

# Copper core - porous silica shell - nanoparticles for glycerol hydrogenolysis

Kuo-Tseng Li\*, Hsien - Chang Wang and Chih-Hao Wang

Department of Chemical Engineering, Tunghai University, Taichung, 40704, Taiwan

\*Email: ktli@thu.edu.tw

NSC Project No. : NSC 102-2221-E-029-021-MY2

Glycerol has become one of the top 12 building blocks of biorefinery. The hydrogenolysis of glycerol to 1,2-propanediol (shown in eq. 1) is one of the possibilities of glycerol utilization [1].



Copper-based catalysts are mostly often used for glycerol hydrogenolysis to produce 1,2-propanediol in the presence of high pressure hydrogen. In the literature, Cu/SiO<sub>2</sub> catalysts for glycerol hydrogenolysis were prepared by several different methods, including precipitation-gel, homogeneous-precipitation、heterogeneous deposition-precipitation、incipient wetness and ion-exchange. For supported metal catalysts, applicable metal atom mobility appears at about T<sub>m</sub>/3 (called Hutting temperature). The melting point of copper is 1357.77 K, therefore, copper atom mobility appears at 453K. Core-shell structure can be used to prevent the metal sintering of catalysts. Recently, we prepared palladium core - porous silica shell particles (Pd@SiO<sub>2</sub>) for catalyzing the hydrogenation of 4-carboxybenzaldehyde [2]. The palladium nanoparticles encapsulated in porous silica shell have been proved to be highly stable for CO oxidation [3].

In this work, hydrogenolysis of glycerol to 1,2-propanediol was studied over copper core - porous silica shell - nanoparticles (denoted as Cu@SiO<sub>2</sub>) with several different Cu/Si atomic ratios. At a reaction temperature of 200°C, the Cu@SiO<sub>2</sub> catalysts were able to achieve 1,2-propanediol yields of 72.8% and 96.5% without and with externally added hydrogen. These Cu@SiO<sub>2</sub> nanoparticles were characterized with TEM, nitrogen adsorption, XRD, H<sub>2</sub>-TPR and NH<sub>3</sub>-TPD.

## References

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Keywords: Hydrogenolysis catalysts; Cu@SiO<sub>2</sub> - core - shell - nanoparticles ; Glycerol ; 1,2-propanediol.

報告型式： ☒口頭 ☐海報 ☐皆可

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