OBTAINING A COMPOSITE MATERIAL FOR VARISTOR CERAMICS IN ONE SHORT-TIME OPERATION CYCLE OF A COAXIAL MAGNETOPLASMA ACCELERATOR

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Zinc oxide is a semiconductor material, which can be used in solar cells, photocatalytic systems, surge arresters, etc [1]. The creation on its basis of varistors (devices for protection against an overvoltage) with improved non-linear current-voltage characteristics is a promising task in science and technology [2-3]. The industrially produced ZnO-based varistors contain additives of other metal oxide phases, for example, bismuth, aluminum, antimony, nickel, cobalt, etc. [3]. However, all existing methods for obtaining varistors are multi-stage and resource consuming [4]. This paper shows the possibility of obtaining a composite material of the Zn-Bi-Ni-Sb-Co-Al-O system in one short-term cycle (about 1 ms) of a coaxial magnetoplasma accelerator operation. The synthesis of such composite product by the proposed method eliminates the preparation, mixing and other stages. The resulting material can be used as the basis for varistor ceramics. Figure 1 shows the XRD pattern of the obtained synthesis product with marked reflections of the main phases, as well as the corresponding SEM-image.

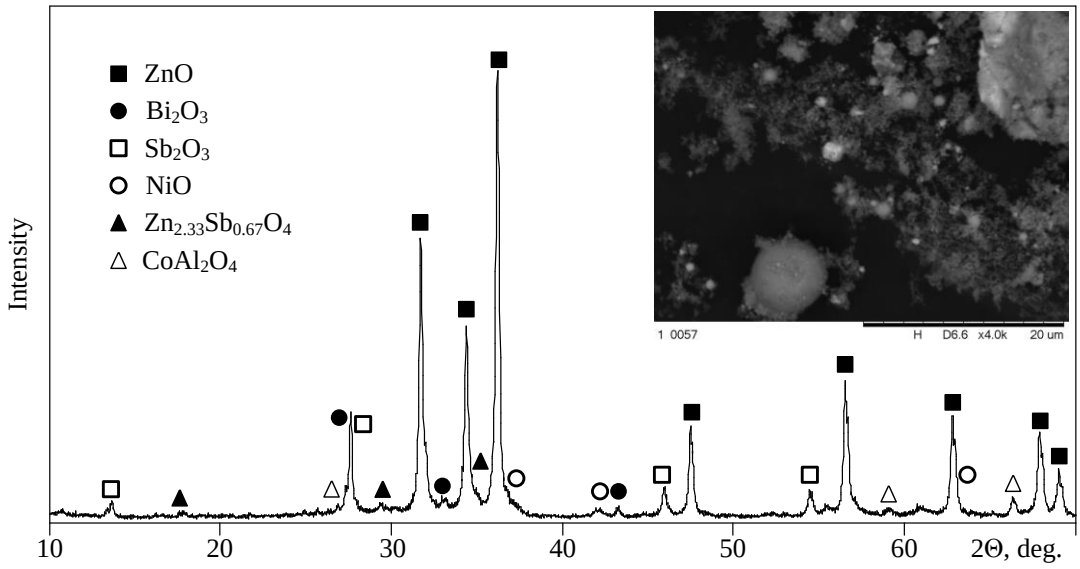

Fig.1. XRD-pattern of the plasma dynamic synthesis product

Earlier in the article [5], the results on the possibility of synthesizing ZnO-Bi_2O_3 composite materials with a core-shell structure by the proposed method were presented. Such a structure of particles improves the characteristics of varistor ceramics (non-linearity coefficient, breakdown voltage, leakage current) and significantly reduces the number of stages for its creation. By analogy with the previous results, analytical studies were carried out to confirm the formation of such a structure for the synthesized multicomponent product. Using this product of plasma dynamic synthesis, ceramic samples were obtained by spark plasma sintering. These samples of varistor ceramics were studied by X-ray diffraction (to find the phase composition) and scanning electron microscopy (to study the structure and density) methods, and their main electrical characteristics were determined by the volt-ampere method.

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