

EFFECT OF TIN OXIDES ON THE PHASE COMPOSITION AND STRUCTURE OF COO- Al_2O_3 - SnO_2 AND NIO- Al_2O_3 - SnO_2 SPINELS OBTAINED BY SHS METHOD

O.V. LVOV, N.I. RADISHEVSKAYA

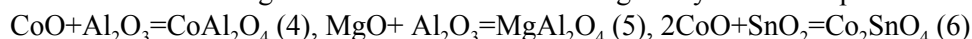
Tomsk Scientific Center SB RAS, 10/4 Akademicheskii Pr., Tomsk, 634055, Russia, Lvov@vtomske.ru, +7(3822)492294

Spinel is a traditional material for the production of ceramic pigments with a wide range of colors. Sky-blue pigment (ceruleum) is known to contain tin dioxide, cobalt aluminate (blue cobalt), as well as magnesium and zinc oxides. Therefore, in the work, SnO_2 tin oxide is added as an additive that influences on the color of pigment.

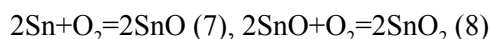
Pure color pigments were obtained by the SHS method under the air atmosphere in the $\text{MgO-CoO-SnO}_2\text{-Al}_2\text{O}_3$ system from MgO , Al_2O_3 , Co_2O_3 , SnO_2 oxides and aluminum powder (ASD-4). The thermogravimetric analysis conducted using a SDT Q600 thermal analyzer showed that the oxidation of aluminum proceeded through stages:



The green mixture is heated during these reactions before starting the synthesis of spinels.



The increase in mass after $\sim 1100^\circ\text{C}$ is connected with oxidation of tin.



Tin and its oxide SnO are strong reducing agents, which leads to the formation of a large number of cobalt inclusions in the product during synthesis.

X-ray diffraction analysis (DRON-UM1 diffractometer with filtered $\text{Co } K\alpha$ radiation) of $\text{MgO-CoO-SnO}_2\text{-Al}_2\text{O}_3$ pigment showed that the products contained corundum and the large amount of cobalt along with the spinel phases.

The study of the pigment section showed that the main phases were a mixture of cobalt and magnesium aluminospinel, and there were also the blue inclusions of Co_2SnO_4 . In addition, particles of Co_3Sn_2 intermetallide were detected, which was confirmed by micro-X-ray spectral analysis (Camebax) (Fig. 1).

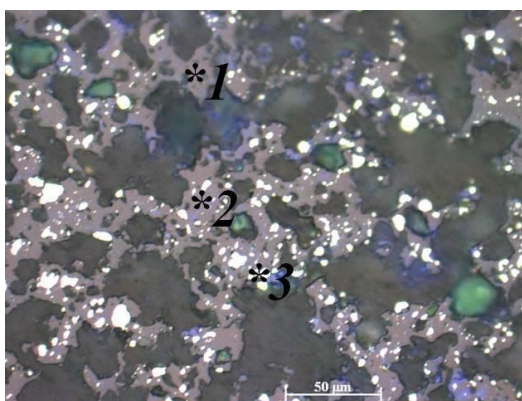


Fig.1. Micrograph of $\text{MgO-CoO-SnO}_2\text{-Al}_2\text{O}_3$ pigment, Axiovert 200M, where 1 is $(\text{Co}, \text{Mg})\text{Al}_2\text{O}_4$, 2 is Co_2SnO_4 , 3 is Co .

IR spectroscopic analysis (Nicolet 5700 FT-IR spectrometer) showed that $\text{MgO-CoO-SnO}_2\text{-Al}_2\text{O}_3$ pigment had absorption bands typical for the spinel structure.

Spinel-type pigment synthesized by the SHS method in the $\text{MgO-CoO-SnO}_2\text{-Al}_2\text{O}_3$ system has a bright blue color; however, a large amount of the formed metal phase significantly degrades its quality.