

Plenary 2

- Date / Time: January 17 (Sun.), 2021 / 13:10-14:00
- Session Chair: Eun-Ha Choi (Kwangwoon Univ., Korea)



Plasma Biology and Chemistry for Innovations in Agriculture and the Food Cycle

Prof. Peter Bruggeman
(Univ. of Minnesota, USA)

Abstract

The unique non-equilibrium conditions of low temperature plasmas enable the delivery of highly reactive plasma species to surfaces. This distinctive ability of low temperature plasmas led to major advances in the microelectronics industry. More recently, advances in the generation and control of atmospheric pressure plasmas enabled the extension of the use of atmospheric pressure plasmas to the treatment of heat sensitive substrates including polymers, tissue, plants and wounds leading to the emergence of many new applications in biology, medicine and agriculture.

This presentation will provide an overview of the-state-of-the-art of the field of atmospheric pressure low temperature plasmas with a focus on its use for innovations in agriculture and the food cycle. We will review plasma-based food decontamination, nitrogen fixation and the potential beneficial impact of plasma on plants and foods in general while focusing on the fundamental plasma physics, chemistry and biology that underpin these emerging applications. We will further motivate the advantages of plasma compared to conventional technologies and highlight the remaining challenges that are being addressed to enable the implementation of plasma technology in agriculture and the food industry.

Acknowledgement:

This work was partially supported by U.S. Department of Energy, Office of Science, Office of Fusion Energy Sciences, General Plasma Science program, under Award Number DE-SC-0016053 and DE-SC-0020232, the National Science Foundation under NSF OIA 2020695 and the U.S. Department of Agriculture, National Institute of Food and Agriculture under Award number 2017-67017-26172.

Biography

Dr. Peter J. Bruggeman is currently Professor and Associate Head of Mechanical Engineering at the University of Minnesota. He serves as the Director of the High Temperature and Plasma Laboratory and Associate Director of the Department of Energy Center on Plasma Interactions with Complex Interfaces consisting of 8 institutions. He also leads a Multi-University Research Initiative on "Plasma-driven solution electrochemistry". Prof. Bruggeman obtained his PhD from Ghent University, Belgium, in 2008 and was an Assistant Professor of Applied Physics at the Eindhoven University of Technology, the Netherlands, from 2009 until he joined the University of Minnesota in 2013. A significant part of his research is focused on the fundamental physical and chemical processes of low temperature non-equilibrium plasmas enabling many environmental, biomedical and renewable energy applications and technologies. He has published over 110 papers in peer-reviewed journals and delivered invited and keynote lectures at over 80 international meetings. His research has been recognized by several awards including the 2012 Hershkowitz Early Career Award, the 2013 Institute of Pure and Applied Physics Young Scientist Medal and Prize in

Plasma Physics, the 2016 US Department of Energy Early Career Award, the 2018 Peter Mark Memorial Award of the American Vacuum Society and the 2020 George W. Taylor Award for Distinguished Research of the College of Science and Engineering of the University of Minnesota. Prof. Bruggeman is an active member of his research community. He is currently the section editor for Low Temperature Plasmas of the Journal of Physics D: Applied Physics (Institute of Physics Publishing, UK) and serves as an editorial board member of several other journals. He also served on the committee charged by the National Academies with the Decadal Study of Plasma Science (Plasma 2020) and co-edited the "2017 Plasma Roadmap" giving directions for the future development of the field of low temperature plasma. Prof. Bruggeman is also an elected member of the board of directors of the International Society of Plasma Chemistry. He has been a member of more than a dozen international scientific and organizing committees of meetings in his research field. Prof. Bruggeman was the elected chair of the 2018 Gordon Research Conference on Plasma Processing Science and organized the conference "Frontiers in Low Temperature Plasma Diagnostics X" in 2013 in the Netherlands.