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# Preparation of Cu/ZnO/SBA-15 Catalyst for Methanol Synthesis via $CO_2$ Hydrogenation at Low Pressure: Effect of Calcination Temperature

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## Extended Abstract

The increase in atmospheric carbon dioxide ($CO_2$) leaves a significant impact on the global warming. The current solution highlighted the need to reduce the alarming $CO_2$ levels. This also includes any sustainable route that utilizes the generated $CO_2$ gas to a more valuable product [1]. Synthesizing highly value-added industrial products such as methanol through the catalytic $CO_2$ hydrogenation is a very effective way to reduce $CO_2$ emissions, since methanol not only is a clean, renewable fuel but also can be used as an intermediate to produce valuable chemicals [2].

Numerous of studies have been made to develop effective catalysts for $CO_2$ hydrogenation to methanol. Cu-based catalysts, which contain ZnO and $Al_2O_3$ are active for methanol synthesis and have been commercially used for more than 50 years, but research for new more active catalysts continues [1]. In our previous studies Cu/ZnO/SBA-15 catalyst has been developed as an active catalyst for methanol producing in a fixed-bed tubular micro-activity reactor (Microactivity-Effi, PID Eng&Tech S.L.*)* at 20 bar with $H_2$ to $CO_2$ molar ratio 3 to 1.

Preparation of Cu/ZnO/SBA-15 catalyst: an aqueous solution of $Cu(NO_3)_2 \cdot 2.5H_2O$ and $Zn(NO_3)_2 \cdot 6H_2O$ was prepared and then an aqueous solution of glycine was added to the first to obtain the "impregnation solution" as in [3]. The "impregnation solution" was added dropwise to of SBA-15 and water is allowed to evaporate into the air by stirring at the room temperature. The viscous blue gel obtained after evaporation is treated for 5 min in an ultrasonic bath, and then calcined. The sample was divided in two parts – one part was calcined at 300°C for 3h, and the other at 450°C for 3h with heating speed 1°C/min.

In this research the effect of calcination temperature on the structural parameters of catalyst was studied. The surface area and the pore size were determined by $N_2$ adsorption-desorption isotherms obtained at −196 °C using a Quantachrome Instruments Nova 1200 E-Series surface and porosity analyzer. The aim of the study was to determine the most appropriate temperature of calcination. The results showed that uniform pore size distribution could be obtained when calcination temperature used was 300°C.

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