Universal method for preparing two-dimensional metal dihalides

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Abstract

Crystal in a reduced dimension exhibits extraordinary characteristics that bring important insights into materials properties and ways to develop high efficiency devices. Being in atomic thicknesses, two-dimensional (2D) materials have revolutionized the materials science and opened a new era for 2D devices (1, 2). Metal halide is an exceptional group of layered materials received extensive attention in the recent decade as a promising 2D system to access low-dimensional physics. While there are several literature reports on the metal trihalide, there has been an increase in the reports on metal dihalide family - a group of layered materials which have excellent electrical and magnetic characteristics that are predicted theoretically to be sustained down to the two-dimensional limit. Here we report a mechanical exfoliation method for a series of 2D metal dihalides, from bulk layered crystals and characterize them by Raman spectroscopy, optical measurements and photoelectron spectroscopy.
Current synthesis methods mostly rely on catalysts/substrates to induce the crystal growth or chemical deposition. Moreover, the stringent requirements for the parent crystals (i.e., high purity, optimization of the sublimation temperature for each crystal and seek for an appropriate catalyst) calls for a unified synthesis methodology when it comes to a wide range of metal halide families. On the other hand, mechanical exfoliation is a simple method to produce 2D materials with high quality; it is a simple and robust method which led to exploration of several 2D materials. To expand the research into the metal dihalides, we need such simple methods which can yield pure crystals and by exfoliation can produce 2D materials with ease.

References

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