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Directing pores in MOF and COF for multifunctional material

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Framework compounds such as metal-organic frameworks (MOF) and covalent organic frameworks (COF) are characterized by their micro pores which offer a huge accessible surface for applications in gas storage, catalyst and others. Additional functionalities for electronics, photonics and magnetics applications can be attained by an accommodation of functional guests (molecules, ions, or nano objects) into the pores. For example, electronic or semi conductive MOF has been achieved by incorporating p-type conductive molecules into the pore of Cu-based MOF[1]. An achievement of device scale MOF/COF thin films with controlled crystallographic orientations has been required to enhance these sophisticated functionalities for real applications. Recently, we have reported the heteroepitaxial growth of MOF via a solution processing of the precursor metal hydroxide oriented films[2]. The resultant MOF film exhibited crystallographic orientation along all three axes, which can be used as quasi-single crystal because pores are aligned to the specific directions in the macroscopic scales. The orientation is primary depends on the crystallographic plane of the seed metal hydroxide layer because of liquid phase epitaxy. In this presentation, recent advances on the fabrication and application of the oriented MOF/COF films will be reviewed. Topics include (see Figure 1)[2-6]: fabrication of oriented MOF/COF films via solution processing, versatility of the epitaxial growth approach, impregnation of functional molecules and nano particles, and others.

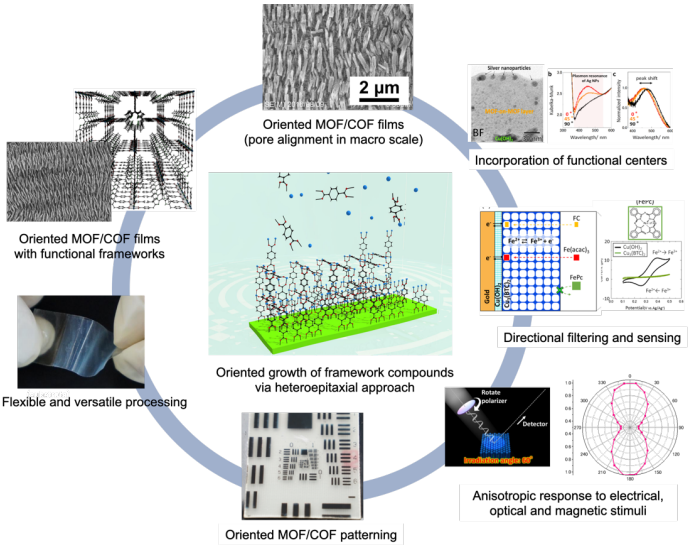

Figure 1. Fabrication of oriented framework compounds and their applications.

References

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4. Ikigaki, Okada, Takahashi, *J. Sol-Gel Sci, Technol.* (2019) 89, 128.
5. Okada, Takahashi, et al., *Cryst. Eng. Comm.* (2017) 19, 4194.
6. Okada, Takahashi, et al., *Adv. Funct. Mater.* (2014) 24, 1969.
7. Ikigaki, Okada, Takahashi, et al., *Angew. Chem. Int. Ed.*, (2019) 58, 6886.