Multi-layered core-shell catalyst for CO_2 reforming of methane

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The catalytic CO_2 reforming of methane possesses an eco-friend implication to produce syngas (H_2 and CO) by converting both major greenhouse gases CH_4 and CO_2. However, the catalyst deactivation by sintering and carbon coking is the major issue to implement scale-up process in real applications. In this study, we prepared one-pot synthesized catalysts consisting of single core@shell and multi-layered catalysts sequentially synthesized (dual and triple-layered core@shell), while keeping a total loading of Ni (*ca.* 10 wt.%) in the sample. The Ni impregnated on SiO_2 (Ni/SiO_2) catalyst was also compared. The CO_2 reforming of methane reaction was carried out under the steady-state condition from 650 to 850 ℃ with a mixture of CH_4 and CO_2 in Ar balance (CH_4:CO_2:Ar=3:3:4). The catalytic performance is in the following order: Dual layered $Ni@SiO_2$ > triple-layered $Ni@SiO_2$ > single $Ni@SiO_2$ > Ni/SiO_2. Moreover, the dual-layered core-shell catalyst revealed superior long-term stability under the reaction condition with SV=100,000 h^{-1} for 100 h time-on-stream. The catalysts were also characterized by H_2-TPR, NH_3-TPD, XPS, and TEM to analyze the activity trend and the catalytic stability.