

Color Characteristics and Properties of High-Temperature Ceramic Pigments, Obtained by Utilization of Bio-Waste

Irena Markovska

Burgas State University "Prof. Dr. Assen Zlatarov", 1 Prof. Yakimov Bul., 8010 Burgas, Bulgaria

Mariela Minova *

Burgas State University "Prof. Dr. Assen Zlatarov", 1 Prof. Yakimov Bul., 8010 Burgas, Bulgaria

Fila Yovkova

Burgas State University "Prof. Dr. Assen Zlatarov", 1 Prof. Yakimov Bul., 8010 Burgas, Bulgaria

Adriana Georgieva

Burgas State University "Prof. Dr. Assen Zlatarov", 1 Prof. Yakimov Bul., 8010 Burgas, Bulgaria

Abstract

The subject of present study are high-temperature pigments from the alumina – silica system. For their preparation, both pure starting raw materials and bio-waste – ash from oxidized rice husks containing 94.47% SiO₂ were used. As colorants in the batches, cobalt, copper and nickel oxides were introduced. The quantities of the materials were weighed with an accuracy of 0.1g, then mixed and homogenized dry in a Pulverizete-6 planetary mill. The high-temperature firing of the pigments was carried out in a NaberTherm high-temperature furnace, Germany, in an air atmosphere in covered porcelain crucibles at a final temperature of 1450 °C, with a 2-hour isothermal hold. The performed X-ray phase analysis shows that the main phases in all compositions are mullite and corundum. It has been proven that when NiO is introduced into the batches in both series – from pure raw materials and when rice husk waste is added, nickel spinel is also obtained, i.e. nickel shows a strong tendency to spinel formation. It has been established that copper ions, in turn, show a tendency to form solid solutions with mullite. A part of them is included in the crystal lattice of mullite, defects it and in this way promotes mullite formation. In terms of color characteristics, the best indicators are the compositions with the chromophore cobalt. This chromophore produces pigments with a saturated blue color. In the pigments obtained with the addition of oxidized rice husks as a source of SiO₂, the amount of blue color is $b^* = -28.2$ and in the pigments obtained from pure raw materials the amount of blue color is $b^* = -31.1$.