Chemical functionalization of 2D materials

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Abstract

Thanks to their exciting chemical, electrical, optical, mechanical and thermal properties, two-dimensional (2D) materials have attracted great interest in material science research and found interesting applications in energy conversion and storage, optoelectronics, biomedicines, photocatalysis, sensors, etc. 2D materials research has been started after the successive exfoliation of graphene in 2004. The extraordinary physicochemical properties and promising device applications of graphene motivated researchers to develop new atomically thin 2D materials. As a result, a series of 2D layered materials including transition metal dichalcogenides, hexagonal boron nitride, graphitic carbon nitride, layered metal oxides, layered double hydroxides, transition metal carbides or carbonitrides, black phosphorous nanosheets and elemental analogues of graphene have been established within the past few years. Chemical functionalization is found to be an effective way to improve physical and chemical properties of 2D materials. The functionalization can be either through direct covalent bonding or through non-covalent interactions such as van der Waals, electrostatic, π- π and cation- π interactions [1-2]. Herein, I will present the chemical functionalization of 2D materials including graphene, phosphorene and MXene, using our recently synthesized functional organic molecules through covalent and noncovalent approaches. The chemically modified 2D materials have been fully studied using several spectroscopic and microscopic characterization techniques. Finally, relevant potential applications of the chemically modified 2D materials will also be discussed [3-5].

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