
«Influence of plasma power on the size distribution of deposited zinc oxide nanorods»

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Problem statement

**Zinc oxide** is widely used in the field of electronics as a material for:

- solar cells
- fluorescent devices
- backup power supplies
- fuel cells
- components of artificial intelligence systems
- various types of sensors

The method of plasma-enhanced chemical vapor deposition (PECVD) makes it possible to achieve versatility, controllability, one-stage, cost efficiency, and scalability for the process of obtaining zinc oxide, and also high purity of the final material.

The current work is devoted to studying the effect of plasma power on the size and morphological characteristics of the resulting zinc oxide nanoparticles.
Zinc oxide nanopowders were obtained by PECVD with optical emission spectrometry control at different plasma discharge powers (30, 50, and 70 W).

Dimensional and morphological characteristics of the zinc oxide nanoparticles were studied by scanning electron microscopy (SEM).

The received SEM data were statistically processed.

The optical emission spectra of zinc-hydrogen-oxygen plasma (Zn : H$_2$ : O$_2$ = 2 : 1 : 1) at various plasma discharge power...
Conclusions

As a result of the plasma-chemical synthesis, rod-shaped zinc oxide nanoparticles with different transverse diameters were obtained. According to the SEM data, the zinc oxide nanoparticles have a rod-like shape with different transverse diameters depending on plasma discharge power. Using a statistical analysis of the results of measuring the diameters for the zinc oxide rods, it was found that the formation of the powder particles is random at a low plasma power (20 W), which was confirmed by a very wide particle size distribution. With an increase in the plasma discharge power, the diameter of the zinc oxide rods decreased with a simultaneous narrowing of the variability for their size range. The transverse diameter of the zinc oxide rods decreased by 2 times with an increase in the plasma discharge power from 30 to 50 W, and more than 15 times when going from 50 to 70 W.

SEM images of zinc oxide nanopowder obtained at various plasma discharge power: (a) 30 W, (b) 50 W, (c) 70 W

Transverse size distribution of ZnO rod-shaped structures obtained at various plasma discharge power: (a) 30 W, (b) 50 W, (c) 70 W

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