DIAGNOSTICS OF PLASMA-LIQUID SYSTEMS: CHALLENGES AND THEIR MITIGATION

Shurik Yatom[1]

[1] Princeton Plasma Physics Laboratory, Princeton University, Princeton, NJ 08543, United States of America

Abstract

Non-equilibrium, low-temperature plasma is gaining a very steady and dedicated following in the bustling, inter-disciplinary community interested in plasma science and technology. Small scale, uncomplicated ways of plasma generation in the ambient atmosphere and high plasma-induced chemical reactivity make low-temperature plasma very attractive for a wide variety of applications in biomedicine, environmental remediation, and agriculture. These applications prompt new avenues for studying plasma in rich chemical environments and plasma interaction with liquids. Often, these environments pose new challenges for plasma investigation, application of diagnostic methods and interpretation of results.

In this talk I will review two popular methods of laser diagnostics in plasma-liquid systems and generally in low-temperature plasmas. These are Thomson scattering and laser-induced fluorescence. Setting up the plasma-liquid interaction experiment will be described, while stressing the important points for laser diagnostics and maintaining conditions for correct and repeatable measurements. I will discuss the caveats that are encountered when measuring inherently unstable and collisional systems such as plasma interacting with liquid and how these challenges impact data analysis and calibration efforts for these two-diagnostic approaches.

Acknowledgements

The author is very grateful to the colleagues within Princeton Collaborative Research Facility (PCRF): Yevgeny Raitses, Sophia Gershman, Santosh Kondeti, Arthur Dogariu and Michael Shneider, who continually contribute to author's work through brainstorming, advice, and direct help in lab work.

The OH measurement in open air DBD discharge is supported by the U.S. Department of Energy (DOE) under Contract No. DE-AC02-09CH11466.

The work on plasma characterization in RF plasma jet in contact with liquid and humid He DBD discharge is supported by the Princeton Collaborative Research Facility (PCRF), which is supported by the U.S. Department of Energy (DOE) under Contract No. DE-AC02-09CH11466.