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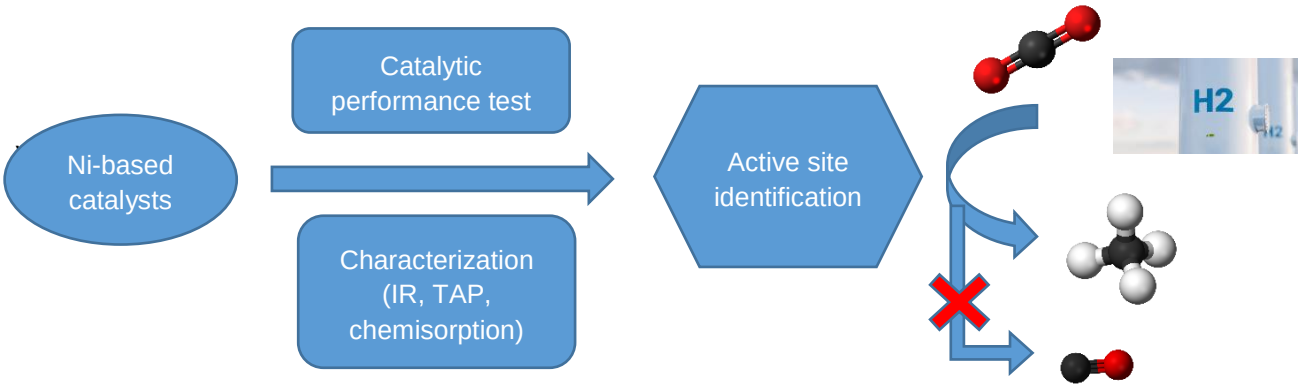
Identifying active sites for CO_2 methanation in Ni-based catalysts

Aim

Synthesize and characterize Ni-based catalysts with different Ni particle size to assess the link with conversion and selectivity for CO_2 methanation. Figure out the structure of Ni which is most active and selective to CH_4 combining controlled trials and characterizations.

Justification

Today's challenge for the chemical industry is ensuring sustainable supplies of fuels, chemicals and materials for a growing global population, while limiting global warming and climate change. Controlling the atmospheric CO_2 level forms an inseparable part of this evolution. CO_2 can also be hydrogenated into chemicals or fuels such as methane, formaldehyde, dimethyl ether, formic acid, methanol and other alcohols. The activation of CO_2 and its hydrogenation to hydrocarbons or alcohols are challenging because CO_2 is very stable, requesting co-reagents and efficient catalysts. Ni-based catalysts are outstanding to convert CO_2 into CH_4 for their low cost and relatively high activity. To further improve Ni-based catalysts to meet industrial requirement, fine control and thorough characterization of the Ni structure are needed to identify the most active and selective site.



Program

1. Literature survey on Ni-based catalysts for CO_2 methanation.
2. Synthesis of Ni-based catalysts with different particle size using different methods (e.g. incipient wetness impregnation, deposition-precipitation…)
3. Catalytic performance test of these catalysts with different particle size.
4. Using TAP reactor to gain insight in the intermediates, in combination with in situ IR to reveal the reaction pathway.
5. Characterization of the structure of Ni particles and identify different active sites.