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Catalysis, kinetics and reaction engineering

Bi-metallic catalysts of mesoporous Al_2O_3 supported on Fe, Ni and Mn for Methane decomposition: Effect of activation temperature

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A b s t r a c t

Methane decomposition reaction has been studied at three different activation temperatures (500°C, 800°C and 950°C) over mesoporous alumina supported Ni-Fe and Mn-Fe based bimetallic catalysts. On co-impregnation of Ni on Fe/Al_2O_3 the activity of the catalyst was retained even at the high activation temperature at 950°C and up to 180 min. The Ni promotion enhanced the reducibility of Fe/Al_2O_3 oxides showing higher catalytic activity with a hydrogen yield of 69%. The reactivity of bimetallic Mn and Fe over Al_2O_3 catalyst decreased at 800°C and 950°C activation temperatures. Regeneration studies revealed that the catalyst could be effectively recycled up to 9 times. The addition of O_2 (1 ml, 2 ml, 4 ml) in the feed enhanced substantially CH_4 conversion, the yield of hydrogen and the stability of the catalyst.

Keywords: Carbon nanotube, Hydrogen production, Methane decomposition, manganese promoter, Nickel promoter

1. Introduction

The declining nature of non-renewable fossil fuels and global warming stimulated the fundamental research in promoting better energy options with low emission, and therefore renewable alternative energy sources are gaining considerable attention [1]. In the recent era, hydrogen is emerging as one