UNIVERSIDAD DE CÓRDOBA

nanoval

CONACYT

Mechanosynthesis modification MOF-Ni to the conversion of biomass-derived methyl levulinate into gamma valerolactone using functional metal-organic frameworks employing a continuous flow

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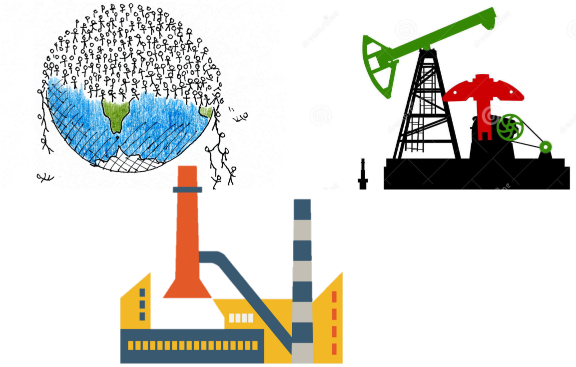
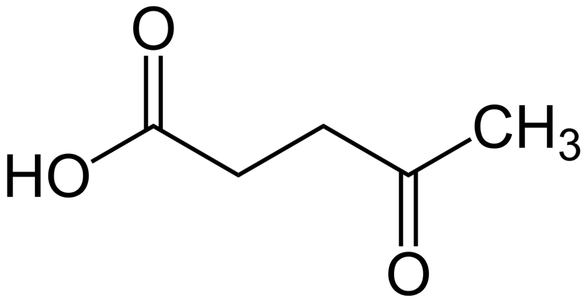
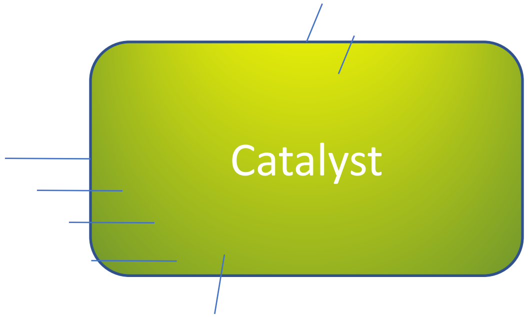
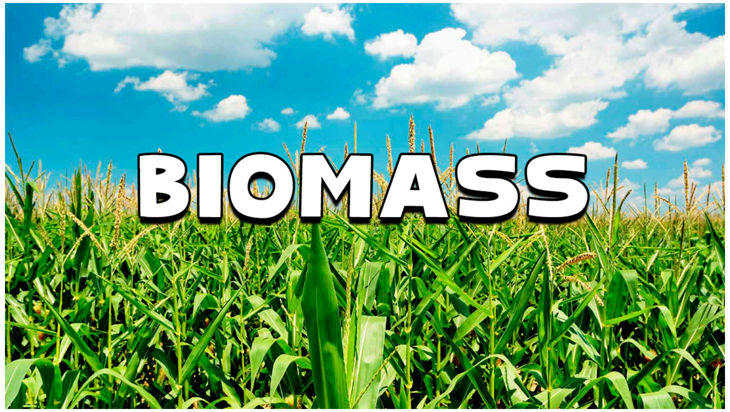
1. Introduction



