Large-scale prochiral 2D Covalent Organic Framework at the Solution-graphite surface

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Two-dimensional polymers (2DP) have attracted much attention due to their potential applications in electronics, catalysis and sensing applications. On-surface synthesis of 2DPs based on boroxine linkages have provided insights into the molecular dynamics[1] on the surface and a thorough understanding of 2D polymerization dynamics holds a key towards the fabrication of 2DPs with large crystal domains. Asymmetry in monomer building blocks [2] has been explored as a factor to slow down the molecular dynamic of 2D crystal nucleation and molecular arrangement to form the extended network of covalent organic frame works covalent organic framework (COF). By introducing the asymmetry in the molecular building block (naphthalene-2,6-diyldiboronic acid), the average number of molecular nucleation centers is reduced, propagating the growth of large domains of single crystal 2DP on the surface. In this investigation, we have investigated the prochiral asymmetry in molecule on the formation of 2DP at solution-graphite interface (fig 1). We also demonstrate the role of solvent and electric field's [3] in the interplay between COF, self-assembled structures, and the growth of domain size. This study is carried out at the solution-graphite interface and characterized using scanning tunneling microscopy (STM). Furthermore, we explore the influence of light-induced COF formation at the same interface.



Fig. 1. Molecular model and corresponding STM image of (a) symmetric COF, (b) asymmetric COF, (c) dimeric self-assembly in prochiral NDBA molecule on HOPG surface.

References:

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