Nanocomposites and nanomaterials

Ag/CeO_2 supported on MWCNTs as effective ketonization catalyst

G. Dovbeshko [1], E. Kovalska [2], W. Miśta [3], R. Klimkiewicz [3]

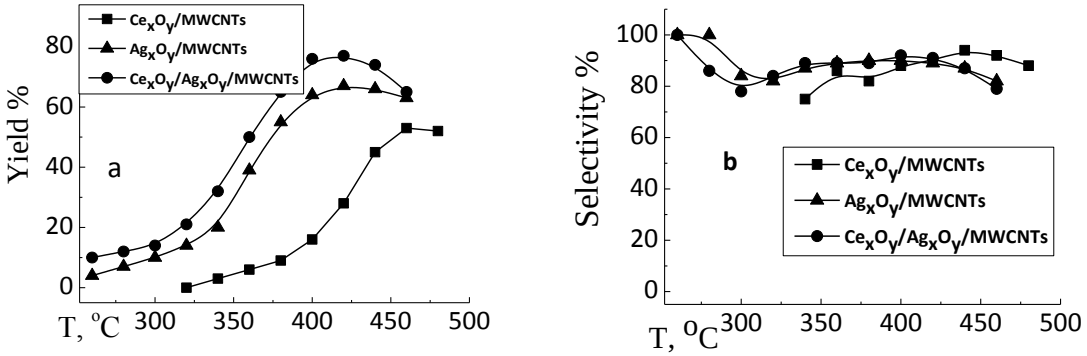
[1] *Institute of Physics, National Academy of Sciences of Ukraine, 46, Prosp. Nauky, Kiev-03028, Ukraine*

[2] *Chuiko O.O. Institute of Surface Chemistry, National Academy of Sciences of Ukraine, 17, General Naumov str., Kiev-03164, Ukraine*

[3] *Institute of Low Temperature and Structure Research, Polish Academy of Sciences, Wroclaw, Poland*
E-mail: r.klimkiewicz@int.pan.wroc.pl

On oxide catalysts, dehydration and dehydrogenation pathways of primary alcohols occur but if there is a particular configuration of Lewis acidic sites and the redox ones, bimolecular reactions of primary alcohols yielding esters and symmetrical ketones take place. Due to strong growth of interest in processing of waste and/or natural products there are new prospects for the use of both these coupling reactions. Moreover, catalytic transformations of alcohols are one of the most attractive methods to produce chemical intermediates. Cerium oxide plays in these developments a vital role.

Various carbonaceous materials were used as supports for heterogeneous oxide catalysts. The materials used are of different origin. MWCNTs play an increasingly important role in this direction of applications. This creates opportunities to produce novel materials as inorganic nanohybrids with properties not responding to the simple sum expected from the individual blocks. Due to the interactions between the constituent parts of such nanometer-scale ensembles, novel or enhanced catalytic features can be expected.



Total dehydrogenation values at varying temperature (0.75 h^{-1}) – yield (a) and selectivity (b).

Exemplary conversion and yields [%] of butan-1-ol transformations over Ag_xO_y/Ce_xO_y/MWCNTs catalyst:

[°C]	conversion	yelds of: butyraldehyde	heptan-4-one	butyl butyrate	butene	others
420	85	35	32	10	5	3

The synthesized materials were characterized by high dispersion of the dopants. The Ag_xO_y/Ce_xO_y/MWCNTs combines the features of both additives, i.e. superior catalytic activity and bimolecular condensation into symmetric ketone. These results are not a simple sum of the effects of the both dopants, they indicates a promoting effect of the silver component. The results of TPR analysis show, in accordance with XRD, TEM, that CeO_2 nanoparticles on the MWCNTs are highly dispersed with a strong interaction between the particles and the MWCNTs support. The high activity of the catalyst is attributed to the interaction between Ag and CeO_2 (synergetic effect). The interaction of ceria with Ag is a strong function of the crystal size of ceria.

1 *Koval'ka E.O.* Coated multi-walled carbon nanotubes with ceria nanoparticles, Prog. and Abstracts Book of Int. Symposium "Modern problems of surface chemistry and physics", Kyiv, Ukraine, -2010.-P. 386.
2. *Cyganiuk A., Klimkiewicz R., Bumajdad A., Włoch J.,Kucinska A., Lukaszewicz J.P.,* Manufacture of a nanostructured CeOx/carbon catalyst for n-butanol conversion, Materials Letters, -2014.-118 P. 119–122.