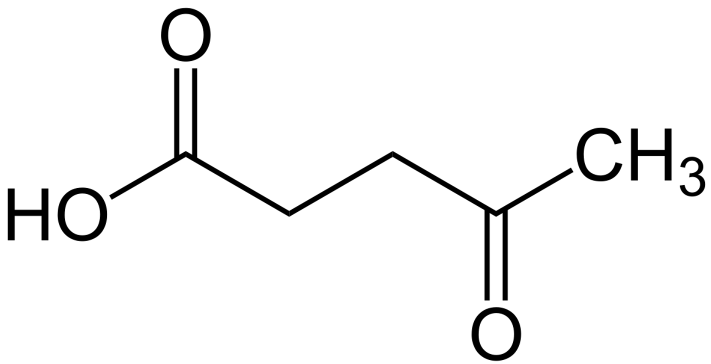


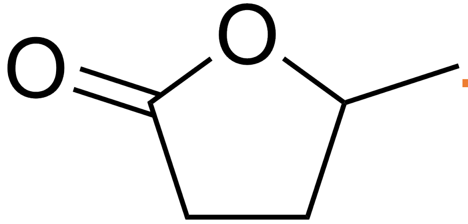




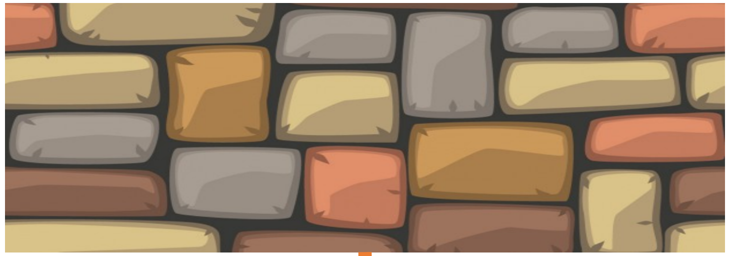
C. Xu, E. Paone, D. Rodríguez-Padrón, R. Luque, F. Mauriello, Recent catalytic routes for the preparation and the upgrading of biomass derived furfural and 5-hydroxymethylfurfural, Chem. Soc. Rev. 49 (2020) 4273-4306.

1. Introduction





- Biodegradable, nontoxic compound
- Fuel additive
- Green solvent



Value-added chemicals

Metal-based heterogeneous catalytic

- ✓ High metal dispersion within the support
- ✓ Good metal accessibility

I. T. Horváth, H. Mehdi, V. Fábos, L. Boda, L.T. Mika, γ-Valerolactone—a sustainable liquid for energy and carbon-based chemicals. Green Chem. 10 (2) (2008) 238–242. https://doi.org/10.1039/b712863k

1. Introduction

MOFs

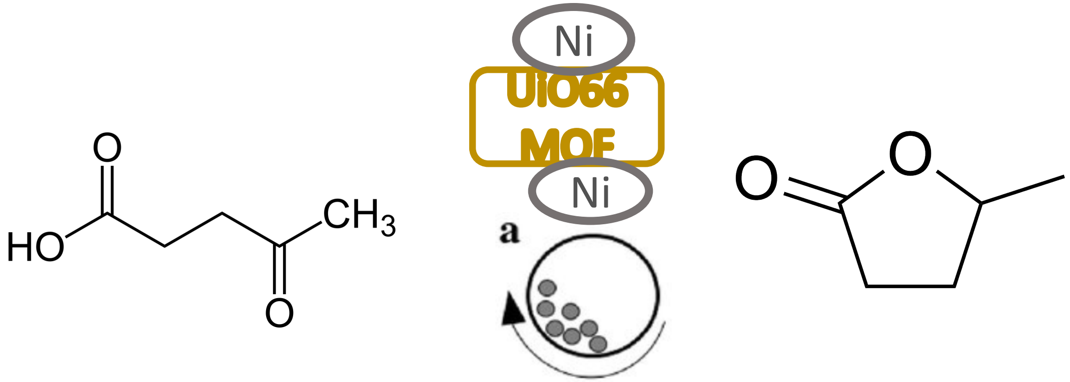
UiO-66 MOFs

Novel porous materials based on inorganic metals and multidentate organic ligands

Catalytic material itself and also serve as support for diverse catalytic units (e.g., metal and metal oxide particcles, organic functional groups)

