Proceedings International
Platinum Open Access Journal (ISSN 2668-6384)

Proceedings, Abstract
Volume 3, Issue 4, 2021, 35 - 36
https://doi.org/10.33263/Proceedings34.035036

Insight into the Effect of Iron Alumina Catalyst on Methane Decomposition in Terms of CNT Quality and Methane Conversion in the Fluidized Bed Reactor †

Kaushal Parmar [1], K. K. Pant [1], S. Roy [1,*]

[1] Department of Chemical Engineering, IIT Delhi;
* Correspondence: kkpant@chemical.iitd.ac.in (F.L.);
† Presented at International e-Conference on Green Chemistry and Engineering towards Sustainable Development – An Industrial Perspective (16-18 June 2021), Surat, Gujarat, India
Received: 5.06.2021; Revised: 10.06.2021; Accepted: 12.06.2021; Published: 15.06.2021

Abstract: The need for clean, sustainable energy sources increases due to environmental fouling from fossil fuel emissions. Hydrogen is one of the best clean fuels with high energy density and no adverse environmental effects. The most common hydrogen production method, i.e., Steam Methane Reforming (SMR), produces a high amount of CO_2 (1300 times more than the product). This creates a need for new technology that can produce hydrogen without hampering the environment. Thermo-Catalytic Decomposition of methane (TCD) is an attractive approach for COx-free hydrogen production. The energy requirement of the TCD process is quite similar to SMR (37.8 kJ/mol H_2 vs. 41.3 kJ/mol H_2). Furthermore, the TCD process avoids energy-intensive units, i.e., pressure swing adsorption for CO_2 separation, because it produces COx-free H_2 and solid carbon. Different forms of carbon (i.e., CNTs, graphene) can be made by optimizing the shape and size of the metal crystals of the catalyst. In this context, methane decomposition in a fluidized bed reactor was investigated. An iron-based alumina-supported catalyst was prepared for methane decomposition in the fluidized bed reactor. High methane conversion (>80%) and multi-walled bamboo-shaped carbon nanotubes were obtained by the catalyst. Prepared catalysts, as well as CNTs, were characterized by TPR, BET, FE-SEM, HR-TEM, Raman spectroscopy, TGA, etc. Hydrodynamic aspects of the fluidized bed reactor were also taken into consideration.

Keywords: fluidized bed reactor; methane decomposition; hydrogen, carbon nanotubes; thermo-catalytic process.

Funding

This research was funded by Hindustan Petroleum Corporation Limited (HPCL) and the Centre for High Technology Delhi (CHT).

Acknowledgments

The author Kaushal R. Parmar is a recipient of the Prime Minister's Fellowship Scheme for Doctoral Research, a public-private partnership between the Science & Engineering Research Board (SERB), Department of Science & Technology, Government of India, and Confederation of Indian Industry (CII). The author's host institute for research is the Indian

Institute of Technology Delhi, and the partner company is Hindustan Petroleum Corporation Limited and Centre for High Technology.

Conflicts of Interest

The authors declare no conflict of interest.