# Graphite/h-BN van der Waals heterostructure as a gate stack for HgTe quantum wells

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## Abstract

Two dimensional topological insulators have attracted much interest due to their potential applications in spintronics and quantum computing. To access the exotic physical phenomena, a gate electric field is required to tune the Fermi level into the bulk band gap. Hexagonal boron nitride (h-BN) is a promising alternative gate dielectric due to its unique advantages such as flat and charge-free surface. Here we present a hexagonal boron nitride/graphite van der Waals heterostructure as a top gate on HgTe heterostructure-based Hall bar devices. We compare our results to devices with h-BN/Ti/Au and $HfO_2$/Ti/Au gates. Devices with a h-BN/graphite gate show no charge carrier density shift compared to as-grown structures, in contrast to a significant n-type carrier density increase for $HfO_2$/Ti/Au. We attribute this observation mainly to the comparable work function of HgTe and graphite. In addition, devices with hexagonal boron nitride gate dielectric show slightly higher electron mobility compared to $HfO_2$-based devices. Our results demonstrate the compatibility between layered materials transfer and wet-etched II-VI semiconductor heterostructures and provide a strategy to solve the issue of significant shifts of the carrier density in gated HgTe heterostructures.

## References

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[2] Calvo, M. et al. Physical Review Letters 2017, 119, 226401.
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## Figures

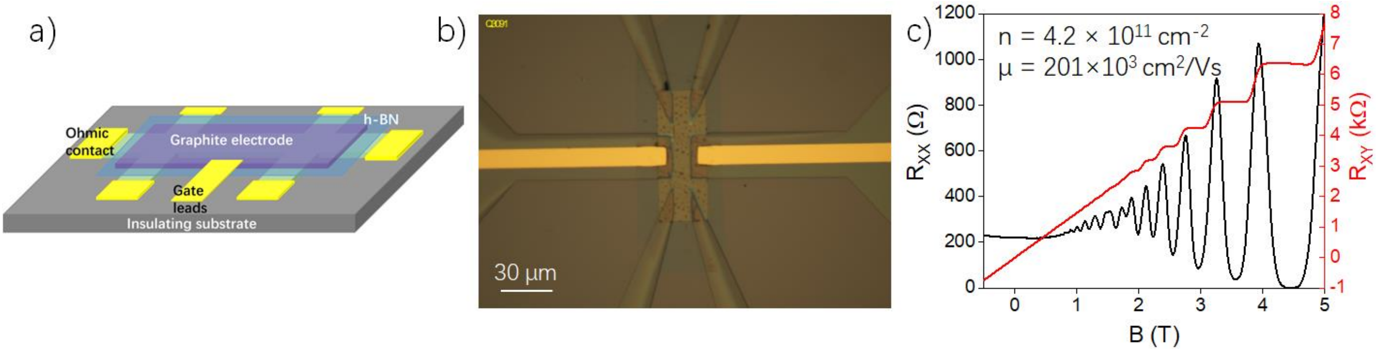

**Figure 1:** a) Schematic drawing of a Hall bar device. b) Optical image of h-BN/graphite gated Hall bar device. c) Longitudinal (black) and Hall (red) resistance as a function of magnetic field of h-BN/graphite gated device.