Poster Presentation

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Chemically delaminated free standing covalent organic nanosheets (CONs)

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Exfoliation of 2D layered materials to ultrathin nanosheets and their scalable fabrication to homogeneous thin films are gaining extensive attention among the scientific community due to their emerging importance in sensing, separation and catalysis. COFs represent a new class of organic 2D material which posses a predesignable porous and crystalline framework structure. Attempts to exfoliate them as 2D nanosheets and their further fabrication to large scale thin films proved to be difficult. Strong π-π stacking between layers and possible re stacking after exfoliation are two major obstacles to achieve single or a few layered CONs. Meanwhile, insolubility and poor dispersion of COF crystallites in various solvents prevents their fabrication to produce uniform thin films which could have significant impact in separation or in opto-electronic devices. In order to address these shortcomings, we developed scalable, uniform, and durable CON thin films through the Layer by Layer (LbL) assembly at the air-water interface. The synthesis of functionalized CONs were done by [4+2] Diels-Alder cycloaddition reaction between N-hexylmaleimide and anthracene based COF. The successful functionalization of COF layers disturbs the π-π interaction and loss of planarity of the anthracene units. This results in exfoliation of COF to functionalized CONs. The functionalized CONs are highly stable and dispersible in various organic solvents (DMA, DMF, NMP, $CHCl_3$, DCM) which is found to be stable for more than one month. Taking into account these observations, we fabricated scalable CON thin films via LbL assembly at the air-water interface. It is important to note that, the thin film thickness can be controlled by adjusting the CONs concentration, and it is possible to fabricate 1.2 nm to 2.5 μm thickness of CON sheets. We speculate the dispersion interaction between alkyl groups plays the pivotal role for holding the nanometer sized CONs together to form defect free self standing thin films.

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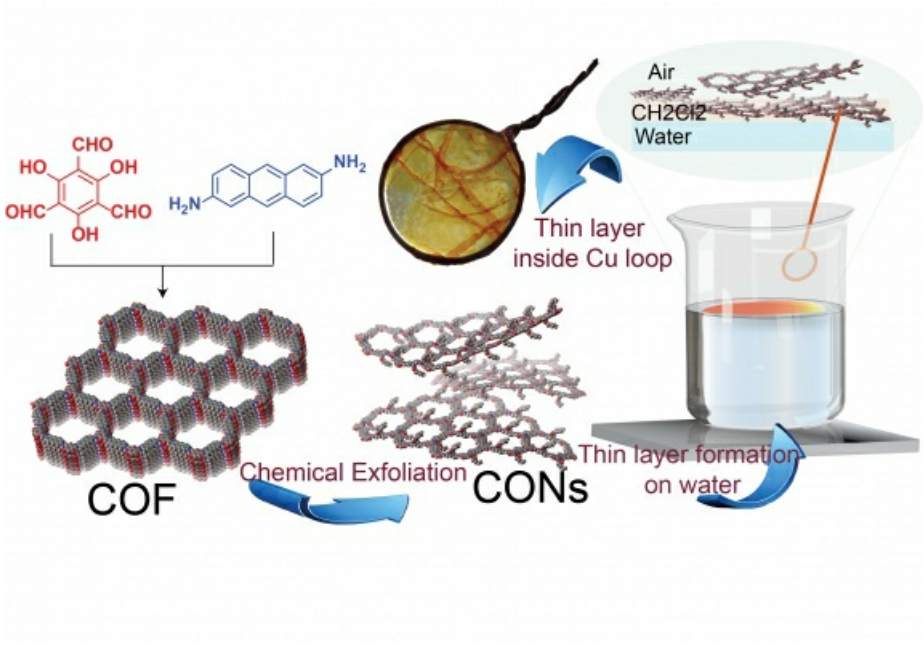

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