivation of the Dirac point shifts of SLB coated GFETs induced by the adsorption of charged analytes on the SLB.**

The shift of the Dirac point is due to the local potential change [47], which is caused by the adsorption of SA molecules:

$$\Delta V_{D.P.} = \Delta\varphi \quad \text{Eq. S1}$$

The potential change through the aqueous solution from the SA layer to the location of the GFET can be illustrated by the Debye–Hückel model, which states that the electrical potential decays exponentially in an electrolyte solution [47]:

$$\varphi_d = \varphi_d^0 e^{\frac{z}{\lambda_D}} \quad \text{Eq. S2}$$

where  $\varphi_d^0$  is the potential at the SA layer,  $z$  is the distance from the SA layer, and  $\lambda_D$  is the Debye length. In addition,  $\varphi_d^0$  can be obtained by the Graham equation:

$$\varphi_d^0 = \frac{2k_B T}{e} \sinh^{-1} \left( \frac{\sigma}{\sqrt{8I\epsilon\epsilon_0 k_B T}} \right) \quad \text{Eq. S3}$$

where  $\sigma$  is the surface charge of the SA per area and  $I$  is the ionic strength. By substituting Eqs. S2 and S3 into S1, we can obtain the equation needed to describe the relationship between the Dirac point shift and the SA surface charge.

$$\Delta V_{D.P.} = \frac{2k_B T}{e} \sinh^{-1} \left( \frac{\sigma}{\sqrt{8I\epsilon\epsilon_0 k_B T}} \right) e^{\frac{-z}{\lambda}} \quad \text{Eq. S4}$$