Structural and morphological characterization of films based on metal-organic frameworks

João. A. O. Neto[1], Maximiliano J.M Zapata[2], Carlos B. Pinheiro[3]

[123]Instituto de Ciências Exatas-ICEx, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil.
E-mail: joao2712@ufmg.br

Thematic Area: Organometallic.

Keywords: Metal-organic Framework, Films, Characterization.

Metal-organic frameworks (MOFs) are known for their diverse properties, which result from the careful selection of organic linkers and metallic building blocks, leading to various arrangements with micro and mesoporosities [1]. MOF-74, notable for its open hexagonal 1D infinite porous structure, is particularly suitable for applications in catalysis, clean energy generation/storage [2, 3], electronic device manufacturing , and gas sensors [4] or selective gas adsorption [5]. We have been producing Me-MOF-74 (Me= Zn, Mg, Ni, Co) films directly over fluorine-doped tin oxide-coated glass substrates using the solvothermal synthesis method, investigating the effects of physical and chemical parameters such as temperature, concentration, and preparation time on film adhesion and growth connectivity. The structural characterization and particle morphology of the Ni-MOF-74 films have been investigated using grazing incidence X-ray diffraction (GIXRD) and scanning electron microscopy (SEM) techniques (Figure 1). In the synthesis of Ni-MOF-74 films on FTO substrates, no films formed during solvothermal synthesis below 80°C or with concentration reduction to 1/8 of standard values. The morphology of the films and the average particle size vary significantly with temperature and synthesis time, often showing ellipsoidal shapes with sharp ends resembling grains of rice. The particle size on the FTO substrate typically ranges from 2-8µm but can be reduced to around ~1µm by decreasing the concentration.

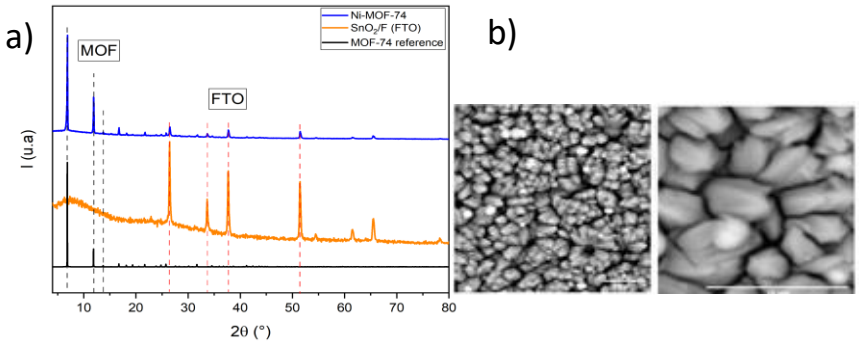

Figure 1: Example of Ni-MOF-74 film structural and morphological characterization by (a) GIXRD and (b) SEM.

Acknowledgments: CNPq; FAPEMIG; CAPES, LabCri-UFMG.

References

[1] H. Deng, S. Grunder, O. M. Yaghi et. al, *Science*. **336**, 1018 (2012).

[2] S.-L. Li and Q. Xu, *Energy Environ. Sci*. **6(6)**, 1656–1683 (2013).

[3] A. H. Chughtai, et al., Chem. *Soc. Rev.* **44(19)**, 6804–6849 (2015).

[4] Ina Strauss, et al. *ACS Applied Materials & Interfaces* **2019**.

[5] Grant Glover, and Yaghi, O. *Chem. Eng. Sci.* **66**, 163–170. (2011).