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Characterization of Interface States in Black Phosphorus Capacitors with Various Gate Dielectrics JIALUN LIU, WENJUAN ZHU, Univ of Illinois - Urbana Champaign — Interfaces and gate dielectrics in two-dimensional (2D) materials-based electronic devices are critical for the performance. In this work, we systematically studied the interface between black phosphorus (BP) and gate dielectrics, including hexagonal boron nitride (hBN) and aluminum oxide (Al_2O_3), using capacitance and AC conductance methods measured at various temperatures. We found that the interface state density in BP/hBN capacitors is one order of magnitude lower than that in BP/ Al_2O_3 capacitors, indicating superior quality of hBN crystals. In addition, we found that as the temperature decreases, the interface trap density extracted from ac conductance decreases due to the reduced trap emission/capture rate. For both BP/hBN and BP/ Al_2O_3 capacitors, the capacitance–voltage (CV) characteristics show that the accumulation occurs when a positive bias is applied on the black phosphorus terminal, indicating that the black phosphorus is naturally p-type doped. This work systematically characterizes interface trap density in the black phosphorus capacitors and provides a new approach for monitoring the interface quality and improving the performance of 2D materials devices.

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