MOFs promote the metal dipersion and avoid metal leaching

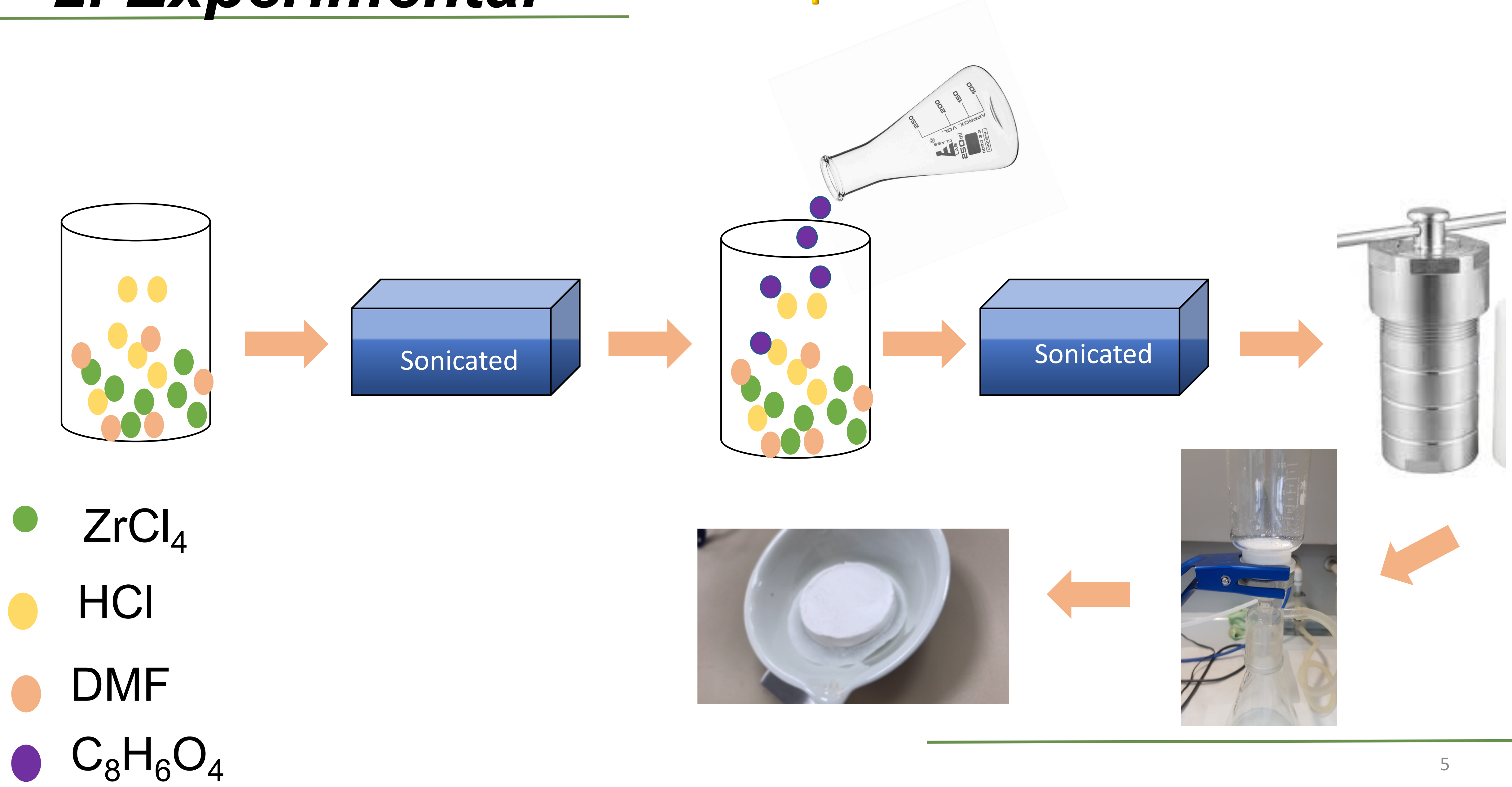
Ni



V. Pascanu, G. González Miera, A. K. Inge, B. Martín-Matute, Metal–organic frameworks as catalysts for organic synthesis: A critical perspective. J. Am. Chem. Soc. 141 (2019)

