Structural effect of Ni catalysts on methane and CO_2 conversion

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Because of its high activity, low cost, and the plentiful supply of the metal, nickel-based catalyst has been extensively employed in the industrial process of steam reforming for hydrogen and syngas production. Nickel-based catalyst has also shown high activity for CO_2 methanation and CO_2 reforming of methane, which has been considered as alternative to the energy intense steam reforming. However, a major challenge is that Ni catalysts have a high thermodynamic potential for coke formation during reactions of methane and CO_2 conversion. It is highly desired to design and synthesize a coke resistant Ni catalyst with enhanced low temperature activity. It has been confirmed the reforming and methanation reactions over the Ni catalyst are structure sensitive. The catalyst preparation in structural controllable way is extremely important. In this presentation, the very recent progresses in the structure control of Ni catalysts for CO_2 reforming of methane and CO_2 methanation will be summarized. The importance of the decomposition methods of the catalyst precursors will be addressed. The present studies confirmed the most convenient way to control the structure of Ni catalysts is via the size control. The decomposition of nickel precursor under the highly energetic electrons at low temperatures (less than 573 K) is an excellent way for the size control. The catalyst with more Ni(111) leads to an improved low temperature activity and an enhanced coke resistance because of the highly reactive carbon formed on Ni(111). The future development will be discussed.

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