Chemical intercalation, exfoliation, and functionalization of hBN materials

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Introducing alkali metal atoms between the carbon layers of graphite to form graphite intercalation compounds (GICs), can tune the interlayer spacing and charge the graphite host through a variety of electronic ground states. Hexagonal boron nitride (hBN) is another prototypical layered material and possesses a hexagonal network consisting of B and N atoms. Because of its structural similarity to graphite, there has been several theoretical calculations predicting host-guest redox-driven hBN intercalation compounds. Based on the analogy with GICs, the hybrid structure of hBN and alkali metal atoms that are intercalated into the interlayer spacing may also exhibit interesting electronic properties and utility as a raw material for 2D materials with unprecedented physicochemical properties. However, the intercalation of alkali metal in hBN has proven to be considerably more difficult than graphite. Here, we will present our latest experimental data, showing that potassium metal can be intercalated into hBN layers. The K-intercalated hBN material is readily dispersible and exfoliable in polar aprotic organic solvents to form suspensions of negatively charged hBN nanosheets.