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# NiCo@SiO<sub>2</sub> core-shell catalyst with high activity and long lifetime for CO<sub>2</sub> conversion through DRM reaction

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## Abstract

A novel NiCo@SiO<sub>2</sub> core-shell catalyst with single NiCo alloy nanoparticle encapsulated by SiO<sub>2</sub> shell was synthesized by microemulsion method. During dry reforming of CH<sub>4</sub> with CO<sub>2</sub> (DRM) reaction, this catalyst exhibited high activity and selectivity, superior over either the Ni@SiO<sub>2</sub> or the Co@SiO<sub>2</sub> core-shell catalyst or the NiCo/SiO<sub>2</sub> supported catalyst. The CO<sub>2</sub> and CH<sub>4</sub> (1 : 1) could be absolutely converted into CO and H<sub>2</sub> with molar ratio around 1: 1. More importantly, this catalyst displayed very long lifetime (> 1000 h) in the DRM reaction at 800°C, much better than either the Ni@SiO<sub>2</sub> or the Co@SiO<sub>2</sub> core-shell catalyst or the NiCo/SiO<sub>2</sub> supported catalyst. Kinetic studies revealed that the catalyst with small metal nanoparticle size exhibited higher activity, which could also inhibit carbon deposition. The encapsulation of metal nanoparticles by SiO<sub>2</sub> shell could effectively inhibit the agglomeration of active sites. Meanwhile, the enhanced activity of NiCo alloy catalyst could also diminish the surface carbon deposition. Therefore, the NiCo@SiO<sub>2</sub> core-shell catalyst displayed excellent stability in DRM reaction, showing good potential in industrial application.

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