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Nanostructured polyphase catalysts based on the solid component of welding aerosol for ozone decomposition

T.L. Rakitskaya[1], A.S. Truba[1,2] A.A. Ennan[2], S.A. Kiro[2], M.V. Oprya[2], V.Y. Volkova[1]

[1] *Faculty of Chemistry, Odessa I.I. Mechnikov National University, 2, Dvoryanskaya St., 65082, Odessa, Ukraine, truba@onu.edu.ua*

[2] *Physicochemical Institute of Environment and Human' Protection, 3, Preobrazhenskaya St., 65082, Odessa, Ukraine*

The solid component of welding aerosol (SCWA) is the airdispersed particulate formed out of the welding arc in consequence of the oxidation and condensation of vapors of components of electrode coatings, welding fluxes, and metals. The comparison of the phase compositions and catalytic properties of the solid components of welding aerosol (SCWAs) obtained as a result of metal welding by electrodes of three types, ANO-4, TsL-11 and UONI13/55 was made. Their phase compositions were investigated by X-ray diffraction phase analysis, IR spectroscopy, and pH-metry. The results of X-ray phase analysis showed a significant difference in the phase composition of SCWAs. SCWA-ANO-4 and SCWA-UONI13/55 predominantly contain crystalline phases of magnetite (Fe_3O_4; 2, deg = 30.033; 35.389; 62.587), manganochromite ($(Mn,Fe)(Cr,V)_2O_4$; 2, deg = 43.027; 53.091; 56.402; 61.727), and manganese oxides (Mn_3O_4; 2, deg = 30,809; 53.683; 62.071). Due to lower iron and higher chromium content in TsL-11 and also the differences in its electrode coating as compared with ANO-4, SCWA-TsL-11 demonstrates twelve well-identified phases, such as oxides of chromium, nickel, iron, manganese, and titanium; manganochromite; fluorides of calcium and nickel; and products of thermolysis of the components of the electrode coating, magnesium and calcium silicates. From the X-ray phase analysis data, crystallite sizes of SCWA phases were evaluated based on Fe_3O_4 phase to be 15-18 nm SCWA-ANO-4, 51 nm for SCWA-UONI13/55 and, based on $(Mn,Fe)(Cr,V)_2O_4$ phase, 45 nm for SCWA-TsL-11. IR spectra of the three samples confirm the polyphase composition of the SCWAs, namely, the presence of iron and chromium oxides and calcite ($CaCO_3$). The catalytic properties of SCWAs were studied in the low-temperature reaction of ozone decomposition. all SCWA samples were found to purify the ozone-air mixtures (OAM) from ozone at its concentration of 1 mg/m^3 to the levels below the maximum permissible concentration (MPC_{O3}) however the protective time of SCWA-ANO-4 (50 h) and SCWA-UONI13/55 (10 h) was higher than that of

SCWA-TsL-11 (3 h) because of the differences in their compositions.