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Steam Reforming of Methane Over Catalyst Derived from Ordered Double Perovskite: Effect of Crystalline Phase Transformation

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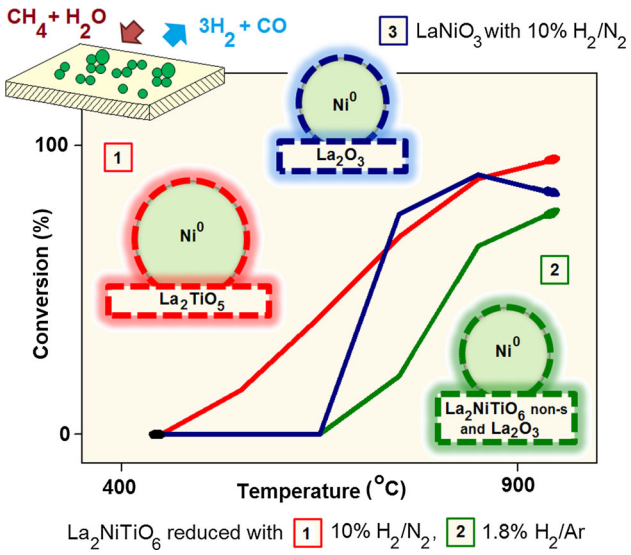
Abstract La_2NiTiO_6 double perovskite was synthesized by modified Pechini method. The catalyst activity for steam reforming of methane was investigated at temperatures from 450 to 950 °C, under different reduction conditions. By reducing La_2NiTiO_6 with 10 % H_2/N_2 at 1,000 °C, the crystalline phase changed to mainly Ni^0 and La_2TiO_5, which decreases the onset temperature of methane conversion to 550 °C and provides a maximum methane conversion of 95 % at 950 °C. This activity is higher when compared to that achieved with La_2NiTiO_6 reduced with 1.8 % H_2/Ar, which is composed of Ni^0 supported on both non-stoichiometric La_2NiTiO_6 and La_2O_3, and also to those of unreduced La_2NiTiO_6 and Ni/La_2O_3 formed by reduction of $LaNiO_3$. Activity improvement is related to the increased number of active sites and/or metal-support interaction.

Graphical Abstract



Keywords Steam reforming · Methane · Crystalline phase transformation · Double perovskite · La_2NiTiO_6

1 Introduction

Natural gas is an attractive fossil energy source because of large worldwide reserves and its lower carbon emissions compared to coal and petroleum [1]. Also, it is expected that Brazil will increase natural gas production due to reserves associated with presalt basins [2], which offer great opportunities to meet future energy needs of this country. From natural gas hydrogen can be obtained by

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