Multi-Virus Detection by Graphene FET Biosensor Modified with Various Antibodies

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Abstract

Multi-virus detection was realized by the graphene FET(GFET)[1] modified with 3 kinds of antibodies. 3 kinds of viruses were introduced into the systems in series and Dirac point shift was monitored, and succeeded in detecting the individual viruses in high sensitivity . GFET has the interdigital electrodes shown in Fig. 1(a) and the gate length and the width are 10 um and 400 um, respectively. These 32 GFETs are integrated in one Si chip to form the GFET arrays as shown in Fig. 1(b). 3 kinds of antibodies(Ab.) such as SARS-CoV-2 Ab., Influenza virus(H9N2) Ab., and RS virus Ab. are modified on the GFET arrays using PBASE as a linker as shown in Fig. 1(c). Micro fluidic channel was put on GFET array to introduce PBS and 3 kinds of viruses. Figure 2 shows the dependence of Dirac point shift on time when (a) RS virus of 3.68×10^5 and 3.68×10^6 FFU/mL, (b) SARS-CoV-2 of 1.0×10^6 and 1.0×10^7 FFU/mL, and (c) Influenza virus(H9N2) of 10.2, 102, and 1024HAU were introduced into GFET arrays modified by 3 kinds of antibodies. After the introduction of RS viruses, (a)Dirac points shift up to 8.64 mV and 13.1 mV, respectively. After the introduction of SARS-CoV-2, (b)Dirac points shift up to 4.48 mV and 9.52 mV, respectively. After the introduction of Influenza viruses, Dirac points shift up to 2.07 mV, 6.90 mV, and 8.98 mV, respectively. Thus, using the GFET arrays modified with the 3 kinds of antibodies, the corresponding 3 kinds of viruses are successfully detected selectively.

References

[1] K. Yamamoto, et.al., *Jpn. J. Appl. Phys.* (2024) 63 016502

Figures

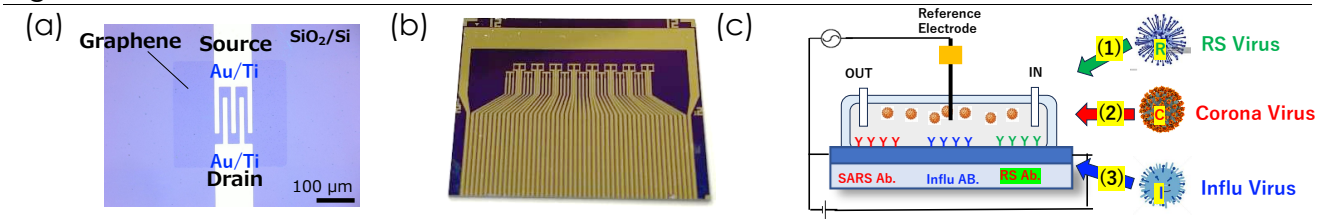

Figure 1: The optical image of (a) G-FET (b) 32 integrated GFET array.(c)GFET modified by antibodies.

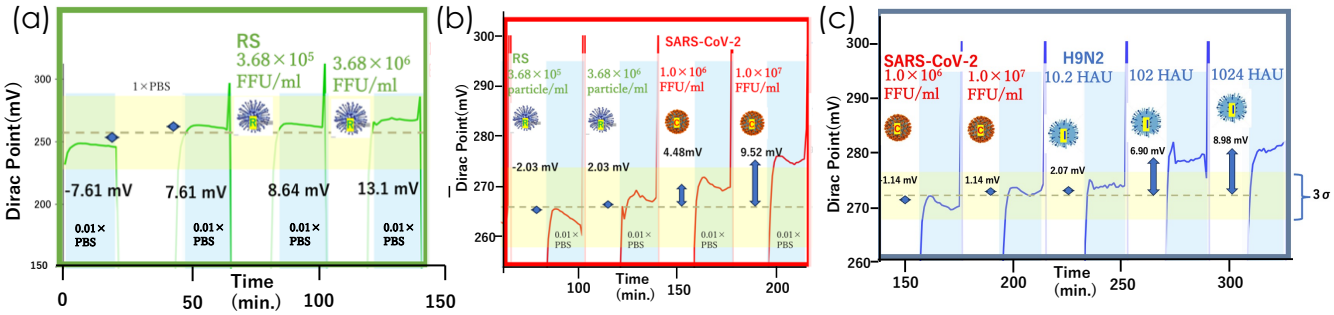

Figure 2: Dirac point shifts after introduction of 3 kinds of viruses into each antibody modified GFETs.