

## Combined steam and CO<sub>2</sub> reforming with CH<sub>4</sub> over ordered mesoporous Ni/SBA-15@SiO<sub>2</sub>

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The combined steam and CO<sub>2</sub> reforming with CH<sub>4</sub> (CSCR) is attractive reaction to produce syngas by using greenhouse gases of CH<sub>4</sub> and CO<sub>2</sub> simultaneously by using Ni-based catalysts with comparable catalytic activity. However, Ni-based catalysts revealed the sintering and coke deposition natures due to its thermal instability at high temperature. To overcome the limitations, an overlayer coating method of Ni nanoparticles by using silica shell was applied with highly ordered mesoporous silica support (SBA-15). The overlayer coating method increased anti-sintering natures of Ni nanoparticles. With the positive contribution of spatial confinement effects of the ordered mesoporous SBA-15, an improved catalytic activity and thermal stability for CSCR reaction were observed with the preservation of original Ni sizes, which were confirmed by XRF, XRD, TEM, TGA and so on.

Keywords: Combined steam and CO<sub>2</sub> reforming with CH<sub>4</sub> (CSCR); Ordered mesoporous SBA-15; Spatial confinement effect; Anti-sintering.