INVITED ORAL PRESENTATION

Materials at order-discorder boundary: defect engineering for superior catalytic performance

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During the presentation, I will describe a new strategy for the synthesis of superior hierarchical catalysts, which lack long-range order but at local scale contain zeolite building units. [1,2] In fact, they are made out of fragments of one or even various zeolite structures and display improved accessibility, strong acidity, and excellent stability. Because of these features, they effectively catalyze reactions involving very bulky molecules, which currently are produced using highly corrosive homogenous catalysts (Fig. 1). To achieve this goal, we built on a well-known technique, namely the interconversion of zeolites, which we interrupted at different times to yield the desired amounts of building units of the zeolites involved. The addition of quaternary ammonium surfactants during their preparation allows the development of well-defined mesoporosity and large surface areas. Using this simple procedure, we were able to produce families of materials with controlled amounts of different zeolitic building units and, consequently, optimize their catalytic performance for various reactions including Friedel-Crafts alkylations and Claisen-Schmidt condensations, and the cracking of 1,3,5-triisopropylbenzene.

An important advantage of this strategy is that the physicochemical properties and, therefore the catalytic performance, of the hierarchical catalysts can be finely tuned by simply stopping the interzeolite transformation at different times. This creates countless opportunities for the development of hierarchical catalysts [3] with optimized properties and superior catalytic performance for those reactions in which zeolites present significant diffusion limitations (Fig. 1). This paves the way for the fabrication of hybrid hierarchical catalysts with optimized properties for those processes in which the combined use of different zeolites yields improved performance.

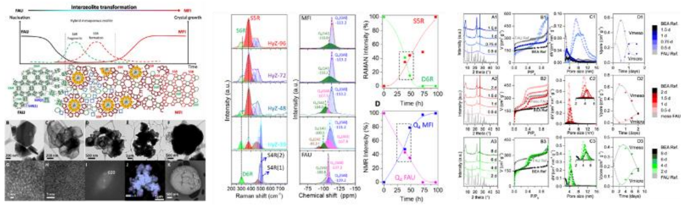

Figure 1. Textural, structural, and morphological characterization of some intermediates of the interconversion of zeolite FAU into MFI and BEA structures.

Acknowledgments: The authors thank to the European Commission for the funding received through the H2020-MSCA-RISE-2019 program (Ref. ZEOBIOCHEM – 872102). We gratefully acknowledge financial support: grant PID2021-1287610B-C21 funded by MCIN/ AEI/ 10.13039/ 501100011033 by "ERDF A way of making Europe". M.J. Mendoza thanks the GVA for a PhD fellowship (GRISOLIAP/2020/165).

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