

# Potential Applications of Hexagonal Boron Nitride

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Large-scale growth of high-quality hexagonal boron nitride (h-BN) has been a challenge in two-dimensional (2D)-material-based electronics. In this presentation, I demonstrate wafer-scale and wrinkle-free epitaxial growth of multi-layer h-BN on a sapphire substrate by using high-temperature and low-pressure chemical vapor deposition.[1] Microscopic and spectroscopic investigations and theoretical calculations reveal that synthesized h-BN has a single rotational orientation with Bernal stacking order. A facile method for transferring h-BN onto other target substrates were developed, which provides the opportunity for using h-BN as a substrate in practical electronic circuits. A graphene field effect transistor fabricated on our h-BN sheets shows highly improved carrier mobility, because the ultra-flatness of the h-BN surface can reduce the substrate-induced degradation of the carrier mobility of 2D materials. Afterwards, I show some potential applications of h-BN for a shell layer capping Au nanoparticles in surface-enhance Raman scattering [2], an encapsulation (or passivation) layer to protect unstable transition metal dichalcogenides (TMDs) [3], and a proton exchange membrane to replace the Nafion film in a polymer electrolyte membrane (PEM) fuel cell.

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References

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- [1] A-Rang Jang *et al.*, *Nano Letters*, 16 (2016) 3360
- [2] Gwangwoo Kim *et al.*, *ACS Nano*, 10 (2016) 11156
- [3] Seongjoon Ahn *et al.*, *ACS Nano*, 10 (2016) 8973