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Contribution ID: **3122** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

(G*) Combined High-Voltage Pulse and Radiofrequency Excitation for Large-Volume High-Pressure Non-Thermal Plasma Generation

Tuesday, 7 June 2022 14:00 (15 minutes)

Large volume, atmospheric pressure non-thermal plasma volumes are desired for uniform plasma processing applications. Nanosecond (ns) pulsed plasma sources are effective at igniting and sustaining plasmas in atmospheric pressure gases and gas mixtures. These pulses produce large quantities of excited species and highly reactive radicals participating in the desired chemical reaction pathways. When sufficiently separated in time, the power delivery of each pulse is relatively discrete resulting in minimal memory effect. The rapid quenching of the electron and excited species densities causes the discharge to essentially face re-ignition conditions every pulse. This dynamic load impedance leads to the efficiency of power delivery from electrical mains to plasma to be sufficiently low. On the other hand, conventional RF discharges can provide high electrical power-to-plasma chemical energy conversion efficiency, however sustaining a uniform discharge at atmospheric pressure proves to be challenging. Commercially available RF power supplies cannot reach the breakdown voltage thresholds required to ignite electrical discharges at atmospheric pressure in most gas mixtures and useful interelectrode gaps. We are particularly interested in a rather new approach of the combination of a ns pulsed high-voltage source with a continuous RF. The ns pulser causes gas breakdown and electrical discharge formation in the interelectrode gap while supplying a high density of energetic electrons to initiate energetic plasma chemistry. Between ns pulses, the sub-breakdown continuous RF field takes over and provides the typical RF processing characteristics such as large diffuse volumes and moderate energy plasma chemistry. Preliminary testing was performed in parallel-plated geometry with argon as the plasma forming gas at 1 atm. Preliminary results demonstrated the ability to produce a repetitive ns discharge and formation of a uniform glow at sub breakdown voltages in between pulses. Gas mixtures containing increasing amounts of N2 and H2 are introduced to see the effect on the plasma characteristics as well as power delivery. Introducing molecular gasses will give insight on the possibility of using this method of power delivery for reactive gas mixtures. We will report on the efficiency of power delivery as well as general dynamics of the discharges.

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