CO_2 Hydrogenation of Copper Nanoparticles Supported on Zirconium Modified Silica

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To date, there is no efficient way to employ and transform the ever-increasing amount of carbons dioxide (CO_2) into more valuable resources. One approach to use CO_2 could be its transformation into more valuable compounds such as methanol (MeOH). [1] Copper based catalysts have shown promising efficiency in terms of activity and selectivity for transforming CO_2 to MeOH when supported on specific metal oxides. Of them zirconia (ZrO_2) is known to promote MeOH synthesis. [2] Recently we proposed a reaction mechanism leading to MeOH occurring on the interface between copper and zirconia going via formate as an intermediate.[3]

Herein we use a surface organometallic chemistry (SOMC) combined with a thermolytic precursor (TMP) approach as well as incipient wetness impregnation (IWI) to maximize the ratio between Zr at the interface vs. the bulk on silica (SiO_2). Cu nanoparticles on such supports show greatly enhanced activity and selectivity towards MeOH under CO_2 hydrogenation conditions compared to Cu nanoparticles on SiO_2.

Solid state nuclear magnetic resonance spectroscopy and X-ray absorption spectroscopy was further used to investigate the catalyst and reaction intermediates.

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