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Biosensing application using nanopores formed by dielectric breakdown of h-BN

Dielectric breakdown is a physical phenomenon observed when applied voltage exceeds dielectric strength of insulator. In case of insulating films, it is known that nanopores can be formed caused by dielectric breakdown, which can be used widely for biosensor applications. One of the techniques to form nanopores is using dielectric breakdown of insulating films, which can be simple in comparison with other methods. In this study, hexagonal boron nitride (h-BN) with thicknesses in the range of 10 to 40nm was used for nanopores formation. In order to observe the dielectric breakdown, an insulating film was inserted between two completely isolated chambers, and potassium chloride (KCl) solution was filled in the chamber. After that, we could observe dielectric breakdown of the insulators after elapsed time when a specific voltage is applied to insulating films. Some molecules can pass through nanopores and generate unique signals as they go through the pores. Furthermore, we could observe the translocation of DNA through nanopores formed by dielectric breakdown and this can be applied to the development of nanopore-based biotechnologies.

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