PRODUCTION OF CERAMIC MATERIALS BASED ON THE SYSTEM OF CO-CR-O, CE-O BY THE METHOD OF SHS.

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Nanodisperse powders based on oxides of cobalt, chromium, cerium are used as pigments, catalysts for various organic reactions. Traditional methods of synthesis of such materials - solid-phase or sol-gel synthesis have a number of drawbacks. A more promising method at present is the sol-gel combustion method. This method is simple, has low energy costs, has no by-products or production waste [1].

The aim of the work is to study the regularities of the processes occurring in the SHS process of nanosized oxide ceramic materials based on the Co-Cr-O, Ce-O system and the study of their functional properties.

The regularities of the SHS process in the combustion of sol-gel systems based on Co, Cr, Ce nitrates have been studied. To aqueous solutions of cobalt nitrate, chromium (0.4 mol / l) or their equimolar mixture, sucrose was added as a reducing agent and dried at a temperature of no higher than 40 °C. The gel obtained as a powder was used as a precursor for the synthesis. From the precursor solution, coatings on porous ceramics were applied by the method of multiple dipping, followed by drying at 100-150 °C and final firing in air at 350-700 °C.

To study the process of thermal decomposition of precursors, a gel powder weighing 0.5-3 g was placed in a crucible that was installed in an electric furnace, which was supplied with an alternating voltage of 100-150 V from an autotransformer. The thermocouple was placed directly into the test gel, which was connected to the LA20 USB ADC and a personal computer. In addition, a second thermocouple located at the inner wall of the furnace was monitored for temperature. Thermograms are shown in Fig. 1.

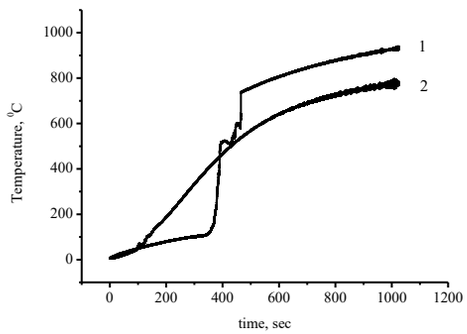

Fig. 1 Thermogram of a mixture of cobalt, chromium and sugar nitrates (50% by weight)
1 - autoignition mode, 2 - decomposition of the mixture.

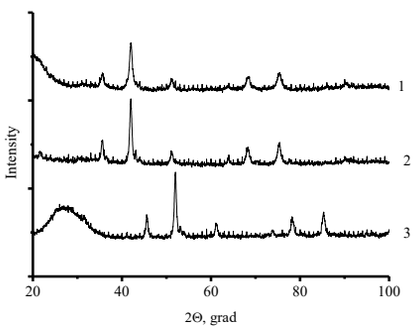

Fig. 2 X-ray diffraction patterns of the decomposition product of an equimolar mixture of cobalt and chromium nitrates with sugar. The content of sucrose in a mixture of 1 to 30, 2 to 50, 3 to 70 wt. %.

A coating technique based on $CoCr_2O_4$ and CeO_2, distributed in a porous layer of alumina, has been developed. The coating was applied by impregnating the product in a tributoxy aluminum solution with the addition of an equimolar mixture of cobalt and chromium nitrates or cerium nitrate followed by heat treatment. The method of differential thermal analysis, X-ray diffraction analysis (Figure 2), and IR spectroscopy showed that at a temperature above 300-400 °C, porous alumina is formed with the submicron particles of $CoCr_2O_4$ cobalt-chromium spinel or CeO_2 cerium oxide distributed therein. It is shown that the coatings obtained have catalytic activity in the processes of deep oxidation of hydrocarbons. Coatings allow to reduce CO and NO_x content in combustion products of methane-air mixture.

REFERENCES

[1] *Rogachev AS, Mukasyan AS // Burning for the synthesis of materials: introduction to structural macrokinetics. - Moscow: FIZMATLIT, 2013.*