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Catalytic conversion of methane and carbon dioxide (greenhouse gases) into syngas over samarium-cobalt-trioxides perovskite catalyst

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ABSTRACT

The catalytic behaviour of samarium-cobalt-trioxides perovskite catalyst was investigated for the mitigation of greenhouse gases (carbon dioxide and methane) to provide cleaner energy (hydrogen and carbon monoxide) and environment. X-ray photoelectron spectroscopy analysis of the as-synthesized catalyst showed peaks corresponding to complexes of cobalt (II), dual oxygen species, and samarium (III) ions. X-ray diffraction pattern showed a monophasic samarium-cobalt-trioxides perovskite structure, while post-reaction analysis showed modification of the perovskite. The temperature-programmed reduction analysis showed peaks corresponding to reduction of cobalt (II) to Co^0. The temperature-programmed desorption displayed peaks ascribed to medium strength basic and acidic sites. Performance test carried out on the catalyst via methane dry reforming, showed excellent reactants conversions of above 90% which was maintained for the duration (30 h) of the experiment. The catalyst remained active over the time of experiment, even though the temperature-programmed oxidation, scanning electron microscopy and energy dispersive X-ray spectroscopy analyses of the used catalyst showed evidence of carbon deposit.