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CHEMICAL BATH DEPOSITION: AN EFFECTIVE METHOD FOR DEPOSITION OF THIN FILMS OF METAL ORGANIC FRAMEWORKS

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Metal-organic frameworks (MOFs) are porous materials that are a subclass of coordination polymers consisting of metal clusters and organic linkers. Properties, such as surface area, porosity, absorptivity and electrical conductivity, can be easily fine-tuned by varying the metal nodes or organic linkers. Due to their diverse functionality, MOFs have been extensively investigated in research fields, such as gas storage and separation, catalysis, drug delivery and sensing. Recently, MOFs have been investigated in the field of photovoltaics, with promising results. The deposition of thin films of MOFs is a crucial requirement to be applied in these devices. Up to date, thin films of MOFs have been obtained using deposition techniques, such as liquid phase epitaxy, layer by layer deposition, electrochemical and doctor blading. Non-uniformity and instability on the substrate are limitations that are associated with these methods. However, chemical bath deposition (CBD) is typically utilized as a thin film deposition technique in the field of photovoltaics that yields stable, adherent, uniform, and hard films with good reproducibility by a relatively simple process. Yet, it has not been utilized in the fabrication of MOFs. In this study, CBD is used to fabricate a uniform, thin porous film on fluorine-doped tin oxide (FTO) substrate. MOF199 was selected as the choice of MOF due to its easy synthesis procedure and stability. The deposition of MOF199 on FTO was confirmed by powder x-ray diffraction and Fourier transformation infrared spectroscopy, where further characterization such as conductivity measurements and SEM are to be done. To enhance film adherence on the surface of FTO, NaOH and 4-aminobenzoic acid was used as a surface activator. Then, different conditions were optimized to obtain a stable thin film of MOF, where an optimum deposition temperature of 30 °C, dormant period 24 hours, and a deposition angle of 30° were identified. A stable and uniform thin film of MOF199 with fine tunable layer thickness could be successfully fabricated using the CBD technique. Thus, this study paves the way to obtain high-quality thin films of MOFs by a simple process.

Keywords: Chemical bath deposition, Coordination polymers, Organic frameworks, Organic linkers, Photovoltaics