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ZIF-8 based materials for selective CO_2 conversion

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The use of carbon dioxide as a renewable feedstock contributes to a more sustainable use of resources and mitigation of emissions.[1] This goal could be achieved by the reverse gas shift reaction (RWGS) where CO_2 is reduced by H_2 generating CO and H_2O.[2] In this purpose, the use of materials with high affinity with CO_2 is very attractive, like the newest class of CO_2 adsorbents, namely metal organic frameworks (MOFs). MOFs are a class of crystalline solids with coordination bonds between transition metals and organic linkers, structing an open framework that can be porous and have high surface areas, an important parameter in catalysis.[3]

In this work, ZIF-8/C was prepared by the impregnation method. Zinc acetate dihydrate was mixed with 2-methyl-1H-Imidazole in an ammonia solution. The as-obtained sample was stirred at room temperature for 4 h before centrifugation and wash with deionized water. The sample was dried at 65 ºC for 12 h. This sample was named ZIF-8. Then it was calcined at 400 ºC for 1 h under N_2 atmosphere at a heating rate of 5 ºC /min, 550 ºC for 1 h at a heating rate of 2 ºC /min and 800 ºC for another 1 h at the same heating rate. This sample was called ZIF-8/C.[3] Metal element was analyzed by inductively couple plasma optical emission spectrometry (ICP-OES, Spectro Arcos), which estimated the composition of Zn in ZIF-8 in 24 wt%. Elemental analysis showed that the pyrolysis process did not oxidize the ZIF-8 to ZnO (Table 1). Other characterizations were performed by FT-IR, XRD, TEM and TGA.

Table 1. Elemental composition of the samples.

Catalyst	Content of elements (% w/w)		
	C	N	H
ZIF-8	43.2	24.7	4.8
ZIF-8/C	42.0	24.8	4.1

Presumably, ZIF-8-derived prepared by this method should have pyridinic N or carbide on the structure of carbonized solid. These sites are known by the activity for CO_2 hydrogenation.[3] Therefore, this material will be deeply studied in this work.

The RWGS reaction was performed in a Hiden CATLAB apparatus equipped with a mass spectrometer. The gas composition was 2 mL/min of CO_2, 2 mL/min of H_2 and 96 mL/min of Ar. The catalyst (20 mg) was loaded in a quartz tubular reactor and heated up to 800 ºC, at a 10 ºC /min rate, under reaction atmosphere of CO_2/H_2. This result is showed in Figure 1, in comparison with a blank experiment with the empty reactor.

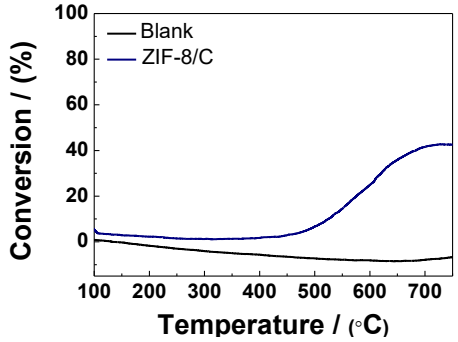

Figure 1. CO_2 conversion with temperature for ZIF-8/C.

The ZIF-8/C material alone was able to convert CO_2 with high CO selectivity and the next steps will be the impregnation of Ni nanoparticles in this material looking for the improvement of CO_2 conversion.

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References

[1] Q. Liu et al. *Nat. Commun.*, **2015**, 6, 5933.
[2] R. V. Gonçalves et al. *Appl. Catal. B: Env.*, **2017**, 15, 240.
[3] Y. Li et al. *ChemSusChem*, **2018**, 11(6), 10.