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Streamers and their applications

A.J.M. PEMEN, Eindhoven University of Technology

In this invited lecture we give an overview of our 15 years of experience on streamer plasma research. Efforts are directed to integrating the competence areas of plasma physics, pulsed power technology and chemical processing. The current status is the development of a large scale pulsed corona system for gas treatment. Applications on biogas conditioning, VOC removal, odor abatement and control of traffic emissions have been demonstrated. Detailed research on electrical and chemical processes resulted in a boost of efficiencies. Energy transfer efficiency to the plasma was raised to above 90%. Simultaneous improvement of the plasma chemistry resulted in a highly efficient radical generation: O-radical production up to 50% of the theoretical maximum has been achieved. A major challenge in pulsed power driven streamers is to unravel, understand and ultimately control the complex interactions between the transient plasma, electrical circuits, and process. Even more a challenge is to yield electron energies that fit activation energies of the process. We will discuss our ideas on adjusting pulsed power waveforms and plasma reactor settings to obtain more controlled catalytic processing: the "Chemical Transistor" concept.

Work done in collaboration with E.J.M. van Heesch, W.F.L.M. Hoeben, S.J. Voeten, T. Huiskamp, J. Zhang, and F.J.C.M. Beckers (now with Oranjewoud/HMVT, Ede, The Netherlands), Eindhoven University of Technology; and the Electrical Energy Systems Team.