An assessment of the longevity of samarium cobalt trioxide perovskite catalyst during the conversion of greenhouse gases into syngas

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A B S T R A C T

Catalytic carbon dioxide (CO_2) reforming of methane (CH_4) has gained interest because it reduces the amount of greenhouse gases in the environment. In addition, the products from the reforming process are utilized as feedstock in the Fischer-Tropsch synthesis. However, rapid catalyst deactivation and sintering due to carbon deposition often accompany the CO_2 reforming of CH_4 reaction. In this study, samarium cobalt trioxides perovskite catalyst was synthesized and employed as catalyst in a 72 h longevity test conducted at 1073 K using CO_2 to reform CH_4 with gas-hourly-space velocity of 30,000 h^{-1}. Feed ratios (0.5–2.0) were varied and excellent catalytic longevity, maximum conversion (above 90%) and yield (above 60%), were obtained at 1.0 feed ratio. Physicochemical properties of the fresh catalyst revealed uniform metallic particles distribution on a single phase perovskite structure, while spent catalyst showed evidence of carbon which was graphitic at 0.5–1.33 feed ratio with C–C and C–H bonds, and formed contaminant of carbon at 2.0 feed ratio with O–C=O bond.