Synthesis of Two-Dimensional Conductive Metal-Organic Framework Thin Films

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Abstract: Conducting metal−organic frameworks (MOFs) present a compelling prospect for the development of high-performance electronic devices, ranging from electrocatalysts and chemiresistive sensors to supercapacitors. Although MOFs typically exhibit low electrical conductivity due to flat bands determined by highly localized organic states and weak hybridization with inorganic units, significant advances have been made in engineering their electrical properties. Specifically, through precise control of symmetry and energy overlap, highly ordered infinite charge transport pathways in conducting MOF platforms have been established. Nevertheless, for practical device integration, a critical challenge lies in processing these materials into functional thin films. This presentation introduces two distinct approaches for synthesizing conductive two-dimensional MOF thin films: a single-step, all-vapor-phase chemical vapor deposition process, and a solution-processable synthetic approach.