Molecular Detection in Liquid by Graphene Hall Measurement

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Abstract

This work presents a very sensitive technique to detect molecules in low concentration solution by introducing the method of liquid gated Hall measurement. L-Histidine of different concentration in pM range and urea in μM range are measured separately. The results show very good sensitivity in both solutions, while the conventional amperometric and potentiometric techniques do not show satisfactory responses. The possible detection mechanism includes charged impurity scattering, chemical doping, dielectric screening processes, and so on. The ability of measuring very low concentration electrolyte using this method definitely provides a promising future for both experimental and theoretical study of applying this method in bio-sensing.

References

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Figures

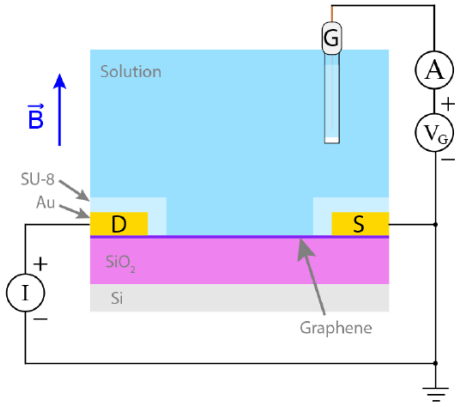

Figure 1: Schematic diagrams of the setup of liquid gated Hall measurement, where G is the gate (Ag/AgCl electrode), I, V_G and A are constant current source, gate voltage source, and ammeter, respectively.

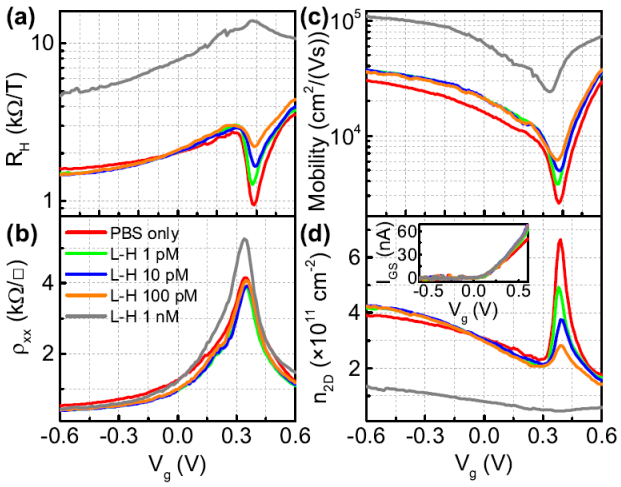

Figure 2: Detection of L-Histidine by liquid gated Hall measurement of graphene at pM concentration with PBS(10^{-2}X) as the supporting electrolyte. (a), Hall resistance R_H, (b), sheet resistance ρ_{xx}, (c), mobility μ, and (d), total carrier density n_{2D} as a function of gate voltage V_G (Inset: gate-source current I_{GS} as a function of V_G).