Liquid-Phase Exfoliation of F-Diamane-Like Nanosheets

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Single-layer diamond ('diamane') is a new form of 2D carbon allotrope. Bakharev et al. reported the first preparation of fluorinated diamane ('F-diamane') films through chemisorption of fluorine on bilayer graphene grown on CuNi(111) [1]. Recently, we revisited the 'stage-2' poly(dicarbon monofluoride) $(C_2F)_n$, in which fluorine atoms are inserted into every second layer of graphite and the carbon atoms establish an sp^3 orbital with a 'double-decked' structure. The structural model of $(C_2F)_n$ proposed by Watanabe et al. [2, 3] suggests that $(C_2F)_n$ is essentially composed of stacked layers of 'F-diamane'. We hypothesize that the low surface energy caused by the short, strong C–F bonds can result in a low friction coefficient between the layers, and thus the 'F-diamane' layers could be readily exfoliated under shear. In this talk, I will discuss the synthesis and exfoliation of $(C_2F)_n$ in different solvents to yield ultrathin sheets, and analytical results showing that the exfoliated sheets indeed retained the 'F-diamane'-like structure. I will also present an improved method for an efficient, high-yield production of ultrathin 'F-diamane'-like nanosheets in solutions. Mild sonication yielded nanosheets hundreds of nanometers to a few micrometers in lateral size and mostly <10 nm in thickness.

References:

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