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HDT of the model diesel feed over Ir-modified Zr-SBA-15 catalysts

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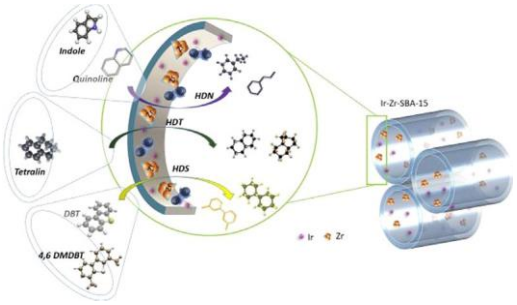
GRAPHICAL ABSTRACT



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ABSTRACT

Iridium catalyst using different zirconium modified-SBA-15 supports were tested in the HDT of tetralin and typical sulfur and nitrogen compounds present in diesel feed. The zirconium modified-SBA-15 supports were synthesized by sol-gel method using two sources of zirconium, zirconyl chloride and zirconium (IV) propoxide. Regarding XRD, N_2 adsorption isotherms and TEM, we obtained better textural and structural properties using the alkoxide, especially when lactic acid was added in order to decrease the hydrolysis rate of zirconium propoxide. In addition, XPS and DRUV-Vis demonstrated that zirconium was incorporated mainly as tetrahedral Zr^{4+} species NH_3-TPD showed that higher acidity is observed when tetrahedral Zr^{4+} species are present. Iridium dispersion was determined by TEM and H_2-chemisorption and reducibility by XPS and TPR. Among the catalysts prepared, the catalyst synthesized using zirconium propoxide and lactic acid presented the highest dispersion, lowest cluster size and lowest reduction temperature. Consequently, this was the most active catalyst for the hydrogenation of tetralin, the HDN of indole and quinoline and the HDS of dibenzothiophene (DBT) and 4,6-dimethyldibenzothiophene (4,6-DMDBT). The presence of Zr^{+4} had a remarkable effect on the dispersion and reducibility capacity of the iridium actives species. In addition, the presence of moderate acidity in this material gives the best catalyst for HDN and HDS in the studied conditions. The inhibition effect of the sulfur and nitrogen compounds over tetralin hydrogenation was studied using individual feeds and a mixture feed. We observe that 4,6-DMDBT and quinoline were the most refractory compounds and they showed the highest inhibition effect. Tetralin hydrogenation was stronger inhibited when using the mixture feed compared with the individual feeds. This can be explained in terms of the competition between the different compounds that retard the rate of hydrogenation of tetralin. However, a high conversion of tetralin was achieved even when 300 ppm of S or N was

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