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CORRELATION BETWEEN THE PREPARATION METHODS AND PHYSICOCHEMICAL CHARACTERISTICS OF $MgAl_2O_4$ AS A SUPPORT FOR Ni CATALYSTS IN PARTIAL OXIDATION OF METHANE

by

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Date & Venue

10:30 pm

Tuesday, 21 March 2023

F3-226

Abstract

Due to different technical challenges associated with direct use of methane, the main component of natural gas, its conversion to higher hydrocarbons has been a subject of great industrial importance. All of the known routes for methane conversion are catalytic processes, where the performance is largely dependent on the physicochemical properties of the catalyst. The catalysts that have shown promising performance in methane reforming are based on expensive metals such Pt, Pd, and Ru. Ni, on the other hand, is a cost-effective metal and has shown promising catalytic activity. Those catalysts are usually in the form of metal nanoparticles supported on an oxide powder such as Al_2O_3 and $MgAl_2O_4$. The support very often plays a role in the surface catalytic reactions. For example, $MgAl_2O_4$, which is the support investigated in this research, has been found to be a promising support for Ni catalysts where its physicochemical properties play a role in minimizing coke formation that usually leads to catalyst deactivation. Its textural properties as well as its surface basic site density were found to play key roles in enhancing coking resistance. Since solid characteristics very often depend on the preparation method and conditions, the main aim of the research herein is to prepare $MgAl_2O_4$ as a support for Ni catalysts by different methods and correlate between the preparation methods and its final properties especially the surface acid-base characteristics and textural properties. The different preparation methods that were investigated include sol-gel, and co-precipitation. $Ni/MgAl_2O_4$ is prepared using the differently prepared supports employing wetness impregnation. Correlation between preparation methods and physicochemical characteristics of the prepared catalyst as well as their coking resistance during partial oxidation of methane reaction were studied.

Keywords: Partial Oxidation of Methane, Synthesis Gas, Natural Gas Conversion, Ni Catalysts, Textural properties.