Scilight

NEWS | NOVEMBER 08 2019

Stable and uniform plasmas demonstrated in record-breaking discharge gap

Savannah Mandel

Scilight 2019, 451101 (2019)
https://doi.org/10.1063/10.0000259

AIP Publishing

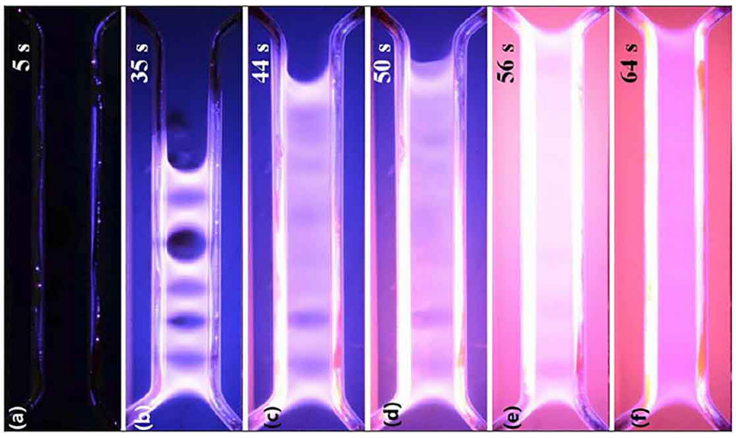
Scilight

1 November 2019

Stable and uniform plasmas demonstrated in record-breaking discharge gap

Savannah Mandel

While using ambient air to generate uniform plasma, scientists successfully increase discharge gap to 7 mm, beating the previous record by 75 %.



Low-temperature plasmas play an important role in surface and materials functionalization, microelectronics, biomedical engineering and the study of natural atmospheric phenomena. For instance, the ability to produce a uniform and stable low-temperature plasma is advantageous for high-precision material modifications. Generating these plasmas is challenging due to various reasons such as the need for low pressure environments and the use of noble gases, which limits the usage of these plasmas in real-world applications.

Previously, scientists believed that a discharge gap tends to be unstable when ambient air is used as the working gas, and the plasma gap could be no larger than 5 mm without resulting in non-uniformity, or filaments. Xian et al. surpassed both limitations and achieved a discharge gap of 7 mm using ambient air.

“Using ambient air as the working gas for plasma generation makes devices simpler and cheaper, and friendlier to the environment. Our plasma does not need any vacuum systems to operate, which makes it practical for industry-relevant materials processing,” Xian said.

They attribute their success in producing the uniform plasma to the high density of seed electrons and the reduced number density of molecules in air at a relatively high gas temperature. The discharge was observed to be uniform across both horizontal and longitudinal dimensions using a super-fast ICCD camera with sub-nanosecond resolution.

The authors plan to continue to use their approach to improve plasma size, stability and uniformity. They theorize that by increasing gas temperature one can expect the maximum discharge gap to widen further.

Source: “Uniform atmospheric pressure plasmas in a 7 mm air gap,” by Yu Bin Xian, Fei Qi, Yiyang Li, Rusen Zhou, Renwu Zhou, Jianjian Wan, Patrick J. Cullen, Xinpei Lu, and Kostya Ostrikov, *Applied Physics Letters* (2019). The article can be accessed at https://doi.org/10.1063/1.5120109.