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Intrinsic transport of h-BN encapsulated few-layer black phosphorus GHIDEWON AREFE, YOUNG DUCK KIM, DANIEL CHENET, XU CUI, DAMIEN CHANG, JAMES HONE, Columbia University — Few-layer black phosphorus (BP) is an exciting two-dimensional material with ambipolar behavior, large on/off ratio, and high mobility with a direct bandgap. The anisotropic atomic nature of black phosphorus exhibits unique angle dependent electronic and optical features. One of the primary difficulties in fabricating few-layer BP devices to study transport is the reactive nature of the material in ambient conditions as it degrades in the presence of air and moisture. In order to characterize the intrinsic physical properties of BP, we fabricated few-layer BP flakes that are fully encapsulated by hexagonal boron nitride (h-BN) with a clean stacking technique. We also characterized the electrical transport of h-BN encapsulated BP devices that show greatly improved environmental stability and high mobility at low temperature due to the suppression of extrinsic scattering effects such as charge impurities, surface polar optical phonons, and absorbents from air. H-BN encapsulated BP devices will be an essential platform for the observation of new physics from BP and realization of BP based advanced opto-electronic application devices body.

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