NEWS | DECEMBER 13 2019

Generating large, tunable plasmas for practical applications

Anashe Bandari

Scilight 2019, 501103 (2019)
https://doi.org/10.1063/10.0000379

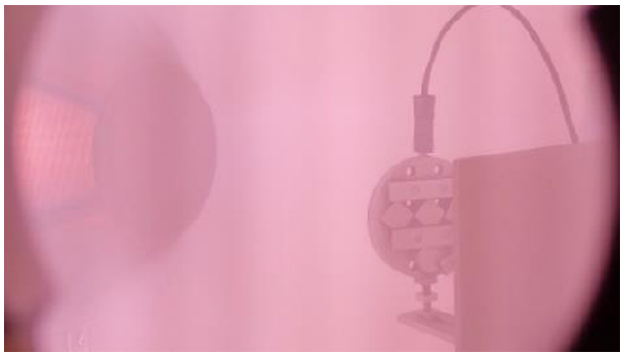
Scilight

9 December 2019

Generating large, tunable plasmas for practical applications

Anashe Bandari

A new method can vary operating parameters for a pulsed plasma created by combining a high-current hollow cathode discharge with a low-voltage glow discharge.



The ability to independently control plasma parameters like concentration, pressure, ion energy and ion current density in large vacuum volumes can help create homogeneous plasmas suitable for both experimental and practical applications. In a recent paper, Denisov et al. demonstrate this capability in a low-pressure gas plasma source based on a non-self-sustained hollow cathode glow discharge generator.

The authors created an adjustable, low-temperature, low-pressure plasma source for generating hollow cathode glow discharge. Plasmas of this type of discharge become more homogeneous at lower pressures, higher discharge voltages and currents, and smaller anode-to-cathode area ratios. By independently altering these properties, the authors' new device can generate large and more uniform plasmas suitable for many practical applications, such as cleaning and metal surface modification and, most importantly, nitriding of materials in order to increase their service life.

The researchers achieved this by injecting fast electrons into a large hollow cathode glow discharge using a supplementary arc discharge. As the injected electrons ionize the background gas, a plasma is produced within the hollow cathode, thus igniting and maintaining a glow discharge.

With the help of an additional electron source, the device is fully tunable – in contrast, in traditional plasma mode generation, operating parameters cannot be independently changed. This ability to adjust plasma properties provides benefits that outweigh the additional operating costs.

Author Vladimir Denisov noted that the plasmas generated by this method have properties similar to nitrogen-oxygen plasmas of the mesosphere (upper atmospheric layers). They plan to use this device for future studies of plasma properties of the mesosphere.

Source: "The source of volume beam-plasma formations based on a high-current non-self-sustained glow discharge with a large hollow cathode," by V. V. Denisov, Yu. H. Akhmadeev, N. N. Koval, S. S. Kovalsky, I. V. Lopatin, E. V. Ostroverkhov, N. N. Pedin, V. V. Yakovlev and P. M. Schanin, *Physics of Plasmas* (2019). The article can be accessed at https://doi.org/10.1063/1.5126485.