Poster MS33

Ruthenium Nanoparticles on Mesoporous MCM-48 by Supercritical CO$_2$ Deposition: Efficient Conversion of Glucose into Sorbitol

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Mesoporous-silica materials (MSM) have attracted a good piece of attention due to their interesting properties such as their ordered controllable porous structure and composition, high surface area, pore volume and thermal stability. All these features make MSM appropriate for a huge variety of applications like in catalyst supports, chromatographic separation or adsorbents. In addition, this kind of materials offer high dispersion of metal nanoparticles and the improvement of reactant access to the active sites of the catalyst. Different transition metals such as Ni, Ru, W or Co have been introduced into MSM materials by diverse preparation techniques. Incipient wetness impregnation is one of the most ordinary techniques employed to load metals on mesoporous materials because it allows preparing materials with high metal loadings, although low metal dispersion degrees are achieved. For that reason, Supercritical Fluid Deposition (SCFD) appears as a promising method to deposit metallic nanoparticles on different type of supports. This technique involves the dissolution of an organometallic precursor in supercritical carbon dioxide (scCO$_2$), and its subsequent decomposition over the mesoporous support. This process takes advantage of the excellent physical properties of scCO$_2$ which are tunable with small variations of P and/or T. The zero surface tension of scCO$_2$ allows better penetration and wetting of pores than liquid solvents. Simple removal from the substrate by depressurization avoids problems of solvent residues or pore collapse on drying. This work presents the preparation and characterization of a Ru/MCM-48 catalyst by SCFD, with a metal loading of 3% w/w. Ruthenocene has been selected as organometallic precursor and impregnation has been performed at 60ºC and 120 bar during 3 hours followed by a decomposition step at 200ºC under CO$_2$ -atmosphere. The catalyst so-prepared has been tested in the hydrogenation of glucose into sorbitol. It was characterized by means of TEM, XRF, XRD, H$_2$ -TPR, NH$_3$ -TPD and ICP. Products from reaction have been analyzed by HPLC. This catalyst characterization and catalytic activity have been compared with a similar Ru/MCM-48 catalyst prepared by wet impregnation. Differences in terms of metal dispersion, preparation time, catalyst activation and catalyst activity will be discussed in the full paper.