VRIJE UNIVERSITEIT BRUSSEL

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DOCTOR OF ENGINEERING SCIENCES

of **Alexander John Cruz**

The public defense will take place on **Tuesday, 13th April 2021 at 5pm.**

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METAL-ORGANIC FRAMEWORKS BY VAPOR DEPOSITION PROCESSES

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Abstract of the PhD research

Nanotechnology has become a backbone of materials science innovation. The transition towards processing at such dimensions has led to the development of high-performance nanomaterials to meet growingly demanding commercial specifications. Metal-organic frameworks (MOFs), a subclass of porous solids comprised of metal-containing nodes connected by polytopic organic linkers, have been gaining attention in the materials science arena. With the many interesting attributes such as high specific surface areas, order, and compositional diversity, MOFs have earned their rightful place in gas storage, catalysis, molecular separations, and recently, on electronic devices. While solution-based synthesis, typically via powder preparation routes, is advantageous for its simplicity, MOF thin film fabrication techniques compatible with production facilities remain a prerequisite to their integration in electronic devices. In this work, the chemical vapor deposition (CVD) and molecular layer deposition (MLD) processes are employed to manufacture MOF layers entirely from the vapor phase. As cornerstones in microfabrication, the spatial uniformity, excellent coating quality, and precise thickness and composition control are key favorable attributes of CVD and MLD. This dissertation tackles the lab-to-fab approach: from mechanistic insights investigated by a range of techniques to process development, optimization, and scale-up. The colossal potential of MOFs in solid-state devices will be seamlessly facilitated if this lab-to-fab transition is realized.