

Nanocomposites and nanomaterials

Diagram of non-destructive transformations of ethanol over graphene/doped ceria nanocomposite catalyst

P. Kraszkiewicz¹, W. Miśta¹, R. Klimkiewicz¹, V. Boiko², G. Dovbeshko²

¹ Institute of Low Temperature and Structure Research, Polish Academy of Sciences, Wrocław, Poland

E-mail: r.klimkiewicz@int.pan.wroc.pl

² Institute of Physics, National Academy of Sciences of Ukraine, 46, Prosp. Nauky, Kiev-03028, Ukraine

Graphene perfectly fulfills the role of high-temperature catalytic support for reactions under anaerobic conditions, i.e. without the participation of molecular oxygen but with participation of oxygen functional groups.

Graphene supported ceria was synthesized and characterized by several techniques which revealed the effectiveness of the method used [1]. The nanocomposite was applied as a catalyst for ethanol transformations.

In general, on many oxide catalysts, such high temperature conversions of primary alcohols concern dehydration and dehydrogenation pathways to alkenes and ethers or aldehydes, respectively, as well as consecutive bimolecular condensation reactions to form symmetrical ketones or esters (Tishchenko reaction):

ETHOXYETHANE → ETHENE

↑ ↑

ETHANOL → ACETALDEHYDE ↔ ETHYL ETHANOATE

↓ ↓

PROPAN-2-ONE

The experiments were performed in a micro reactor connected with OmniStar QMS-200 Pfeiffer mass spectrometer. The obtained results proved that the hybrid component, despite the drastic reduction in amount of ceria, was functioning properly as heterogeneous catalyst with capabilities of targeting.

1. Kraszkiewicz P., Miśta W., Klimkiewicz R., Dovbeshko G., Boiko V.,

Graphene - the new perspective catalytic support // 1st Polish Conference „Graphene and 2D materials”, Szczecin, 27-29 September 2015, p. 90-91.

Acknowledgment: Application for a Polish - Ukrainian. Joint Research Project for years 2015 – 2017, Polish Academy of Sciences and National Academy of Sciences of Ukraine: Hybrid graphene nanomaterials for catalytic applications.