Abstract Submitted
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Anisotropic Dielectric Breakdown of Hexagonal Boron Nitride Film[1] YOSHIAKI HATTORI, The University of Tokyo, TAKASHI TANIGUCHI, KENJI WATANABE, National Institute for Materials Science, KOSUKE NAGASHIO, The University of Tokyo and PRESTO-JST — Hexagonal boron nitride (h-BN) is considered as ideal substrate for 2D material devises. However, the reliability of insulating properties of h-BN itself has not been clarified yet. In this study, the anisotropic dielectric breakdown of h-BN is studied. We have found that the dielectric breakdown in *c* axis direction using a conductive atomic force microscope proceeded in the layer-by-layer manner. The obtained dielectric field strength was ˜12 MV/cm, which is comparable to the conventional SiO_2. On the other hand, to estimate the dielectric field strength in a direction perpendicular to *c* axis, voltage is applied to a relatively thick h-BN (10-60 nm) through Cr/Au electrodes fabricated on the h-BN. We realized that the absorbed water on h-BN significantly affect the *IV* characters and the breakdown voltage. After the adsorbed water was removed by the heating in vacuum, the dielectric field strength was determined to be ˜3 MV/cm, which is the same order as that in *c* axis direction. This value could be increased when we consider the effect of electric field concentration around the metal electrode. Although the large difference in dielectric filed strength for two directions was initially expected due to the highly-anisotropic layered structure with the van der Waals bonding, it was not the case because the sp2 bonding should be broken for dielectric breakdown regardless of its direction.

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