

Independent Effects of Size and Support on Ni Catalysts for Dry Reforming of Methane

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The dry reforming of methane (DRM; $\text{CH}_4 + \text{CO}_2 \rightarrow 2\text{H}_2 + 2\text{CO}$) is a good way to convert greenhouse gases to valuable synthesis gas. Ni-based catalysts have been studied for this reaction, however, the independent effect of Ni size and support have not been reported yet. In this study, designed catalyst in which the Ni nanoparticle size and support can be varied independently was synthesized. 2.6, 5.2, 9.0, 17.3 nm sized Ni nanoparticles were tested for DRM at 800 °C without a significant Ni size change, and different metal oxides of SiO_2 , Al_2O_3 , MgO , ZrO_2 , TiO_2 were tested with 5.2 nm of Ni nanoparticles. The effect of Ni size and support on CH_4 or CO_2 turnover frequency was evaluated separately. In result, Ni nanoparticles with a size of 2.6 nm showed 4.2 times higher CH_4 turnover frequency than those with a size of 17.3 nm. Among various supports, Al_2O_3 showed 4.3 times higher CH_4 turnover frequency than SiO_2 . The separated observation of Ni size effect and support effect would contribute to effective catalytic system for methane dry reforming.