Preparation of carbon-Ni/MgO-Al₂O₃ composite catalysts for CO₂ reforming of methane

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Conversion of biogas (CO₂ and methane) into syngas (mixture of CO and H₂) is a very interesting alternative for the valorisation of such renewable resource [1]. Nowadays, carbon based catalysts have been used for CO₂ reforming of methane because they can withstand higher temperature and possess larger specific surface area and pore structure than metal catalysts [2]. However, lower catalytic activity limits the application of carbon-based catalysts. It is expected to prepare a good catalyst for CO₂ reforming of CH₄ by combining the carbon-based catalyst with Ni catalyst. In this work, carbon-Ni/MgO-Al₂O₃ composite catalysts were prepared using sucrose as carbon precursor and [Ni,Mg,Al]-layered double hydroxide (LDH) as metal catalyst precursor. Different amount of sucrose was added to LDH by impregnation method and carbonized at 800 °C. The effect of sucrose/LDH weight ratio on the resultant carbon-Ni/MgO-Al₂O₃ composite catalysts and catalytic performances was investigated. The N₂ adsorption/desorption results showed that the composition catalyst had a larger specific surface area than metal Ni/MgO-Al₂O₃. After 10 h reaction time, the methane conversion over composite-support catalysts remained stable, obviously different from the Ni/MgO-Al₂O₃, shown in Fig.1. When the weight ratio of sucrose to LDH was 1.2, the catalyst had the highest catalytic activity and best catalytic stability.

Figure 1: Effect of weight ratio of sucrose to LDH on the catalytic performance for CO₂ reforming of CH₄ (800 °C, GHSV= 48,000 ml·g₉cat⁻¹·h⁻¹)

References
