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INVESTIGATION OF Ni-CONTAINING CATALYSTS FOR THE PURIFICATION OF EXHAUST GASES

Abstract. Results of the development of multicomponent oxide catalysts for the purification of exhaust gases based on Ni, Cu, and Cr supported on 2% Ce/ θ -Al₂O₃ by varying the concentration of the active phase of catalyst are presented in paper. It was found that the highest degree of toluene conversion (up to 98.8 %) is observed on the three-component Ni-Cu-Cr/2% Ce/ θ -Al₂O₃ catalyst with optimal metal ratio Ni : Cu : Cr = 1.0 : 3.0 : 0.1 at GHSV = 5410³ h⁻¹ and a temperature of 723 - 773 K. The presence of CeO₂ crystals, X-ray amorphous clusters ($d = 20 - 100$ E) of variable valence metal oxides NiO and CuO as well as solid metal solutions CuO (NiO) and aluminates was detected on the surface of optimum catalyst calcined at 873 K using XRD and transition electron microscopy methods. Preparation of polyoxide supported catalysts as well as study the influence of catalyst composition and modified additives on deep oxidation of toluene - a major component of toxic organic gaseous industry emissions, is the goal of research.

Key words: catalytic oxidation, toluene, purification, nickel, copper.

Introduction. The problem of chemical safety and sanitary air protection is particularly relevant due to the increase of harmful emissions of industrial enterprises, which have a strong toxic effect. Many chemical compounds (toluene, xylene, styrene, phenol, tricresol, mineral spirits, CO, etc.), which negatively affect the living organisms and flora are harmful toxic emissions from industrial plants. Under the Paris agreement, adopted on December 12, 2015 and signed on April 22, 2016, in addition to the United Nations Framework Convention on Climate Change (UNFCCC), developed countries and countries with economies in transition have to reduce or stabilize greenhouse gas emissions [1]. The content of harmful emissions above the MPC in industrial workshops and atmospheric air in the cities cause a negative impact on living organisms and lead to various diseases thereby creates a threat to the safety of the environment [2]. Toluene, xylene and ethyl-benzene are major part of the solvents used in various industries, which are present in gaseous emissions [3]. Toxic and adverse effect of harmful emissions on a living organism can be traced on the example of toluene - a major component of toxic organic gaseous emissions that are present in the emissions of furniture, paint, cable, printing and other industries. For example, the inhalation of toluene with a concentration of 250 mg m⁻³ for 2 h leads to a decrease in heart rate, disturbance of speech, movement coordination [4]. Prolonged inhalation of toluene, which is present in the composition of glue, varnishes, paints, etc., causes neurotoxic deviations that lead to clinical consequences - hallucinations, somnolence, suicide attempts, visual disturbances and seizures.

From the literature data [5] on the methods and apparatuses for neutralization of toxic emissions follows that deep catalytic oxidation is the most economical way for cleaning of gases from the emissions of complex composition [6]. Typically, the catalysts based on noble metals (Pt, Pd) [7], which have high