SYNTHESIS OF MONOCRYSTALLINE ULTRADISPERSED ZINC OXIDE POWDER

E.M.Vodopyanov
National Research Tomsk Polytechnic University
Russia, Tomsk, Lenin Avenue, 30, 634050
E-mail: headfire94@gmail.com

There has been a considerable interest in the study of zinc oxide (ZnO) in recent decades. This is a unique functional material with a high electron mobility, a high thermal conductivity, a wide bandgap (3.37 eV) and a large exciton binding energy (60meV) and the richest family of nanostructures among all materials. Due to its unique properties, zinc oxide is widely used in many industries. Optical and electrical properties are used in solar cells, laser diodes, and gas concentration sensors, varistors, TFTs and others. Antibacterial properties, biocompatibility, and the ability to repel ultraviolet radiation are used in the textile and plastics industry, perfumery, cosmetics, medicine [1,4].

Ultradispersed zinc oxide powder was obtained by the universal plasmodynamic method in discharge of a hyperhigh-speed plasma jet. The jet is generated by a pulse highcurrent (the order of 105 A) coaxial magnetoplasma accelerator (CMPA) of the erosion type [5].

The trunk of the accelerator is an external titanium electrode barrel with zinc disks inside, the diameter of the acceleration channel is 9mm, and the length is 190mm. The basic material (Zinc) is generated by electric erosion of the accelerating canal surface then accelerated plasma jet ejected into the reactor chamber filled with oxygen. The electrical supply to the accelerator was carried out with the help of the capacitive energy storage.

Analytical researches of the received products were done by means of roentgen diffractometry methods. According to the obtained data, the powder is composed of more than 99.9% of the zinc oxide phase that indicates the correct choice of experimental energy parameters and confirms the basic assumption about the possibility of this phase synthesis.

Also the product was analyzed by transmission electron microscopy (TEM) which shows the hexagonal structure of single crystal zinc oxide, and most part of the product consists of 200 nm objects.

Based on the results of this work the following conclusion can be made about the possibility of applying the plasmodynamic synthesis method to obtain an ultradispersed powder of single crystal zinc oxide with a crystal structure - hexagonal system.

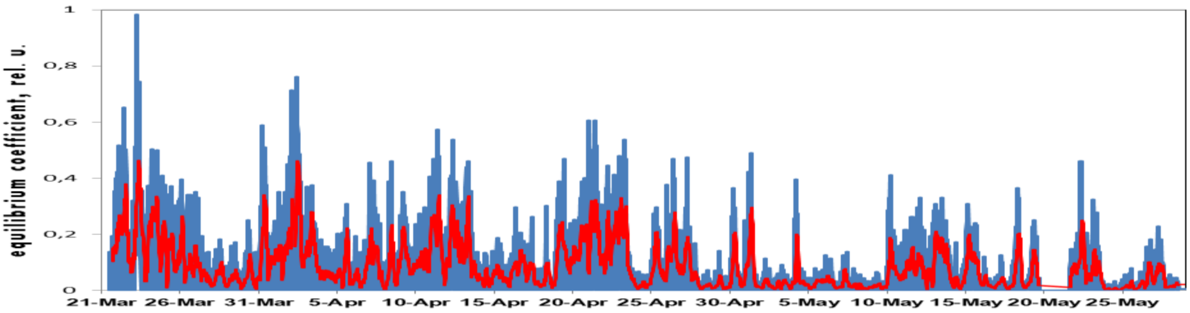
REFERENCES

1. Ozgur U., Hofstetter D., Morkoc H. // Proceedings of the IEEE. 2010. T. 98. №. 7. C. 1255-1268.
2. Kuo C. L. // Ceramics International. 2010. T. 36. №. 2. C. 693-698.
3. Renganathan B. // optics & laser technology. 2011. T. 43. №. 8. C. 1398-1404.
4. Beek W. J. E., Wienk M. M., Janssen R. A. J. // Advanced Materials. 2004. T. 16. №. 12. C. 1009-1013.
5. A. A. Sivkov, A. Ya. Pak, and I. A. Rakhmatullin, RF Patent No. 2475449. C01B 21/082, C30B 29/38, C30I 30/00, B82B 3/00, B82U 30/00, C01B 31/02.

