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NOTE

Hydrogenation of Glycerol and Cellobiose by Immobilized Metallic Nano-Base Catalysts

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The immobilized metallic nano-base catalysts were tested for hydrogenation of glycerol and cellobiose by using of commercial Pt, Pd, Ru and Rh catalysts. The reactions were carried out at the similar conditions to comparison with conventional heterogeneous catalysts. The influence of alkali promoter is also tested for the reaction. Obtained results show that the anchored Ru as nano-catalysts give very good activity and selectivity to 1,2-propane diol in hydrogenation of glycerol.

Key Words: Glycerol, Cellobiose, Catalysts, TEM, Propanediol, Promoter.

The decreasing provisions of environmental resources consisting of nonrenewable carbon and exponential growth in command have left no option to gaze for renewable resources for petroleum and substances.

Cellulosed biomass and vegetable oils are considered as significant renewable resources for changing to chemicals and fuels. Whereas, the change of vegetable oils to bio-diesel has previously been at higher stage of development, the extended range sustainability of the technology would mainly rely on the aggressive costs of the end product bio-diesel. Here, the great quantity of glycerol produced as a co-product along with bio-diesel has scrupulous consequence, the use of which is mainly necessary for the overall feasibility of the approach. Likewise, the sugars resulting from the plentifully accessible biomass can be rehabilitated to poly-OH compounds, alteration of which to chemicals such as glycols provides a different chance to use renewable resources. Therefore, "hydrogenation of poly-OH" merits main notice to get there at new knowledge. Numerous research groups have taken proposal to discover this class of reaction[1]. Nevertheless, there is a requirement for development in the presentation of the procedure for hydrogenation of poly-OH and selectivity to the favoured products. At present study it was comprehensive the synthesis method urbanized previous for nano-metal catalysts to plan novel anchored nano-catalysts for hydrogenation of poly-OH[2-4]. In this presentation, the synthesis, characterization of the immobilized nano-catalysts and their use for hydrogenation of glycerol and cellobiose as model systems are presented.

All solvent was analytical grade and purchased from Merck Company (Germany). All chemicals and metallic materials purchased from fluka (Swiss). The metallic nano catalysts were immobilized on diverse supports using anchoring method. HPLC and GC analysis was performed By Behpajoh setup equpet to a Pentium s computer. (Iran). The hydrogenation experiments were carried out in a 100 mL Parr autoclave and the liquid phase samples were analyzed using HPLC. The gas phase samples were analyzed at the end of the reaction using GC.

The anchored metallic Nano Catalysts were characterized by XRD, TEM, EDAX, CP-MAS-NMR to clarify the structure of the synthesized material. A typical TEM image of the anchored Ru nano-catalyst was shown in Fig. 1, which demonstrate the consistent dispersion of the Ru nanoparticles on the solid support.

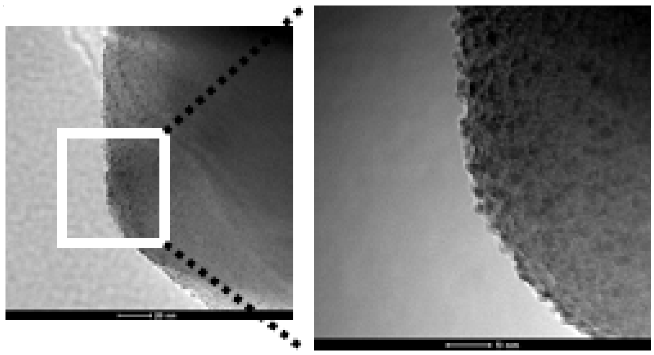

Fig. 1. TEM image of the anchored Ru nano-catalyst

The immobilized metallic nano catalysts were tested for hydrogenation of glycerol and cellobiose. For comparison with conventional heterogeneous catalysts, the reactions were carried out at the identical circumstances with commercial Pt, Pd, Ru and Rh catalysts[5]. The influence of alkali promoter is also tested for the reaction. Ethylene glycol (EG), 1,2-propanediol and 1,3-propanediol were the main products in all the cases. The typical reaction scheme for hydrogenation of glycerol and the experimental results with different catalysts (including anchored Ru nano-catalyst) and promoters are shown in Fig. 2.

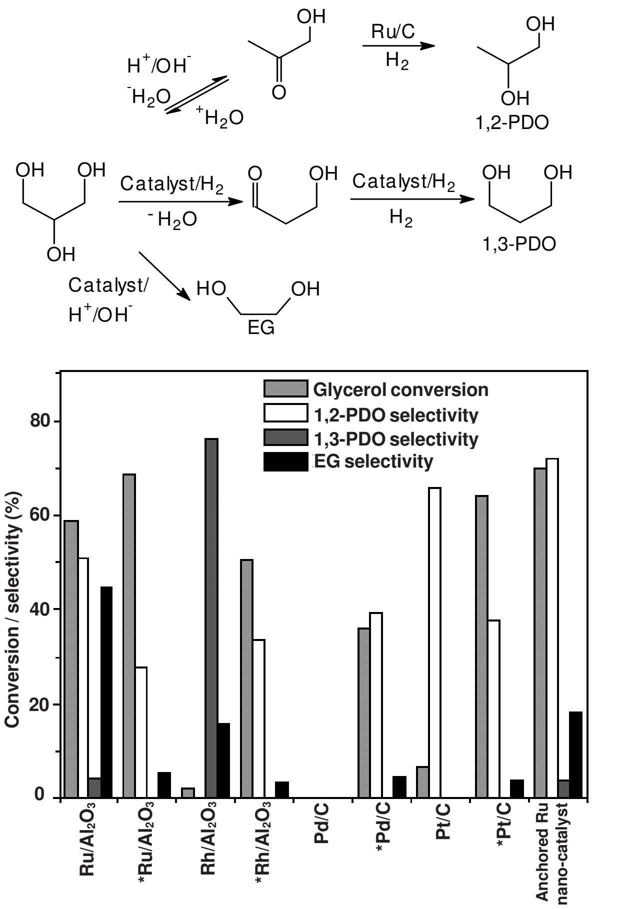

Fig. 2. Reaction design and experimental results for hydrogenation of glycerol with different catalysts
NaOH promoter (glycerol: 10 % in H_2O; catalyst: 0.5 g; 473 K; 41 bar; 9 h)

The consequences in Fig. 2 demonstrate that the anchored Ru nano-catalysts give good activity and selectivity to 1,2-propanediol in hydrogenation of glycerol. The obtained results are accredited to catalyst design and high metal dispersion characteristics. In the presentation, the other characterizations and catalytic experimental results will also be presented.

Conclusion

De-oxygenation of poly-OH warrants notice from the catalyst novelty, solvent engineering and process strengthening point of view. In this presentation, our attempt to design and synthesize new catalytic materials based on the mechanistic understanding of hydrogenation reaction is attend to and new supported nano-catalysts reported.

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