N1-P-010801

SYNTHESIS OF MANGANESE PIGMENTS BY THE SOLUTION COMBUSTION METHOD

O.V. LVOV, N.I. RADISHEVSKAYA, A.Yu. NAZAROVA, R.V. MININ

Tomsk Scientific Center of the SB RAS, Tomsk, Russia

Beige-brown cored pigments, the core of which is a mineral filler coated with solid solutions based on alumomagnesian and manganese spinels, were obtained by solution combustion synthesis (SCS). Solutions of magnesium, manganese, and aluminum nitrates were used as initial reagents, and the mineral marshalite (dusty quartz, a finely dispersed mineral filler) was used as a substrate. The quantitative composition of the starting components was determined from the pigment-to-marshalite ratio equal to 1:3.

Citrate-nitrate synthesis belongs to the solution combustion methods [1]. Active evolution of gases during combustion simplifies the formation of a finely dispersed product. Hydroxytricarboxylic acid citric acid $(NOOSSN)_2C(OH)SON$ was an energetic and gas-generating organic additive. The acidity of the solution was regulated with concentrated ammonia. White and beige-brown pigments were prepared by SCS using aluminomagnesian and manganese-containing spinels deposited on beige marshalite served as mineral. The use of mineral reduces the cost of the synthesized pigment considerably.

The final products were characterized by X-ray diffraction using the DRON-UM-1 diffractometer (filtered CuK_{α}-radiation) with an automated X-ray imaging system. Structural properties were studied using infrared spectroscopy in the 4000-400 cm^{-1} region (Nicolet 5700 FTIR spectrometer, KBr). The elemental composition of silicon and impurities present in marshalite was determined by atomic emission spectrometry using an ICAP 6300 Duo spectrometer (Thermo Scientific, UK). The microstructure of the samples was studied using a Philips SEM 515 scanning electron microscope.

Figure 1 shows the microphotographs of marshalite, white and chocolate pigments. As can be seen, the dispersion of pigments is determined by the size of marshalite particles covered by finely dispersed spinel particles.

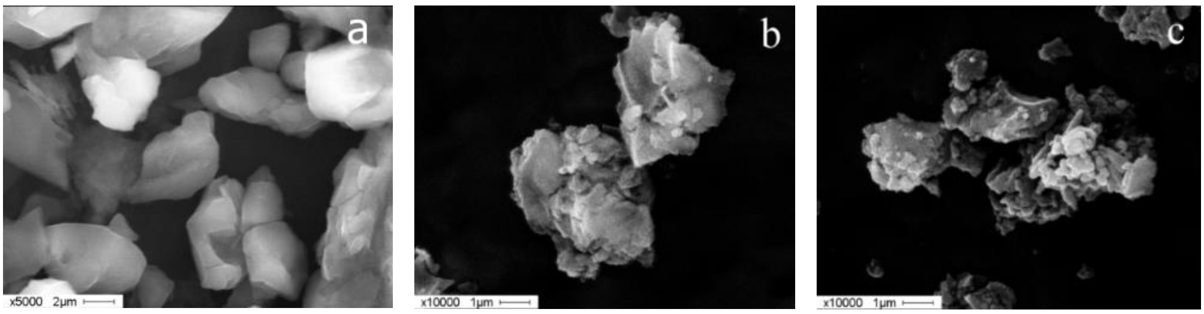

Fig. 1. Microphotographs of marshalite (a), white (b) and chocolate (c) pigments deposited on marshalite, (Philips SEM 515).

Thus, high-temperature spinel-based finely dispersed pigments deposited on marshalite and withstanding an annealing temperature of 1100°C were synthesized by the solution combustion method.

Acid synthesis, the absence of polynuclear complexes and ammonium salts leads to a less polymerized and viscous gel, which ensures its quasi-steady combustion.

The use of natural marshalite, as a substrate, reduces the cost of the pigments' production method.

This method is simple and easily scalable and can be used to produce multicomponent materials.

REFERENCES

[1] V.A. Zhuravlev, R.V. Minin., V.I. Itinb, I.Yu. Lilenko Structural parameters and magnetic properties of copper ferrite nanopowders obtained by the sol-gel combustion//Journal of Alloys and Compounds, 2017, №692.-C.705-712; doi: 10.1016/j.jallcom.2016.09.069.