Dry Reforming of Methane with CO\textsubscript{2} over Supported Fe-Ni Bimetallic and Fe-Ni-Mo Trimetallic Heterogeneous Catalysts

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Objective:
Our goal in conducting this study is to develop novel iron based catalysts to enhance the reaction of CO\textsubscript{2} with CH\textsubscript{4} to create value added chemicals in one single process

Support Pre-treatment
The catalyst was ground into uniform size and weighed for precise measurement in order to prepare for experiment.

Impregnation
The heterogeneous Fe-based bimetallic and trimetallic catalysts were synthesized via a wet incipient impregnation method to uniformly coat the metal salts to the pre-treated support (SiC, SiO\textsubscript{2} and ZrO\textsubscript{2}).

Dry/Calcine
The catalyst was put in in the oven at 80°C for two hours to dry and prepare for calcination. The catalyst was then subjected to the furnace to calcine at 450°C for five hours.

CO Chemisorption (CO Uptake Value)

- Fe-Ni/SiC: 4.1085 (µmol/g)
- Fe-Ni-Mo/SiC: 0.8593 (µmol/g)

Challenges
The biggest challenge in conducting this study is to secure a highly efficient catalyst that enable the conversion of the greenhouse gases, CO\textsubscript{2} and CH\textsubscript{4} in one-step to produce value added chemicals.

Future Studies
Catalyst characterization such as Brunauer Emmett Teller (BET) surface area, pore size and volume, Transmission Electron Microscope (TEM), X-ray photoelectron spectroscopy (XPS), X-ray diffraction (XRD) are to be carried out with an aim to establish a relationship between activity and properties.

Catalyst Testing
The synthesized catalysts are to be tested for CO\textsubscript{2} dry reforming with methane through a flow bed reactor with controlled CO\textsubscript{2} and CH\textsubscript{4} flow rate and on-line GC analysis to determine the catalyst performance such as selectivity, conversion and stability.

Emission of CO\textsubscript{2}
Global warming has become an issue concerning the emission of CO\textsubscript{2} which is a greenhouse gas. Methane is a major component of natural gas which is inexpensive and very attainable.

Chemistry

\[ \text{CO}_2 (g) + 
CH_4 \rightarrow 2\text{CO} + 2\text{H}_2 \quad \Delta H_{298} = 247 \text{kJ/mol} \]

\[ 2\text{CO}_2 (g) + C_2\text{H}_6 (g) \rightarrow 4\text{CO} + 3\text{H}_2 \quad \Delta H_{298} = 429 \text{kJ/mol} \]