

Borshkov Institute of Catalysts SB RAS, Novosibirsk, Russia
Zelinsky Institute of Organic Chemistry RAS, Moscow, Russia
Lomonosov Moscow State University, Moscow, Russia



X International Conference "Mechanisms of Catalytic Reactions"

Svetlogorsk, Kaliningrad Region, Russia
October 2 - 6, 2016

ABSTRACTS

Novosibirsk-2016

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УДК 544.47+66.09
ББК Г544

M45 Mechanisms of Catalytic Reactions. X International Conference (MCR-X)
(October 2 - 6, 2016, Svetlogorsk, Kaliningrad Region, Russia) [Electronic resource]: Book of abstracts / Borekov Institute of Catalysis SB RAS ed.: prof. V.I. Bukhtiyarov, - Novosibirsk: BIC, 2016. p.328,
-- 1 electronic optical disc (CD-R). ISBN 978-5-906376-15-2

В надзаг.:

Borekov Institute of Catalysis SB RAS, Novosibirsk, Russia
Zelinsky Institute of Organic Chemistry RAS, Moscow, Russia
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Topics of book:

- First-principles approach, theory and simulation in catalysis;
- Advanced methods for studies of mechanisms of catalyzed reactions;
- In-situ and operando studies of model and real catalysts;
- Kinetics and reaction intermediates of catalyzed processes;
- From mechanistic studies to design of advanced catalyst systems.

The Conference is accompanied by the School-Symposium of young scientists "Quantum-mechanical modeling of catalytic processes".

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ББК Г544

ISBN 978-5-906376-15-2

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Investigation of Activity Supported MoCrGa Catalyst at Oxidative Conversion of Methane of Natural Gas

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Currently, light alkanes are the largest inexpensive and available source of raw materials for the chemical industry. However, as a class they belong to the least reactive organic substances due to the high strength of the C-H and C-C bonds, low polarity, absence of the lone electron pairs of the carbon and hydrogen atoms, the low electron affinity and high ionization potential. Direction on functionalization of hydrocarbons, especially the saturated hydrocarbons, which are the main component of the oil and gas, becomes relevance.

Results of research of the efficiency of developed catalyst systems in oxidation of methane of natural gas to the target products are presented in this paper.

Mono-, bi- and three-component catalyst systems for the oxidation of linear hydrocarbons have been developed. Pretreatment of carrier for preparation of catalysts on the base of EKR clay was carried out. EKR clay was dried at $T = 473$ K for 2 h, calcined at $T = 773$ K for 2 h, treated with a solution of 10% HCl and then calcined again at $T = 773$ K for 2 h.

Catalysts based on Mo, Cr and Ga were prepared by incipient wetness impregnation of the mixed solutions of nitrate salts supported on EKR clay, followed by drying at $T = 473$ K for 2 h. Calcination of samples at $T = 773$ K for 2 h in air was carried out for decomposition of supported metal salts and volatilization of nitrates from the catalyst surface. Research the activity of developed catalysts was conducted on a flow installation at atmospheric pressure in a quartz tubular reactor with a fixed catalyst bed.

Activity of the developed Mo-Cr-Ga catalysts supported on EKR clay was investigated in oxidation of methane under conditions: $\text{CH}_4 : \text{O}_2 = 2 : 1$ (67 % : 33 %), $T = 300-900^\circ\text{C}$ and a GHSV = 500 - 2000 h^{-1} . It has been found that the reaction products are formed both in liquid and gaseous phases at varying temperature and GHSV. The formation of ethanol, propanol, ethanol and acetaldehyde occurs at temperatures from 400 to 700°C. H_2 and CO are formed in gas phase at temperatures from 600 to 900°C.

Thus, the supported mono-, bi- and three-component catalysts for oxidation of methane of natural gas into the target products have been developed. Varying the composition of active phase of catalyst was conducted. It was found that supported three-component MoCrGa catalyst is optimal for yield of target products.

Acknowledgement. This work was supported by the Ministry of Education and Science of the Republic of Kazakhstan, grant 0330/GF4.