

Additive Manufacturing of Catalyst Supports for the Conversion of Bio-sourced Molecules.

MOUNAJ Meryem,

Polytechnic University of Hauts-de-France, Boulevard du Général de Gaulle - 59600 Maubeuge, France.

Meryem.mounaj@uphf.fr

Abstract

This study focuses on developing an innovative process to manufacture porous ceramic catalyst supports, based on alumina. By utilizing the stereolithography (SLA) technique, structures with precisely controlled geometries and microstructures can be produced. The main challenge is to achieve an optimal balance between mechanical strength and textural properties. To this end, and after sintering up to 1600°C, the surface properties of the monoliths are enhanced using different methods such as chemical etching and/or the coating with an intermediate layer, namely gamma-alumina. These post-treatments allow increasing the specific surface area of the monoliths from 0 to 20 m²/g.

Currently, the deposition of a metal-organic framework (MOF), the UiO-66-SO₃H is studied. This MOF is reputed for its high chemical and thermal stability, owing to its 12-fold coordinated Zr₆O₄(OH)₄ clusters by terephthalate linkers carrying a sulfonic function (-SO₃H). Such MOF developing strong Brønsted acid sites has been successfully used under the powder form for the dehydration of fructose into 5-hydroxymethylfurfural (5-HMF), an essential molecule with broad applications in the food, pharmaceutical, and biofuel industries. It is expected that its deposition onto alumina monoliths will facilitate its recovery. Its long-term catalytic activity and stability will be especially evaluated.

References

- [1] B. Yeskendir, P. M. de Souza, P. Simon, R. Wojcieszak, C. Courtois, Y. Lorgouilloux, S. Royer, J.-P. Dacquin, J. Dhainaut, *ACS Appl. Nano Mater.*, 5 (2022) 13168–13180.
- [2] R. Ghorbani-Vaghei, D. Azarifar, S. Dalirana, A. R. Oveisi, *RSC Adv.*, 6 (2016) 29182–29187.
- [3] B. Yeskendir, J.-P. Dacquin, Y. Lorgouilloux, C. Courtois, S. Royer, J. Dhainaut, *Mater. Adv.*, 2 (2021) 7139–7155.

Figures

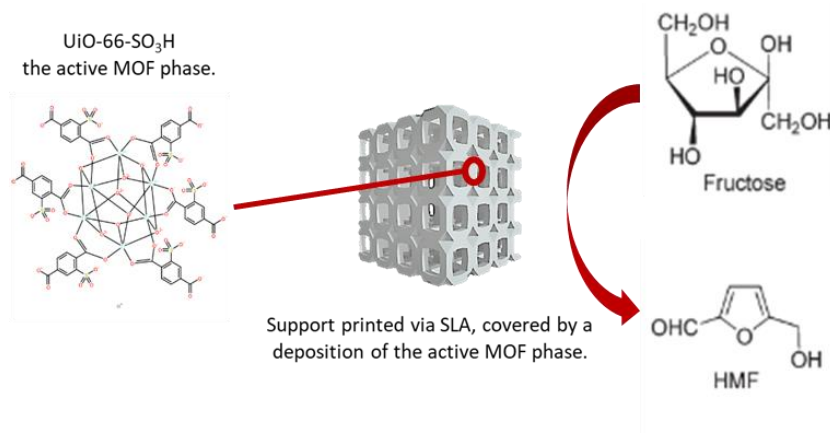


Figure 1: Schematic representation of fructose conversion into 5-HMF using an SLA-printed substrate coated with a MOF catalyst

