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Chemically Controlling Black Phosphorus Exfoliation to Achieve Variable-Sized Phosphorene[1] AMY NG, THOMAS SUTTO, US Naval Research Laboratory, YEXIN DENG, Purdue University, RHONDA STROUD, TODD BRINTLINGER, US Naval Research Laboratory, PEIDE YE, Purdue University, NABIL BASSIM, US Naval Research Laboratory — Phosphorene is the 2-dimensional form of phosphorus and a close relative of graphene. It has a nonzero fundamental band gap that gives rise to semiconductor properties, which makes it highly desirable for numerous applications in optoelectronics and as a replacement channel for conventional semiconductor devices. However, difficulties in isolating large area single-, few-, or multi-layer sheets are an impediment to realizing the aforementioned applications. We are investigating multiple chemical routes for optimal production of phosphorene sheets. Utilizing various solvent systems, ranging from a simple ethanol to dimethylformamide to more viscous ionic liquids, we have obtained flakes of differing thicknesses and sizes. We characterized the structure and composition of the resulting phosphorene sheets with aberration-corrected scanning transmission electron microscopy in addition to optical/macroscopic studies. Flake size, quality, and quantity obtained as a function of the solvent system, where factors such as viscosity, surface tension, chemical behavior, and degree of agitation, will be presented.

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Amy Ng
US Naval Research Laboratory

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