

Superior Chemical Sensing Performance of Black Phosphorus

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We investigated the superior chemical sensing ability of black phosphorus (BP) comparing with representative 2D materials. In order to understand the sensing performance of materials without any other control factors, identical fabrication process was prepared with similar flake size distribution and film morphology. The sensing results onto various gases showed that BP possessed about tens of times higher molar response factor and response time than that of MoS₂ and graphene. In addition, only BP showed highly selective response to NO₂ and unresponsive to oxygen functionalized molecules. Theoretical calculations based on density functional theory indicate that the superior sensing of the BP can be attributed to the higher molecular adsorption energy. In addition, ambient stability of our exfoliated BP sensor showed strong potential for practical sensing applications. With these superior properties in hand, it is anticipated that BP can lead the nano-sensing devices in the nearby future.