**Study of mixed oxide pigments based on Bi-Ce-Nb**

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New environmentally inorganic compounds based on mixed oxides containing $Bi_2O_3$, $CeO_2$ and $Nb_2O_5$ have been developed as new type of pigments. The compounds were characterized using of methods of thermal analysis, X-ray powder diffraction and by spectral reflectance data. Methods of thermal analysis were used for determination of the temperature region of the pigment formation and thermal stability of compounds.
The samples of $Bi_2Ce_{2-x}Nb_xO_7$ ($x$ = 0, 0.25, 0.50, 0.75, 1.0, 1.25, 1.5, 1.75 and 2.0) have been synthesized by conventional solid-state reaction method. The starting mixtures containing basic oxides ($CeO_2$, $Nb_2O_5$ and $Bi_2O_3$) were homogenised in a porcelain mortar with pestle. The mixtures were then calcinated in corundum crucibles in an electric resistance furnace with the heating rate of 10 °C.min$^{-1}$. The calcination temperatures in interval from 800 to 1000 °C after step 50 °C were maintained for 2 h.
The formation of studied compounds was followed by thermal analysis using the STA 449C Jupiter (NETZSCH, Germany) which allows evaluation of data and simultaneous registration of the thermoanalytical curves TG and DTA. The measurements were provided at temperature interval from 30 to 1200 °C with heating rate 10 °C·min$^{-1}$ in air atmosphere and corundum crucibles. The samples were measured in portions 400 mg. Thermal analysis of starting oxides $CeO_2$ and $Bi_2O_3$ has been published previously [1,2].
The pigments were applied into organic matrix and their colour properties were investigated depending on content of Ce and Nb, and calcination temperature. The colour properties are described in terms of CIE *L*a*b** system. The optimum conditions for their synthesis were determined.
Based on chroma of pigments, the increasing calcination temperature mostly causes the growth of chroma. The colour of samples with $x$ from 0 to 1 is from yellow to yellow orange. On the other hand, the samples with higher content of Nb ($x$ = 1.5 and 2) are characterised by light yellow green hue because their colours are shifted to negative field of CIE L*a*b* system that is connected with green hue.
The best colours were obtained for the pigment, where $x$ = 0 and 0.5 at calcination temperature 950 and 1000 °C, which indicates the lowest lightness and at the same time are characterized by the high value of chroma. Their hue is yellow orange. These results confirm that the temperature for synthesis of samples with interesting colour must be in temperature higher than 900 °C.
Characterization of prepared compounds suggests that they have a potential to be alternative yellow colourants for paints. The compounds are characterized by high temperature stability and this fact gives a possibility of their utilization for colouring of ceramic glazes. This property gives a direction for their utilization as new environmentally friendly pigments because they would be substitute the problematic pigments, especially pyrochlore yellows.
The basic representative of pyrochlore pigments is the Naples yellow $Pb_2Sb_2O_7$ which represents sulphur-yellow up to orange-yellow tint depending on the weight ratio of lead and antimony. However, most of the conventional inorganic pigments contain the toxic metals such as Cd, Co, Cr, Hg, Pb and Sb which have an adverse effect on the environment and human health. Therefore, development of harmless inorganic colouring compounds has been required in order to replace the toxic pigments by environmentally friendly or less toxic one [1].

[1] L. Stránská, P. Šulcová, J. Mouchová, *J. Therm. Anal. Calorim.* **109** (2012) 643-648.
[2] P. Šulcová, *J. Therm. Anal. Calorim.* **109** (2012) 639-642.