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CERIA-TITANIA SUPPORT OF COBALT OXIDE CATALYSTS: THE EFFECT OF SURFACTANT ADDITION ON PHYSICAL-CHEMICAL AND CATALYTIC PROPERTIES

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Ceria-titania can be interesting support of active components in catalytic reactions, in which water vapor is present as product and/or component of reaction mixture, e.g., oxidation of volatile organic compounds. Ceria can easily release or uptake oxygen from the inlet gas, whereas titania exhibits hydrophobic properties. Our recent results showed great importance of the supports surface area on specific activity of cobalt oxide catalysts in oxidation of ethanol [1].

This study is focused on the effect of Pluronic P123® addition during preparation of the ceria-titania supports on the properties of cobalt oxide catalysts in the deep oxidation of ethanol. The supports with CeO_2/TiO_2 molar ratio of 0.25 were prepared by sol-gel reaction and subsequent heating at 500 °C. It was found that addition of the surfactant into the reaction mixture increased surface area of the obtained products; the BET surface area of the supports increased with increasing amount of added surfactant (Table 1). Catalytic activity, represented by temperatures T_{50} and reaction rates r_{200} achieved at 200°C, of the prepared supports in ethanol oxidation were increasing as well. Deposition of cobalt oxides (supports impregnated with cobalt nitrate were heated at 500°C) slightly decreased the surface area, but activity of the catalysts was considerably increased and beneficial effect of the Pluronic P123® addition during supports preparation was confirmed.

Table 1: Effect of surfactant concentration on surface area of the ceria-titania supports and catalytic properties in deep oxidation of ethanol

Support	$C_{Pluronic}$, mol l^{-1}	S_{BET} m^2 g^{-1}	T_{50} °C	r_{200}, mmol $g^{-1}h^{-1}$	Catalyst	S_{BET}, m^2 g^{-1}	Co, wt. %	T_{50}, °C	r_{200}, mmol $g^{-1}h^{-1}$
S0	0	5	232	3.02	Co_3O_4/S0	2	2.8	216	5.28
S20	20	14	226	3.77	Co_3O_4/S20	-	4.0	213	5.59
S100	100	150	197	8.30	Co_3O_4/S100	36	3.9	189	9.36

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References

[1] K. Jirátová, F. Kovanda, J. Balabánová, D. Koloušek, A. Klegová, K. Pacultová, L. Obalová, Reac. Kinet. Mech. Cat., 2017, in press. DOI: 10.1007/s11144-017-1142-x.