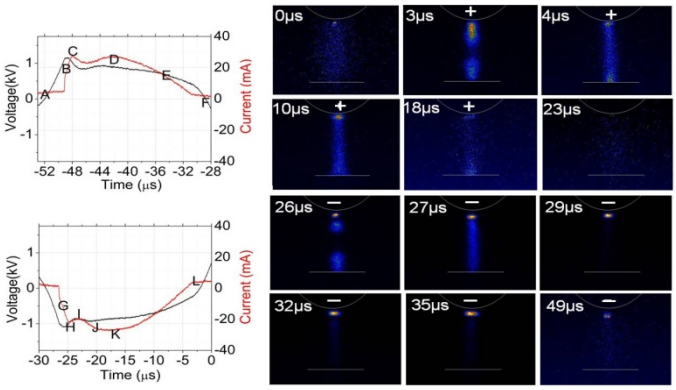
STEADY STATE AC-EXECITED ATMOSPHERIC PRESSURE PLASMAS IN CONTACT WITH LIQUID

Jingjing Liu and Michael G. Kong
Department of Electronic and Electrical Engineering, Loughborough University, Leicestershire, United Kingdom

Steady-state plasmas with pin-to-water electrodes and excited at AC (20kHz) and DC are investigated by means of electrical and optical characterization. Dissipated power and power density of the AC excited plasmas fall between those of the DC-existed plasmas with a water anode and a water cathode. Time-resolved nanosecond images of AC plasmas reveal that they are time dependent and continuous between different cycles. Time-resolved images of DC plasmas show that they are not time dependent.

Rotational and vibrational temperatures are obtained through OH band[1] and N_2 band[2]. Temperatures of pin and water electrodes are obtained by electronic thermometer. It is shown that both gas and electrode temperatures of AC plasmas fall between those of the two DC cases (e.g. one with water cathode and the other with water anode). From the production of reactive species (OH, H_α, O777 and O845), it is found that the efficiency of reactive species is much higher in the AC plasmas (1.2~2.5 times) than those of the two DC plasmas. AC excited liquid plasmas have the highest energy use efficiency among the three systems, because with the same input power, they can produce the most active species, resulting in the moderate rotational temperature and electrode temperature.

1. C. de Izarra, "UV OH spectrum used as a molecular pyrometer", Journal of Physics D-Applied Physics, 2000, vol.33, pp.1697-1704.
2. C. O. Laux, T. G. Spence, C. H. Kruger, R. N. Zare, "Optical diagnostics of atmospheric pressure air plasmas", Plasma Sources science and Technology, 2003, vol. 12, pp. 125-138.



Voltage and current waveforms at 19.0W in the steady state and its corresponding nanosecond images (2ns exposure time) at different instants of time.