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Black Arsenic-Phosphorus: Layered Anisotropic Infrared Semiconductors with Highly Tunable Compositions and Properties BILU LIU, CHONGWU ZHOU, University of Souther California — 2D layered materials with diverse properties have attracted significant interest in the past decade. The layered materials discovered so far have covered a wide, yet discontinuous electromagnetic spectral range from semimetallic graphene, insulating boron nitride, to semiconductors with bandgaps from middle infrared to visible light. Here, we introduce new layered semiconductors, black arsenic-phosphorus (b-AsP), with highly tunable chemical compositions and electronic and optical properties. Transport and infrared absorption studies demonstrate the semiconducting nature of b-AsP with tunable bandgaps, ranging from 0.3 to 0.15 eV. These bandgaps fall into long-wavelength infrared (LWIR) regime and cannot be readily reached by other layered materials. Moreover, polarization-resolved infrared absorption and Raman studies reveal in-plane anisotropic properties of b-AsP. This family of layered b-AsP materials extend the electromagnetic spectra covered by 2D layered materials to the LWIR regime, and may find unique applications for future all 2D layered material based devices. Ref. Liu, B., et al., Black Arsenic-Phosphorus: Layered Anisotropic Infrared Semiconductors with Highly Tunable Compositions and Properties. Adv. Mater., 2015, 27, 4423-4429.

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