

Interplay between promoters and Ni-based mesoporous silica for methane dry 2 reforming reaction

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Abstract:

Commercially viable Ni-based heterogeneous catalysts have immense potential for the application in reforming reactions, but their rapid catalyst deactivation due to coking still remains a major challenge during these catalytic reforming applications. Herein, the endurance test of 72 h for methane dry reforming at low temperature and atmospheric conditions was conducted over a series of different promoted Ni-based catalysts. Intriguingly, bare SBA-15 supported Ni catalyst blocked the reactor after 51 time-on-stream due to excess carbon formation during the reaction. In addition, the catalyst promoted with yttrium showed the outstanding catalytic performance with CH₄ and CO₂ conversion of about 83.0% and 90.9%, respectively. On the other hand, boron promoted catalysts greatly improved the Ni and SBA-15 support interaction by facilitating the formation of NiSO₃ and detected lowest coke formation and catalytic activity among counterparts. Moreover, different carbon species (herringbone fibers, amorphous and carbon shell) were identified in the spent catalysts.

Keywords: Syngas; Methane dry reforming; catalysts deactivation; Boron promoter; Ni catalyst.