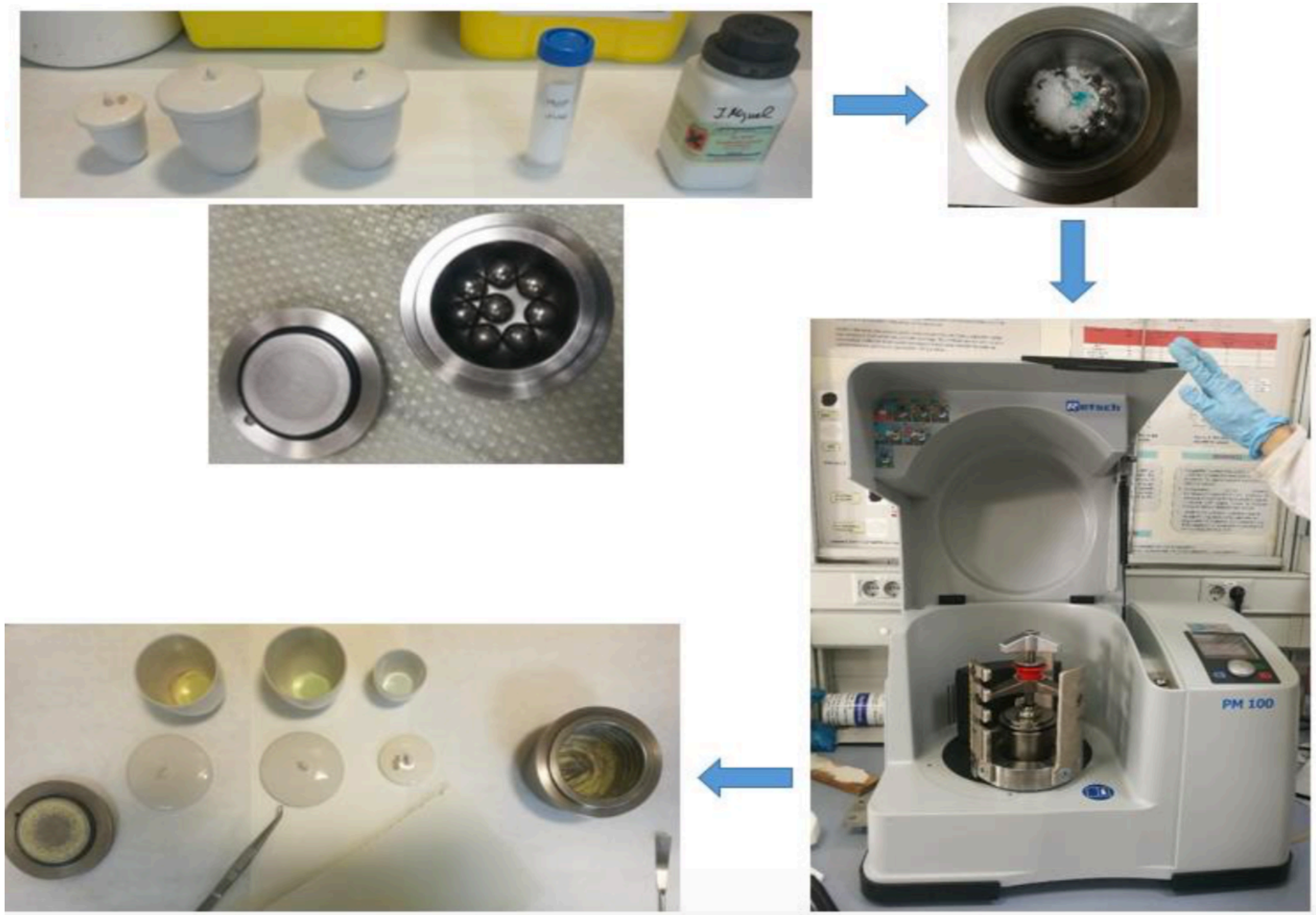
2. Experimental

Preparation of UiO-66 MOFs



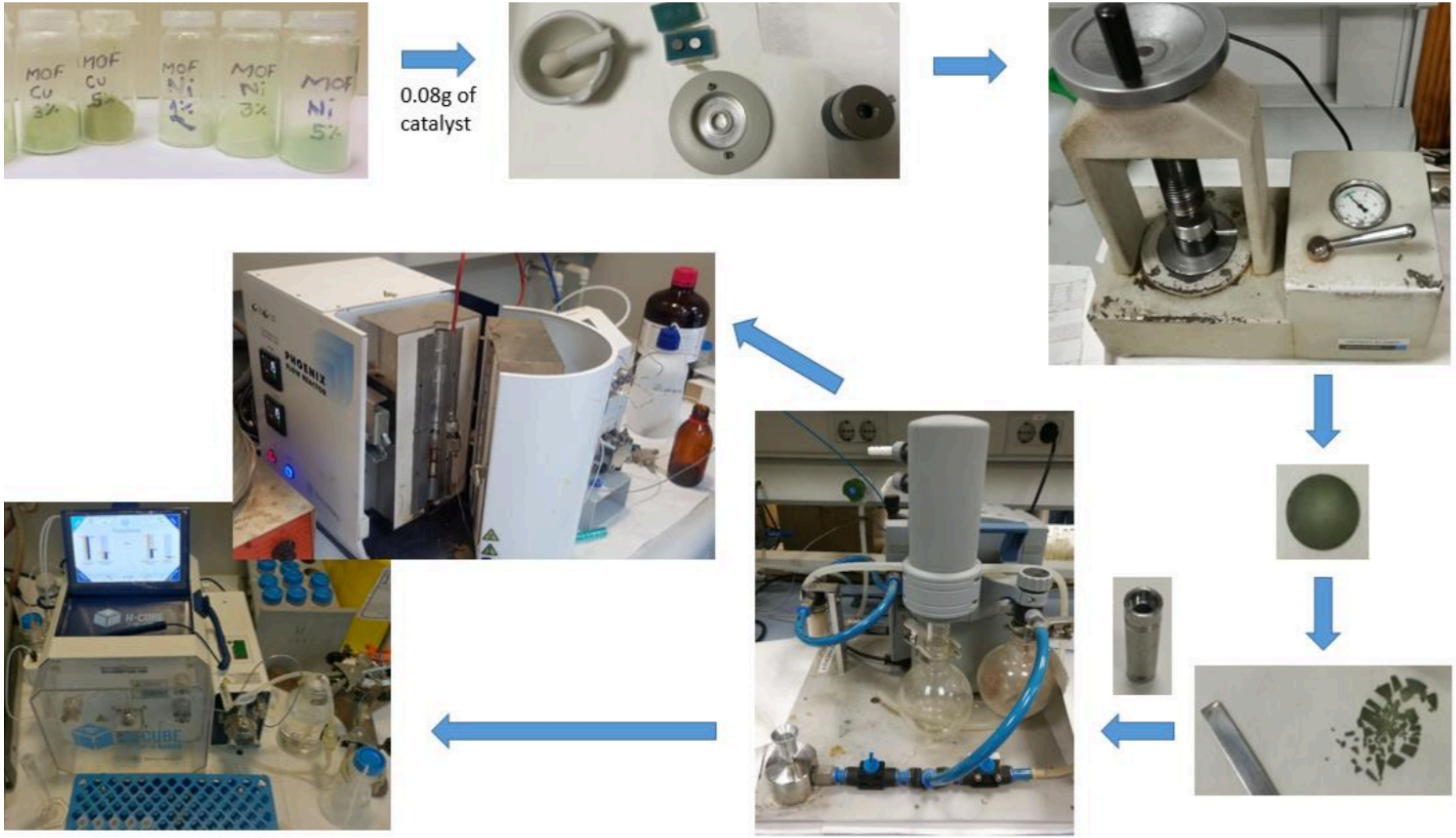
2. Experimental

Preparation of Ni/UiO-66 MOFs



2. Experimental

Catalytic experiment



2. Experimental

Catalysts characterization

XRD difractograms were acquired in a Bruker model DISCOVER D8 diffractogram. Briker Diffrac. Suite plus Eva software, supported by Power Diffraction File database, was used for phase identification.

Textural properties of the materials were evaluated by N2 adsorption/desorption measurements using a Micromeritics ASAP 2000.

XPS experiments were performed in an ultrahigh vacuum (UHV) multipurpose surface analysis system SpecsTM. XPS CASA program was used to analyzethe obtained data.

