Журнал Сибирского федерального университета
Journal of Siberian Federal University 2010 3 (2)

Химия
Chemistry

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Компьютерная верстка **И.В. Гревцовой**

Подписано в печать 18.06.2010 г. Формат 84x108/16. Усл. печ. л. 8,6.
Уч.-изд. л. 8,1. Бумага тип. Печать офсетная. Тираж 1000 экз. Заказ 2503.
Отпечатано в ПЦ БИК СФУ. 660041 Красноярск, пр. Свободный, 82а.

Свидетельство о регистрации СМИ ПИ № ФС77-28-726 от 29.06.2007 г.

Journal of Siberian Federal University. Chemistry 2 (2010 3) 99-103
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УДК 665.644.4; 546.264-31

Reforming of Light Alkanes by CO_2 Over Bimetallic Supported Catalyst

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Received 4.06.2010, received in revised form 11.06.2010, accepted 18.06.2010

The bimetallic cobalt-containing catalyst supported on alumina has been investigated in the reaction of interaction between carbon dioxide and light alkanes (mix of C_2-C_4 hydrocarbons) or individual methane at varying experiment temperature and pressure. It has been shown that the catalyst possesses the high activity in reforming of alkanes. The reactants' conversion and products' yield and composition depend on composition of initial feed and process conditions. The main product of CO_2+CH_4 reaction is synthesis-gas at atmospheric pressure, also water and oxygenates are produced at higher pressure. The yield of oxygenates (mainly methanol and ethanol) is about 2 % under the certain conditions (P= 2-5 atm). In addition to above products olefins are formed at the interaction between carbon dioxide and alkanes (C_2-C_4). One of the advantages of the synthesized catalyst is its resistance to coke formation.

Keywords: CO_2 reforming, bimetallic catalyst, light alkanes, synthesis-gas

Introduction

One of new widely developing methods of methane (CH_4) utilization is its catalytic interaction with carbon dioxide (CO_2) so called dry reforming of methane according to the reaction (equation 1) [1-4]:

$$CO_2 + CH_4 \rightarrow 2CO + 2H_2 \qquad \text{(equation 1)}$$

Synthesis-gas (or syngas – $CO+H_2$) produced by this reaction is recognized as the most real alternative raw material for producing the various hydrocarbon fractions including motor fuel, hard hydrocarbons, olefins, and oxygenates to be used in different directions of energetic and chemistry [1-5]. The development of methods of combined utilization of carbon dioxide and alkanes can also solve the ecological problem. Both carbon dioxide and methane are "green-house" gases. `

The interaction between light alkanes (C_2-C_4) and carbon dioxide is performed as a prospective process too, because they are components of the real natural, associated and petrochemical gases. CO_2 reforming of alkanes (C_{2+}) is not widely investigated. The reason of that is high coke formation due to cracking of hydrocarbons strengthened with increase in number of carbon atoms of hydrocarbon. Carbon can be produced during decomposition of carbon dioxide too. As a result the catalysts covered by carbon deposition lose their activity in process of CO_2 reforming that discourages their use especially under high pressure. For commercial application the

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