Functional 2D Conjugated Polymers by Interfacial Synthesis

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The discovery of graphene one decade ago has triggered enormous interest in developing chemistry of synthetic two-dimensional materials (2DMs). In our work, we have employed interfacial chemistry toward the controlled synthesis of organic 2DMs with diverse structures and functions.[1] For instance, we demonstrated the synthesis of 2D conjugated metal-organic framework (2D c-MOF) at the air-water or liquid-liquid interfaces. The 2D c-MOFs feature with stacked layers and possess unique electronic properties, such as full π delocalization, narrowed band gaps, high conductivity and high mobility, which render 2D c-MOFs as advanced electronic materials. One representative iron-bis(dithiolene) 2D MOF exhibited as a p-type semiconductor with a band-like transport and high mobility of ~220 cm^2/Vs.[2] Owing to their conductivity, the 2D c-MOFs have shown potential for transistors, photodetectors, sensing, magnetics, and energy storage and conversion.[1,3,4] Besides the coordination polymer, we have also synthesized conjugated 2D covalent polymers at the air-water or liquid-liquid interfaces. In our latest work, we have employed a surfactant-monolayer-assisted interfacial synthesis (SMAIS) method to prepare 2D polymers, like 2D polyimides and 2D polyimines, which exhibit few-layers and micrometer-sized single-crystalline domains.[5,6] In short, we expect to develop interfacial chemistry methodologies toward the controlled synthesis of organic 2DMs and achieve delineation of reliable structure-property relationships and superior physical and chemical performances of organic 2DMs.

References

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