**THERMO-CATALYTIC DIRECT OXIDATION OF METHANE INTO METHANOL USING Cu/CeO2 CATALYST**

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**Abstract**

Methane is one of the most abundant and highly used energy source and also 25 times more hazardous greenhouse gas then CO2. Because of this the most efficient use of methane is very important. Although, being one of the major source of energy, there are several problem associated with methane uses. The biggest challenge in the methane usage and its transportation. Gaseous methane transportation requires a expensive pipeline infrastructure which makes its transportation cost intensive.

Along the transportation issue, conversion to methane into methanol can provide solution, economical use of unutilised methane gas in petrochemical plant. Furthermore, methanol itself is an important fuel and can be raw material of other useful chemicals. Efficient conversion of methane into methanol is an old and challenging problem. Currently methanol from methane is produce in two step process. First methane converted into syngas, then in second step syngas converted into methanol. As the first step of 2- step process is very energy intensive and its overall efficiency is very low. To make methane conversion into methanol more economical, a single step process is required. Here, direct oxidation of methane to methanol under gaseous condition on copper supported CeO2 catalyst, prepared using a sol-gel method, is investigated[1].

In this study, Cu@CeO2 catalysts is prepared by sol-gel method in which typically, a certain amount of Ce(NO3)3 ⋅ 6H2O, Cu- (NO3)3 ⋅3H2O and 2.0 g of citric acid monohydrate were dissolved into 20 ml distilled water at room temperature with vigorous stirring. The mixture is continuously stirring at 80°C for 4 h. The resulting collosol was dried at 90°C for 12 h and then calcined at 500 °C for 4 h to obtain the final catalyst.

Figure-1:Variation of methane conversion with time at T=4670C P=5bar, 50mg catalyst

Preliminary investigation shows that methane was majorly converted into co2 as shown in fig.1 methane conversion of 83% was observed fore 8 h of time on stream study. Liquid product analysis confirmed the formation of methanol. currently investigation are going on to further characterization the product formation.

**Keywords :** Methane, Methanol, Cu/CeO2 , Metal interaction, C-H activation, Direct oxidation

**Reference** [1] M. Wu *et al.*, “Single-Step Oxidation of Low-Concentration Methane to Methanol in the Gaseous Phase Using Ceria-Based Iridium-Copper Catalysts,” *ChemistrySelect*, vol. 8, no. 5, pp. 1–11, 2023, doi: 10.1002/slct.202204745.