3. Results and discussion

Textural properties

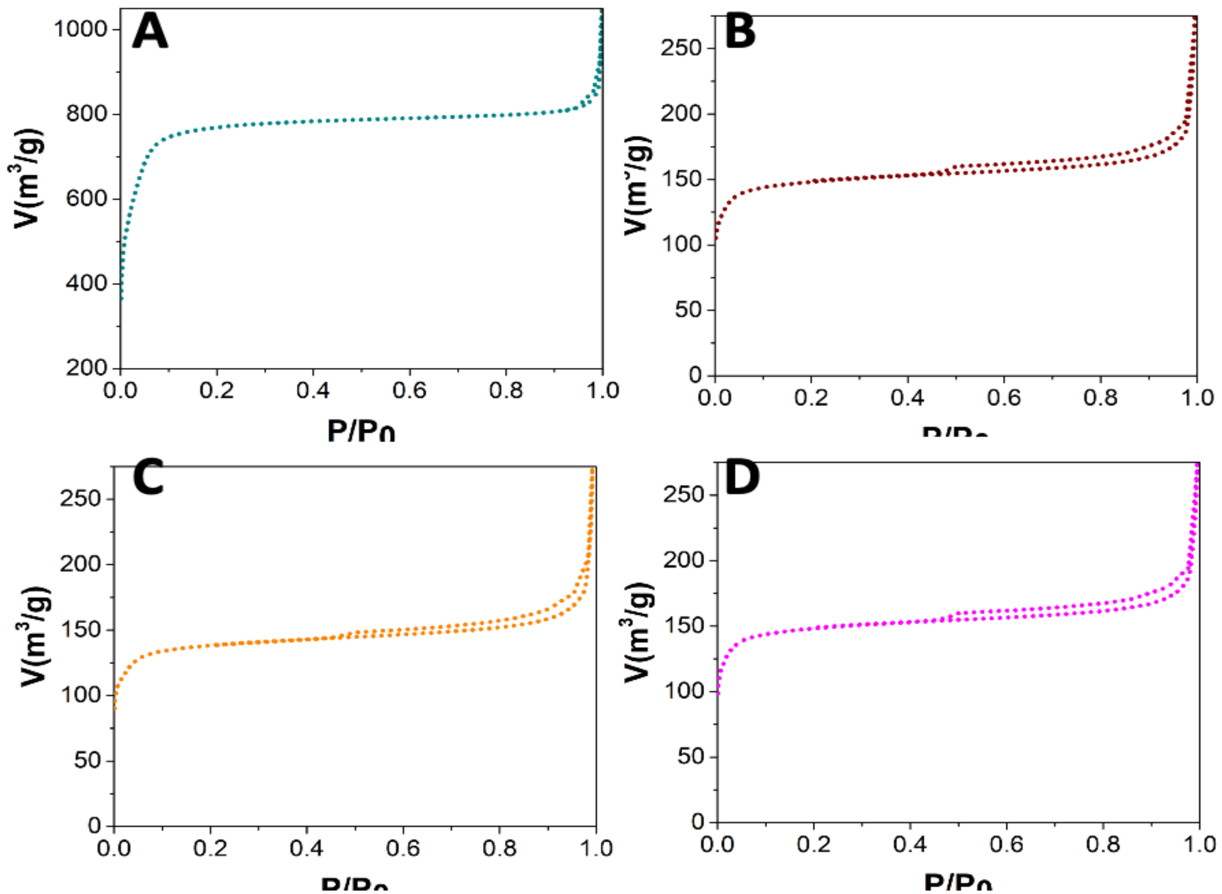


Figure 1. N2 adsorption-desorption isotherms of A: UiO-66, B: 1% Ni/UiO-66, C: 3%Ni/UiO-66, D: 5%Ni/UiO-66.

Table 1. Results of the surface area

Sample	Surface area ($m^2.g^{-1}$)
UiO-66 MOF	1399
1%Ni/UiO-66	496
3%Ni/UiO-66	465
5%Ni/UiO-66	444

