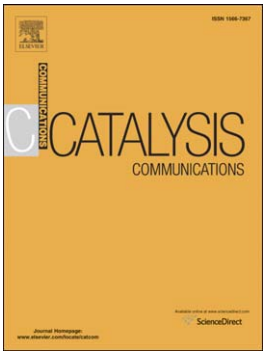

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Composite TiO_2/Fiberglass catalyst: Synthesis and characterization

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Abstract

The paper presents the synthesis and characterization of highly dispersed titania on the surface of fiberglass material. Scanning electron microscopy and X-ray digital 3D-microtomography showed that each support fiber was uniformly coated by modifying component. The layer of titania consisted of anatase particles of 18 nm, an average pore size was 3.1 nm. The prepared material revealed a catalytic activity in n-heptane cracking, deep and partial oxidation. The major products of n-heptane conversion at 300-400^{o}C in the presence of oxygen were ketones with a carbon number of 3-4. Above 500^{o}C, the deep oxidation increased dramatically with a simultaneous appearance of α-olefins.

Keywords: sol-gel synthesis, titania, anatase, fiberglass catalyst, n-heptane oxidation

1. Introduction

Titanium dioxide possesses a number of unique properties such as chemical stability, biological safety, photosensitivity, catalytic activity, etc. Such a set of physical and chemical characteristics determines the width of studies for development of new functional materials on the basis of TiO_2. Thin film polyfunctional materials based on TiO_2 are promising candidates for application as catalysts [1, 2], sensors [3, 4], solar cells [5-7], and protecting coatings [8, 9]. The possibility to use TiO_2 in oxidation of saturated hydrocarbons was shown [10].

Fiberglass materials of silicate origin are known for high thermal stability, mechanical strength, low values of hydraulic resistance, as well as flexibility, which gives the opportunity to create the catalysts of various geometric forms for application in microreactors [11-14]. Current studies of fiberglass materials show the possibility of creating the catalysts with high activity [14-16]. Thus, the fiberglass catalysts containing very small amounts of platinum (0.01–0.02 wt.%) showed very high activity in a number of reactions, particularly, in the deep oxidation of hydrocarbons [17], the oxidation of SO_2 [18], the oxidative degradation of