

Using Ceramic Rod to Increase Ethylene and Propylene Yields of Steam Cracking of Naphtha

Ramin Karimzadeh, Jafar Towfighi

Chemical Engineering Department, Tarbiat Modares University ,Po.Box. 14115-111 , ,
Tehran, Iran, email : ramin@modares.ac.ir

Heinz Zimmermann

LINDE AG, Process Engineering and Contracting Division, Dr. Carl-von-Linde-Str. 6-14 ,D-82049 Hoellriegelskreuth , Germany

Abstract

The yields of light products of steam cracking of naphtha have been increased through a tube with ceramic packing . The use of packed bed reactors in commercial scale has pressure drop limitation. A reactor consisting of a coil with ceramic tube rod inside the coil is a good substituting of ceramic packed bed reactor. Steam cracking of naphtha in industrial reactor of Arak petrochemical complex is simulated for two different cases of the steam cracking reactors. In the first case, the existing reactor in the Arak petrochemical plant with known operating conditions was simulated. In the second case, a reactor with a ceramic rod at operating conditions in Arak reactor was simulated. The results show that the skin temperature of the coil with ceramic rod is lower than the skin temperature of empty tube for given gas temperatures. It is also shown that the yield of ethylene in a reactor with the ceramic rod is higher than the yield in empty reactor for a given gas outlet temperature.

Keywords : Steam Cracking, Ceramic rod, Naphtha, Modeling, Ethylene

Introduction

Light Olefins, ethylene and propylene, are produced commercially via steam cracking of various hydrocarbons, such as ethane, naphtha and gas oil. These low molecular weight olefins are among the most important base chemicals for the petrochemical industry.

Modern steam cracking plants today typically are the center of petrochemical complexes producing 500,000 - 1,000,000 tons per year ethylene the main petrochemical building block. Ethylene yield on weight basis is typically 30 % with naphtha feed stock and goes down to 25 % for gas oil feed stock.

Towfighi et.al.¹ investigated several different metal oxide catalysts and inert ceramic packing in different size diameters. In these experiments it was shown that the improvement of yields over the inert ceramic materials are in a similar range as with catalysts^{2,3,4,5}. It could be demonstrated that the yields of products are in a similar range with different surface area of inert material packing. However using packing materials in industrial scale provide high pressure drop and coke formation on the surface of packing. Karimzadeh et al⁶ proposed a novel reactor consisting of a tube with a ceramic rod inserted improving the yield of ethylene and propylene in steam cracking of naphtha at given temperature. A sketch of