3. Results and discussion

XRD analysis

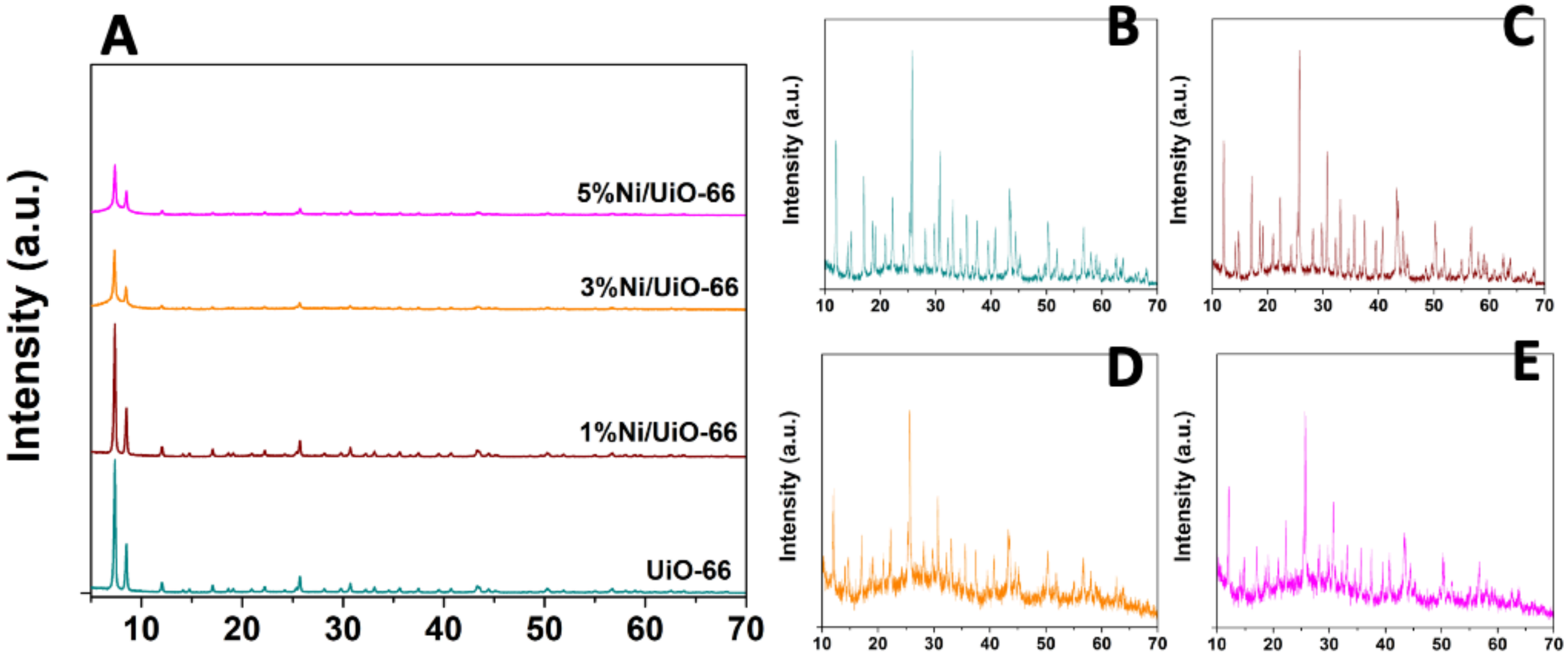


Figure 2. A:XRD patterns of the synthesized materials

3. Results and discussion

XPS analysis

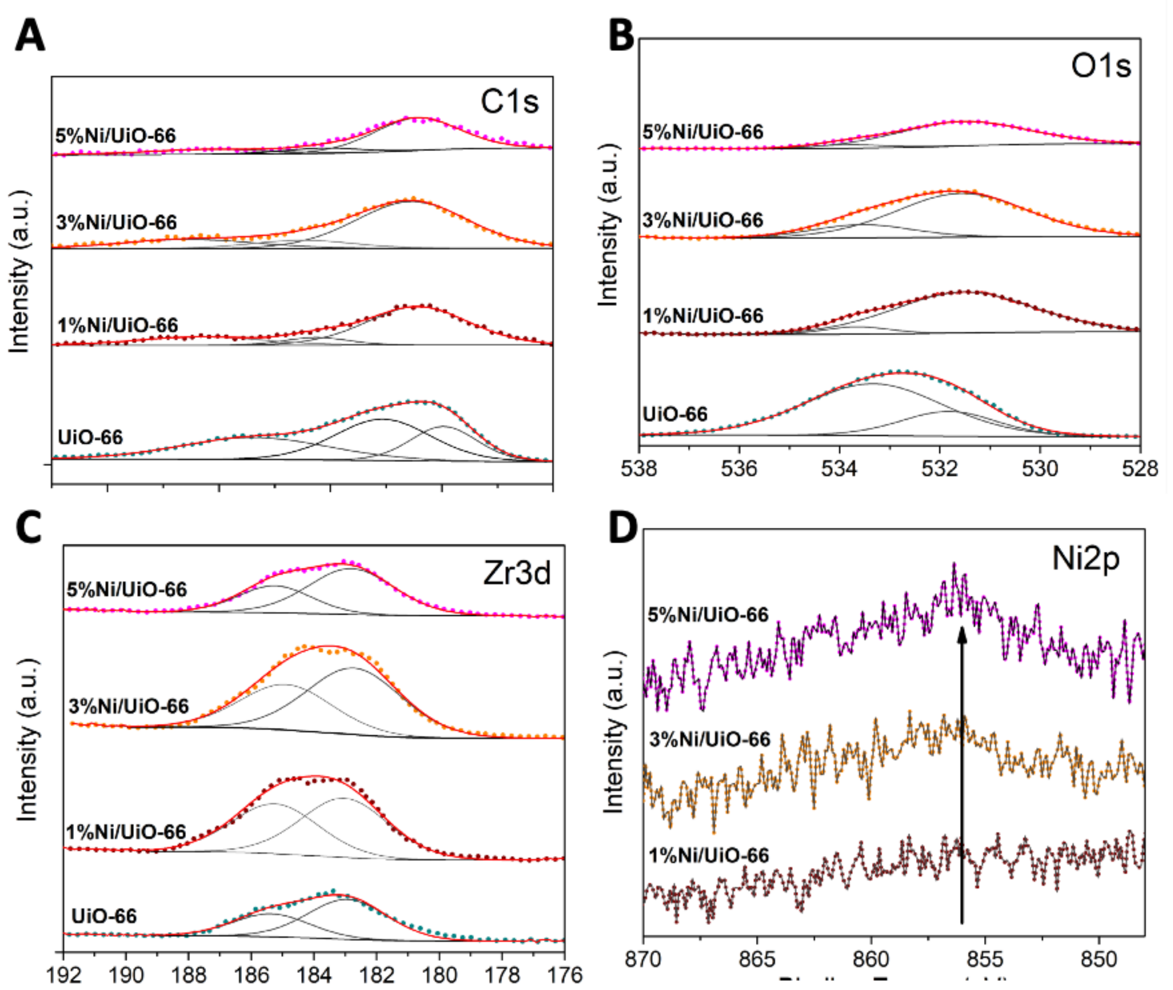


Figure 3. XPS spectra of the prepared samples in the A:C1s, B: O1s, C:Zr3d and D: Ni2p regions

