

Interzeolite Transformation Intermediates: Superior Catalysts for the Conversion of Bulky Molecules

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Interzeolite transformation has been used to produce a novel family of hierarchical catalysts featuring excellent textural properties, strong acidity, and superior catalytic performance for the Friedel–Crafts alkylation of indole with benzhydrol, the Claisen–Schmidt condensation of benzaldehyde and hydroxyacetophenone, and the cracking of polystyrene [1,2]. Intermediate solids of the FAU interzeolite transformation into BEA display both increased accessibility due to the development of mesoporosity and strong acidity caused by the presence of ultrasmall crystals or zeolitic fragments in their structure (see Figure 1). [3]

During the presentation, I will describe a new strategy for the synthesis of superior hierarchical catalysts, whose properties evolve during interzeolite transformation. They are composed of zeolitic fragments and display improved accessibility. Because of these features, they effectively catalyze reactions involving large molecules. We realized this strategy for the interconversion of FAU into BEA. Additionally, we used quaternary ammonium surfactants to develop well-defined mesoporosity in the intermediates. By stopping the interconversion of FAU into BEA at different times, we were able to produce Interzeolite Transformation Intermediates (ITIs) showing optimized catalytic performance for a number of acid-catalysed reactions.

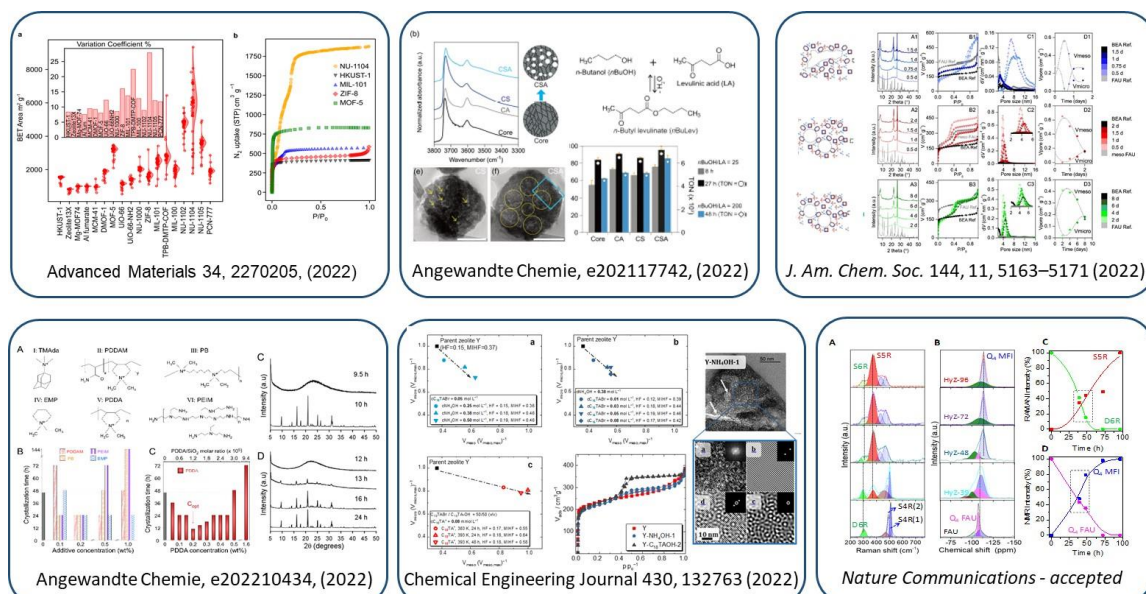


Figure 1. Some of our recent results and publications on the preparation and testing of more accessible heterogeneous catalysts for the conversion of bulky molecules.

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 [4] with optimized properties and superior catalytic performance for those reactions in which zeolites present significant diffusion limitations.

References:

- [1] M. J. Mendoza-Castro, E. De Oliveira-Jardim, N.T. Ramírez-Marquez, C. A, N. Linares, J. García-Martínez, *J. Am. Chem. Soc.*, **144(11)** 5163–5171 (2022)
- [2] M. J. Mendoza-Castro, Z. Qie, X. Fan, N. Linares, J. García-Martínez, *Nature Communications*, (accepted)
- [3] G. Fleury, M. J Mendoza-Castro, N. Linares, M. B.J. Roeffaers, J. García-Martínez, *ACS Materials Lett.* **4** 49–54 (2022)
- [4] R. Jain, A. Chawla, N. Linares, J. García-Martínez, J.D. Rimer, *Adv. Mater.* **33(22)**, 2100897 (2021)



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És catedràtic de Química Inorgànica i Director del Laboratori de Nanotecnologia Molecular de la Universitat d'Alacant (UA), on ha desenvolupat una extensa tasca docent i investigadora en nanomaterials i en la seva aplicació al sector energètic.

Ha publicat nombrosos articles científics en aquestes àrees i és autor de més de vint-i-cinc patents. Els seus darrers llibres són "*The Chemical Element: Chemistry's Contribution to Our Global Future*" (Wiley, 2011) i "*Chemistry Entrepreneurship*" (Wiley, 2021). Fundador de l'empresa de base tecnològica *Rive Technology*, que comercialitza la tecnologia de catalitzadors que va desenvolupar a l'Institut Tecnològic de Massachusetts (MIT).

El lideratge científic i empresarial de Javier García ha estat reconegut amb el Premi Rei Jaume I en la seva categoria de Noves Tecnologies, l'Emerging Researcher Award de l'American Chemical Society i el Kathryn C. Hach Award de l'American Chemical Society. És membre del Consell de Tecnologies Emergents del Fòrum Econòmic Mundial, de l'Acadèmia Jove Global i Fellow de la Royal Society of Chemistry. Des del 2019 és President de l'Acadèmia Jove d'Espanya.

Javier García ha estat elegit per liderar la Unió Internacional de Química Pura i Aplicada (IUPAC) per al període 2022-2023 exercint fins llavors com a vicepresident.