METHANE PRODUCTION OVER NiSUPPORTED F-SBA-15: DIFFERENT AMOUNT OF Ni LOADINGS

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ABSTRACT:
Formation of bulky wastes of carbon dioxide (CO2) from burning of fossil fuels had impacted to the earth's environmental issues. The CO2gases trapped in the ozone layer and thus mitigate the climate change through the greenhouse gases (GHGs) effect. Numerous attentions have been drawn towards recycling and transformation of CO2gases into more valuable products via CO2methanationby using variety of supported metal catalysts[1–2]. For the choice of support, mesoporous material type of support such as SBA-15 is preferred due to its favorable textural properties with higher surface area(600-1,000 m2/g), larger pore size diameter(5-30 nm), higher thermal and hydrothermal stability as well as highly uniform-arranged mesopores. Nickel (Ni) is selected as type of metal due to its low price and easily available[3]. However, if the carbon deposition and metal sintering occurred over metal-based support, it may rapidly trigger the deactivation of catalyst due to weaker interaction between metal and support[4], and thus resulted to a lower catalytic performance towards methane production. Therefore, this study highlighted on the modification structure of SBA-15 support into fibrous type (F-SBA-15) in order to produce higher accessibility of metal to be dispersed intoit due to the formation of higher surface area and wide pore diameter, in agreement with Firmansyah et al. [5].In addition, different amount of Ni loadings (1, 3, 5, and 10wt.%) onto F-SBA-15 support for methane productionwere also controlled. Their physical properties were characterized using XRD, BET, and FTIR. In-situ FTIR adsorbed pyrrole analysis revealed the presence of basic sites originated in the catalysts. The catalytic activities of CO2methanation were performed using stainless steel fixed bed reactor. Meanwhile, the presence of coke on the surface of all spent Ni-based F-SBA-15 wereinvestigated using XRD analysis.

Keywords: Ni/F-SBA-15; Methane; Ni loadings; Metal-support interaction; Coke deposition.