Sept 30, 2021

Non-Equilibrium Plasmas as the Next Frontier: Perspectives from Catalysis, Electrochemistry, and Energy

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ABSTRACT:

Plasmas, also called gas discharges, are one of the unsung heroes of modern science and engineering. In addition to being used for important scientific discoveries throughout history – such as the discovery of argon –one class of plasmas, called non-equilibrium or non-thermal plasmas, have also formed the backbone of many technologies that sustain the modern world, from microelectronics to lighting. Recently, a number of advances have shown that the non-equilibrium environment in the plasma is well-suited to overcoming challenges across a wide variety of domains, leading to a number of emerging areas where plasma engineering is well-posed to make important contributions over the next several decades. In this talk, I will overview our work in three specific areas that have shown significant promise. The first is in the field of catalysis, where a non-equilibrium plasma can serve to excite a gas into a non-equilibrium state that promotes unique interactions at catalytic surfaces, promoting more effective chemical conversion. The second is in the field of electrochemistry, where plasma interactions at the surface of a liquid can drive redox chemistry without the need for a solid electrode or catalytic material, opening up new opportunities for materials synthesis and water purification. The final is on energy conversion plasmas, where we explore using non-centrosymmetric crystals to directly convert mechanical or thermal energy into a plasma source, overcoming on the major barriers to moving plasma technologies out of the lab and into the field.

BIOGRAPHY:

David B. Go is Professor and Department Chair in the Department of Aerospace and Mechanical Engineering, with a concurrent appointment in the Department of Chemical and Biomolecular Engineering, at the University of Notre Dame. He has published widely in the areas of plasma science and engineering, heat transfer and fluid dynamics, and chemical analysis and holds 6 patents or patent applications, leading to two licensed technologies. Prof. Go has been recognized with the Air Force Office of Scientific Research Young Investigator Research Award, the National Science Foundation CAREER award, the Electrochemistry Society Toyota Young Investigator Fellowship, the Electrostatics Society of America Rising Star Award, and the IEEE Nuclear & Plasma Sciences Society Early Achievement Award. He is an ASME Fellow and the President of the Electrostatics Society of America. At Notre Dame, he has received the Rev. Edmund P. Joyce, C.S.C. Award for Excellence in Undergraduate Teaching and was a Kaneb Center for Teaching and Learning Faculty Fellow. Prior to joining Notre Dame in 2008, Prof. Go received his B.S. in mechanical engineering from the University of Notre Dame, M.S. in aerospace engineering from the University of Cincinnati, and Ph.D. degree in mechanical engineering from Purdue University.