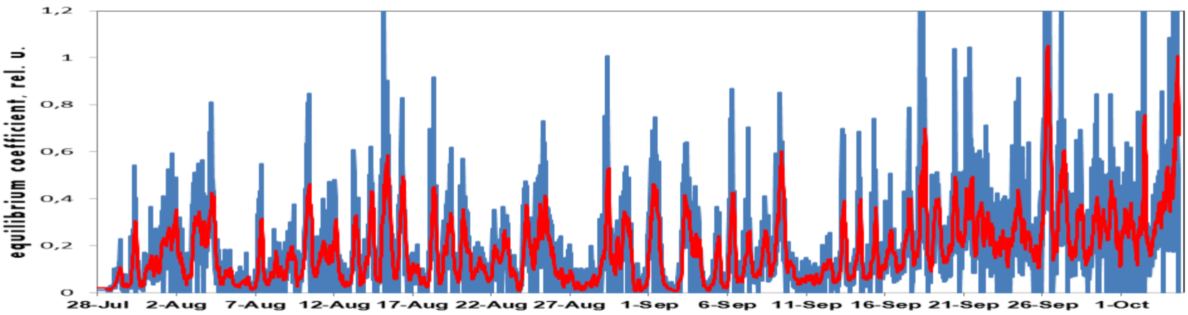
TEMPORAL AND SPATIAL DEPENDENCES IN BEHAVIOR OF ATMOSPHERIC RADON, THORON AND THEIR DECAY PRODUCTS

A.G. Kondratjeva, V.S. Yakovleva, N.S. Mishina
Lenina Avenue, 30, 634050, Tomsk, Russia
E-mail: kond_alla@tpu.ru

The processes of transport and removal of radionuclides in surface atmosphere and dwellings atmosphere are very different [1]. On the transfer of atmospheric radionuclides influence humidity, wind, precipitation, cyclones, rough change of weather conditions. To study temporal and spatial dependences in behavior of atmospheric radon, thoron and their decay products was organized continuous automated radon monitoring, which started in 2011 with help of radiometer of radon isotopes and their decay products (SARAD GmbH, Germany). The analysis of seasonal variations of radon activity concentration in the ground atmosphere revealed maximum in spring-summer period and minimum in winter. In diurnal variations minimum appears afternoon and maximum – before noon. These results are in a good agreement with results of other radon investigations. The analysis of changes of equilibrium coefficients between radon and its decay products showed that the annual average value was 0.2 (0.25 in March-April, 0.12 in May, and 0.27 at the end of September). Dynamics of F_{Rn} in 2011 is shown in Figure 1a (spring season) and 1b (summer-autumn season). Analysis of the F_{Rn} coefficient dynamics shows that its instantaneous (average within 2 hours - red line) values can vary quite widely from 0 to 1. Significant correlations were revealed between activity concentrations of radon, thoron and some of their short lived decay products at synoptic scale. Other interesting results of our investigation are also reported.



a



b

Figure 1. Dynamics of F_{Rn} in 2011: a) in spring; b) in summer-autumn

Supported by Federal Target Program № 14.575.21.0105

REFERENCES

1. Iakovleva V.S., Karataev V.D. Spatial and temporal variations of radon concentration in soil air // Radiation Measurements. – 2001. – Vol. 34 (1-6). – p. 501-504.

MAGNETRON SPUTTERING SYSTEM

A.V. Lazarev, M.A. Andreeva, U.A. Smirnova

National Research Politechnic University,

Russia, Tomsk, Lenina avenue 30, 634050

E-mail: Alefantiy@mail.ru

Thin film coatings have wide application as strengthening, reflective, conductive and dielectric coatings. One of the directions of vacuum-plasma technologies is the deposition of thin film coatings [1]. We consider the technology