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New generation plasma dynamical devices for synthesis new materials and coatings

Alexey Goncharov
Institute of Physics NAS, Ukraine

This is to describe the current status of ongoing research and development of the novel generation plasma dynamical devices based on the cylindrical electrostatic plasma lens configuration fit for synthesis new materials and exotic coatings by intense electron and ion beams. The results carried out in recent years collaboratively between IP NASU (Kiev), LBNL (Berkeley, USA) and HCEI RAS (Tomsk). The electrostatic plasma lens is a well-investigated tool for focusing high-current, large area, energetic heavy ion beams, providing a convenient and quick way of carrying out high-dose ion implantation. The crossed electric and magnetic fields inherent the plasma lens configuration provides the attractive method for establishing a stable plasma discharge at low pressure. Using plasma lens configuration in this way several low maintenance, high reliability plasma devices using permanent magnets and possessing considerable flexibility towards spatial configuration were developed. These devices can be applied both for fine ion cleaning and activation of substrates before deposition and for sputtering. One particularly interesting result of this background work was observation of the essential positive potential at the floating substrate. This suggested to us the possibility of a plasma lens for focusing high-current beams of negatively charged particles, electrons and negative ions, based on the use of the dynamical cloud of positive space charge under magnetic insulation electrons. We describe also the original approach for effective additional elimination of micro droplets in a density flow of cathodic arc plasma. This approach is based on application the cylindrical plasma lens configuration for introducing at volume of propagating along axis's dense low temperature plasma flow convergent radially energetic electron beam produced by ion-electron secondary emission from electrodes of plasma optical tool.

Biography

Alexey Goncharov received the DSci degree from the Institute of Physics, National Academy of Sciences of Ukraine (NASU), Kiev, Ukraine at 1996. He has been a Researcher with the Institute of Physics, NASU, since 1965, where he is currently a Scientist-in-Chief. He has authored or co- authored more than 200 experimental and theoretical publications in peer-reviewed journals and conference proceedings. He is involved with high- current plasma-optical devices for basic sciences and plasma-based high technologies. His research interests include high-current charged particle beams and applications ion-plasma technologies for material science. He is a member of the Ukrainian Physical Society and American Physical Society.

gonchar@iop.kiev.ua

Studies on antibacterial activity of ZnO nanoparticles by ROS induced lipidperoxidation

Bhavani Prasad Naik
Zhejiang University, China

Recent studies indicated the role of ROS toward antibacterial activity. In our study we report ROS mediatedmembrane lipid oxidation of *Escherichia coli* treated with ZnO nanoparticles (NPs) as supported by detection and spectrophotometric measurement of malondialdehyde (MDA) by TBARS (thiobarbituricacid-reactive species) assay. The antibacterial effects of ZnO NPs were studied by measuring the growth curve of E. coli, which showed concentration dependent bacteriostatic and bactericidal effects of ZnO NPs. The antibacterial effects were characterized by scanning electron microscopy (SEM) and transmission electron microscopy (TEM). Further, antibacterial effect of ZnO NPs was found to decrease by introducing histidine to the culture medium treated with ZnO NPs. The ROS scavenging action of histidine was confirmed by treating histidine to the batch of *Escherichia coli* + ZnO NPs at the end of the lag phase of the growth curve (Set-I) and during inoculation (Set-II). A moderate bacteriostatic effect (lag in the E. coli growth) was observed in Set-II batch while Set-I showed no bacteriostatic effect. From these evidences we confirmed that the antibacterial effect of bare as well as TG capped ZnO NPs were due to membrane lipid peroxidation caused by the ROS generated during ZnO NPs interaction in culture medium.

nenavathbhavani@gmail.com