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## Novel generation plasma dynamical devices for synthesis of new materials and coatings

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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 suitable for synthesis of 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-explored 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 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, activation and polishing 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, that is based on the use of the dynamical cloud of positive space charge under condition of magnetic insulation electrons. We describe also the original approach for effective additional elimination of micro droplets in a density flow of cathode arc plasma. This approach is based on application of the cylindrical plasma lens configuration for introducing at volume of propagating along axis's dense plasma flow convergent radially fast energetic electron beam produced by ion-electron secondary emission from electrodes of plasma optical tool.

### Biography

Alexey A. Goncharov received the D.Sci. 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 articles. 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. Prof. A. Goncharov is a member of the Ukrainian Physical Society and American Physical Society.

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## Green synthesis of copper nanoparticles using rice water and their photocatalytic activity

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Copper nanoparticles were synthesized using rice water as stabilizing agent via chemical reduction method in an eco-friendly environment. These copper nanoparticles were characterized by using X-ray diffraction (XRD), Fourier transform infrared (FTIR) spectroscopy, UV-Visible absorption spectroscopy, scanning electron microscopy (SEM) and transmission electron microscopy (TEM). XRD analysis revealed that there are three main characteristic diffraction peaks present at around $2\theta = 43°$, 50° and 74° which correspond to the (111), (200), (220) crystallographic planes of face-centered cubiccrystals. The crystallite size is calculated using Scherer's formula and found to be 6 to 40 nm. Lattice parameter is found to be in the range 3.61 A° - 3.63 A°. The FT-IR spectrum of copper nanoparticles exhibits several bands characteristic of stretching and bending vibrations of O-H, C=C, C-O functional groups. The broad and strong bands are observed at around 3480 $cm^{-1}$, 1645 $cm^{-1}$ and 652 $cm^{-1}$ corresponding to the O-H stretching frequency. The rate of formation of copper nanoparticles was studied by using UV-Visible absorption spectroscopy by measuring the absorbance at around 582 nm. SEM and TEM images of green synthesized copper nanoparticles showed the monodispersed distribution of particles with average size of 25 nm. The photocatalytic activity of the green synthesized copper nanoparticles has also been investigated.

### Biography

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