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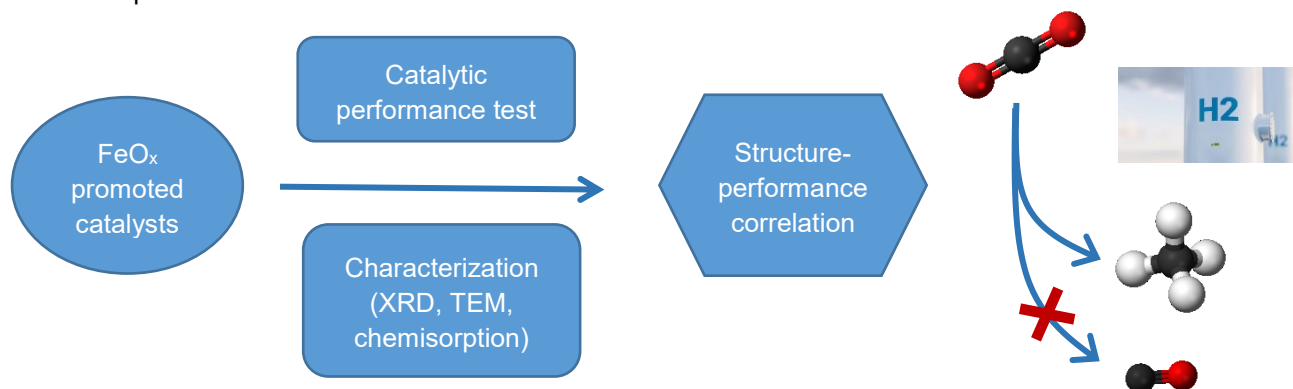
Investigation of CO₂ Methanation Catalysts with FeO_x Promoter

Aim

Synthesize and characterize several supported catalysts (Pt, Rh, Ni) modified with FeO_x to evaluate the link with conversion and selectivity for CO₂ methanation. Figure out the geometric and electronic structures of FeO_x promoted catalysts with different active element and promoter loading and assess which is most active and selective to CH₄ through a combination of controlled tests and characterization.

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 CO₂ level forms an inseparable part of this evolution. CO₂ can be hydrogenated into chemicals or fuels such as methane, formaldehyde, dimethyl ether, formic acid, methanol and other alcohols. However, the activation of CO₂ and its hydrogenation to hydrocarbons or alcohols are challenging because CO₂ is very stable, requesting co-reagents and efficient catalysts. Noble metal catalysts are outstanding to convert CO₂ into CH₄, while Ni-based ones excel for their low cost and still relatively high activity. A redox-active promoter such as FeO_x can result in localized alloy formation for enhanced activity and selectivity, possibly exhibiting a different mechanism than an inert promoter. To further improve methanation catalysts and meet industrial requirements, thorough characterization (chemisorption, XRD, TEM, etc.) of the catalyst structure and FeO_x promoter is needed to establish the structure-performance correlations.



Program

1. Literature survey on catalysts for CO₂ methanation.
2. Synthesis of FeO_x modified catalysts with good dispersion using different methods (e.g. incipient wetness impregnation (IWP), agent assisted IWP, deposition-precipitation, ...)
3. Catalytic performance test.
4. Kinetics.
5. Characterization of the structure of the promoted catalyst and identification of different active sites.