3. Results and discussion

Catalytic activity

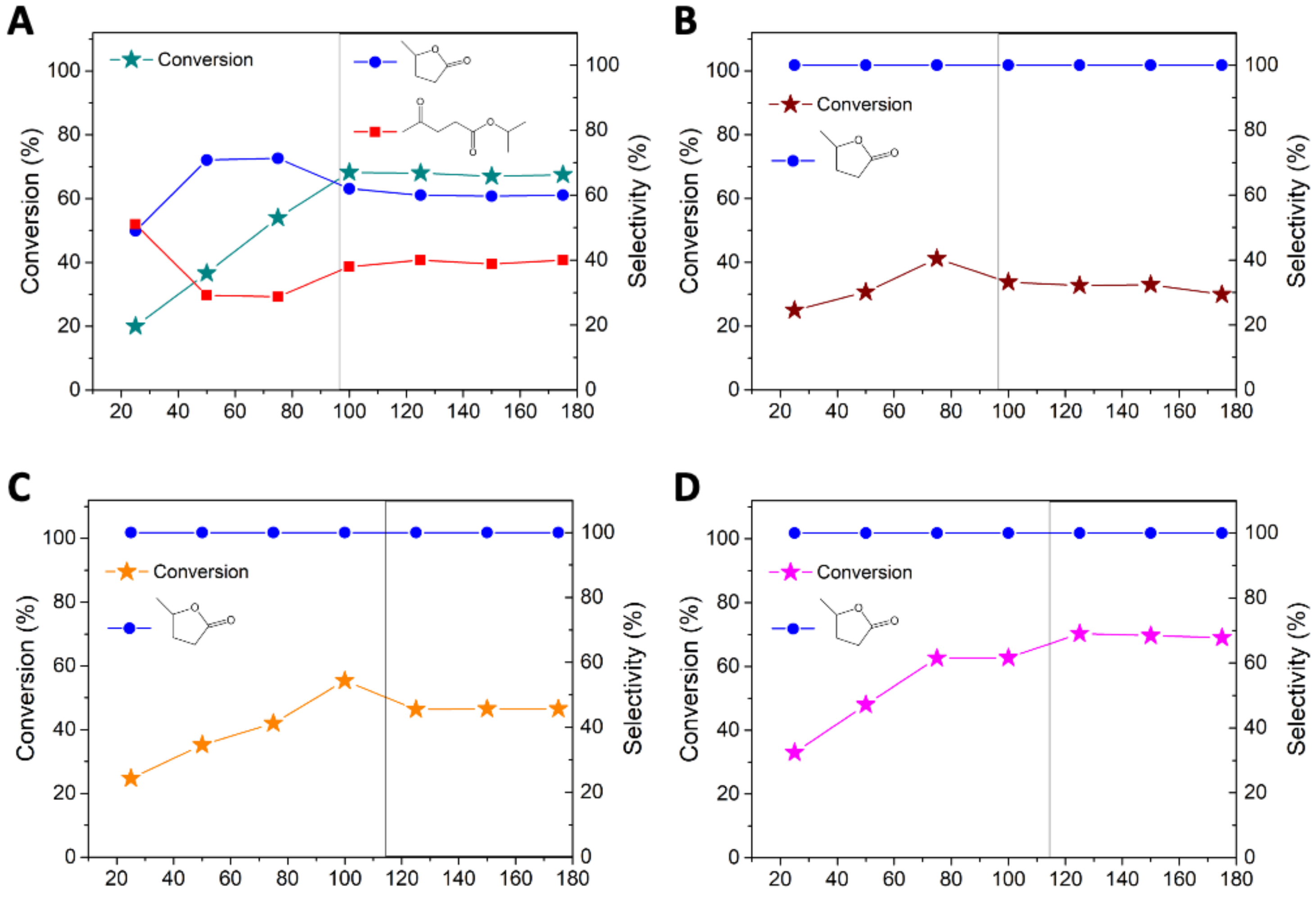


Figure 4. Catalytic performance of A: UiO-66, B: 1%Ni/UiO-66, C: 3%/Ni/UiO-66, D: 5%Ni/UiO-66

4. Conclusions

Mechanochemical modification of UiO-66 with nickel oxide nanoparticles was herein investigated.

Mechanochemical processes resulted to be effective for the incorporation of metal oxide entities on the surface.

65 % decrease in the initial suface area within mechanochemical strategy.

The samples retained a feasible surface area (400 m2/g), and more importantly, the nickel modified samples exhibited a greatly improves selectivity towards GVL higher than 99% and maximun conversion value of 69%.

5. Acknowledgment

¡Thank you very much for your attention!