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Investigations into Sensitivity of Novel COVID-19 Biosensor

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The COVID-19 pandemic necessitated the quick production of PCR tests and rapid antigen tests to diagnose a quick uptake in cases. However, the current diagnostic tests have less than desired sensitivity or too long a wait time until complete diagnosis. The Daniels lab previously constructed a biosensor to detect COVID-19 by immobilizing COVID-19 spike protein polyclonal antibody onto quasi-freestanding epitaxial graphene (QFS-EG) to detect the spike protein antigens of the virus. This biosensor is able to detect COVID-19 spike protein antigens with concentrations as low as 1 ag/mL. However, the reason behind this sensor's extreme sensitivity was yet to be understood. To better understand this sensitivity, we constructed biosensors out of hexagonal boron-nitride on graphene(h-BN-g), a material comparable to QFS-EG. As opposed to a complete left-shifting of the G peak of the graphene as found in the QFS-EG biosensor with each additional layer added to the sensor, there was only a partial left shifting of the G peak in the h-BN-g biosensors. This points to a limited functionality of the graphene in the h-BN-g biosensors, due to an absence of the same strain interactions that exist between the QFS-EG and its SiC substrate. Thus, we conclude that the QFS-EG heterostructure is the optimal one for detecting COVID-19 and can be used in the future to detect other viruses.

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