The effect of synthesis conditions on properties of ZnO nanoparticles prepared by microwave hydrothermal method.

J. Rosowska[1], J. Kaszewski[1], B. Witkowski[1], Ł. Wachnicki[1], M. Godlewski[1]

[1]Institute of Physics, Polish Acad. of Sciences, Al. Lotników 32/46, 02-668 Warsaw, Poland

Nowadays, the interest in the nanoparticles based on II-VI compound semiconductors is associated with their widespread practical applications. Especially, they are interesting objects for potential applications in biology and medicine. A lot of attention attracts ZnO due to its specific properties, such as wide band gap (3.37 eV at room temperature), large exciton binding energy (60 meV). Last but not least, zinc oxide (ZnO) is bio-safe, biocompatible, biodegradable compound and easily penetrates cells [1], which makes it a promising material for applications in biology and medicine, both in the field of diagnostics and therapy. Of particular importance may be the use of zinc oxide nanoparticles in the field of so-called targeted therapies associated with drug delivery systems, where nanoparticles are treated as carriers of drug substances that go directly to the pathological sites in the body. The latter is highly interesting since nanoparticles of appropriate size may cross the blood-brain barrier [1], which makes them potentially useful in the treatment of neurodegenerative diseases and brain tumors. Nanoparticles applicable in biology and medicine must meet some specific requirements. In addition to the biocompatibility, they should exhibit efficient luminescence and have a suitable shape (preferably spherical) and size [2]. In connection with the above, it seems valuable to study and optimize the growth mechanisms of ZnO nanoparticles and to develop a simple and repeatable procedure for synthesizing ZnO materials for biomedical applications. For this purpose, a number of growth processes were carried out using the microwave hydrothermal synthesis, which is relatively simple and easily controlled method. All ZnO nanopowders were prepared according to the same procedure, but using different precipitating reagents (sodium and potassium hydroxide solutions, aqueous ammonia solution), different reaction mediums (distilled water, ethyl alcohol, hydrogen peroxide) and various zinc precursors (like zinc chlorides, zinc nitrates, zinc acetates both hydrated and without intrinsic water).

The effects of synthesis conditions on the morphologies, crystal structures and optical properties of ZnO nanoparticles were analyzed by Scanning Electron Microscopy (SEM), X-ray diffraction (XRD), cathodo- (CL) and photoluminescence (PL). The significant changes of their properties will be reported.

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