Hiden Reference: AP0027
Hiden Product: Integrated Microreactor-MS, with CATLAB-PCS Module & QIC-20 MS Module

PREPARATION AND CHARACTERIZATION OF NICKEL BASED CATALYSTS FOR PARTIAL OXIDATION OF METHANE

Hydrogen, which can be used in many fields without polluting the environment, is thought to be the cleanest fuel source of 21th century. Therefore, low cost production, facile storage and transportation of hydrogen are important research subjects that are investigated by many universities and related commercial facilities.

Steam-hydrocarbon reforming is the major hydrogen production process today. However, this process has many disadvantages like high energy demand and complicated equipment design etc. For this reason, there have been many researches to develop alternative processes for several decades and catalytic partial oxidation and autothermal reforming have come forth as good alternatives. Partial oxidation process doesn't require external heat because of being slightly exotermic and occurs faster 10 or 100 times than the steam reforming, therefore small reactors could be used. Thus, by lowering the total investment and production costs, hydrogen production cost could be lowered. Furthermore, by the help of this process hydrogen, which is needed for the fuel cell, could be produced with a simple on-board fuel conversion device and the problems for hydrogen storage and transportation could be handled. Alike, introducing steam to the reaction area by using autothermal reforming hydrogen production yield can be increased and cost can be lowered.

Methane has seemed to be the best hydrocarbon source for partial oxidation and autothermal reforming process because methane is the main component in natural gas and natural gas is abundant on earth. Additionally, methane has the property of having the highest H/C (H/C=4) ratio in hydrocarbons.



Fig 1. In the Lab - Integrated Microreactor-MS, with CATLAB-PCS Module & QIC-20 MS Module

Researchers have tested many catalysts for partial oxidation of methane and have seen that noble based metals catalysts (Rh, Pt, Ru, Ir) with nickel (Ni) based catalysts are active and selective for this reaction. Although, noble metal based catalysts are stable and active, because of their high cost and low availability, the best alternative have thought to be nickel based

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catalysts. But these catalysts have disadvantages like sintering, coking and phase transformation. There have been many attemps to solve these problems so far but couldn't be solved totally.

With the aim of solving these problems Ni and Ni-Co based catalysts which are loaded on appropriate support will be prepared by impregnation and polyol methods, metallic ratios and methods effect will be investigated. According to literature by using polyol method it is possible to obtain uniformly dispersed and <10 nm active metal size. By uniform dispersion sintering, by <10 nm metallic particle obtaining carbon deposition suppression is thought to be prevented. Additionally, by Ni-Co alloying carbon deposition suppression is sighted. Therefore, low costly, easily producible, highly active, selective and stable catalyst preparing has been planned which can be used commercially.

The catalysts that prepared will be characterized and tested by using TG-DTA, BET, MICROREACTOR-MS, GC which is found in our lab, XRD and AAS which is found in our university research laboratory with SEM which is found in TUBİTAK MAM.

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Paper Reference:
"*Preparation and characterization of Ni based catalysts for the catalytic partial oxidation of methane: Effect of support basicity on H2/CO ratio and carbon deposition*", International Journal of Hydrogen Energy, Volume 35, Issue 22, November 2010, Pages 12147-12160

Hiden Product:
Integrated Microreactor-MS, with CATLAB-PCS Module & QIC-20 MS Module
(QIC-20 System now updated with the New QGA Atmospheric Gas Analysis System. This latest version was released in 2010).

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