INFLUENCE OF PARAMETERS IN THE PLASMA DYNAMIC SYNTHESIS PROCESS ON ULTRADISPERSED ZINC OXIDE [1]

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Zinc oxide is one of the promising n-type semiconductors due to its low cost, environmentally friendly and good electronic properties. ZnO has a wide range of applications: electric power industry, oil refining industry, pharmaceuticals and medicine [2].

There are many ways to produce zinc oxide: sol-gel method, chemical, thermal and hydrothermal methods [1, 3, 4]. These methods have some disadvantages: high cost, time consumption and production process complexity. Also all methods do not allow to obtain a sufficiently high-quality product. A highly dispersed single crystal structure of particles can be obtained by crystallization from the liquid phase with a high quenching rate of the material under supersonic sputtering conditions in a gaseous atmosphere. Such conditions can be obtained by implementing a plasma dynamic method based on a pulsed coaxial magnetoplasma accelerator of erosion type [5]. The plasma dynamic method provides for the synthesis of zinc oxide up to 10 g during one short-term cycle of the accelerator operation (up to 1 ms). The basic precursor is produced by erosion of the zinc barrel. The zinc plasma structure interacts with ionized oxygen, supersonic spraying of product liquid phase and its crystallization in gaseous oxygen medium occurs. As a result of the plasma chemical reaction, a nanodispersed powder is synthesized. The collection of material is carried out some time after the end of the working cycle.

The work presents the results of the conducted experiments on the effect of energy (charge voltage $U = 2.7 \div 3.8$ kV, charge capacity $C = 3.6 \div 7.2$ mF) and structural (barrel material) parameters of the plasma dynamic synthesis process for the final yield of the product. It is proved that, the accelerator system parameters do not affect the entire synthesized product. The obtained material consists of a phase of hexagonal zinc oxide (100%), without any additives. In general, the particles are presented in the form of a single-crystal hexagonal structure and on average their size varies from several nanometers to 350 nm. A wide distribution of particle sizes can positively affect the creation of ceramic samples by the method of spark plasma sintering.

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