

Synthesis of Nano-Structured Powders Using Microwave Energy

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At the moment the world has been actively working in the field of application of microwave (MW) to initiate chemical reactions accelerate the drying process, the intensification of thermochemical synthesis and formation of new phases. The main goal of the research is the development of highly energy-efficient methods of obtaining and processing of functional materials for various purposes.

Development of methods of forming nanostructured oxide powders chemical-thermal method under microwave irradiation.

ZnO is a unique functional semiconductor material with the wide forbidden zone (3.37 eV), the big energy of exciton bond (60 meV) at a room temperature and possessing an effective ultraviolet luminescence.

In the laboratory of technical ceramics and nanomaterials P.O. Sukhoi GSTU the way of obtaining of nanostructured powders ZnO is developed and the influence microwave energy on the mix of reagents in radio-transparent and radio-absorption containers is studied. The quantity of microwave radiation was varied from 200 to 800 W, the frequency of radiation – 2.45 GHz, the duration of process – 2 to 20 min in the conditions of container rotation. The precursor ZnO was formed during 2.5–3 min, and it was determined that the morphology of the received powder essentially depends on a correlation "oxidizer-fuel-water". X-ray diffraction patterns (DRON-7) samples of powders precursor ZnO synthesized in the conditions of small dilutions in the microwave oven have shown presence of well generated crystal phase ZnO, which corresponds to structure of the powder received at thermal processing of nitrate zinc mix with an reducer (e.g. sucrose) in muffle furnace in the temperature interval 900–1000°C. The crystallite sizes of particles in agglomerated nanostructured powder ZnO is 40-50 nm (Fig. 1).

Similarly nanostructured copper oxide powder has been synthesized. X-ray analysis of the resulting product confirmed the presence of nanocrystalline copper oxide form (Fig. 2).

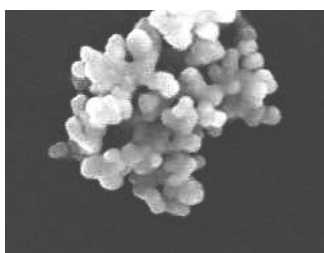


Fig. 1. Nanopowder ZnO

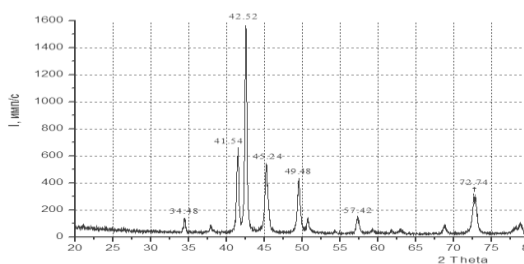


Fig. 2. X-ray diffraction pattern CuO