# OPTICAL AND ELECTRICAL DIAGNOSTICS OF THE EFFECTS OF CONDUCTIVITY ON LIUQID PHASE ELECTRICAL DISCHARGE

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In recent years, there is an increasing interest in the application of high voltage electrical discharge plasma in and in contact with liquids (especially water). The presence of water molecules interacting with plasma generates significant amounts of hydroxyl radicals, a highly reactive. It is difficult to quantitatively measure radical species generated in plasma due to their short lifetimes. Chemical probes have been used to quantitatively measure hydroxyl radicals in liquid phase discharge [1] but the disadvantage is that the addition of the probes can change solution properties (i.e. conductivity) and affect other plasma chemical reactions. In the case of emission spectroscopy, another species diagnostic method, some of the radical species in the excited state generated in the liquid phase plasma will go through non-radiative relaxation processes due to effect of solvent conditions and rapid quenching processes. Previous literature has suggested significant changes in the plasma channel length, temperature and UV light emission characteristics when increasing the solution conductivity [2]. Therefore, it is important to develop calibration methods which allow the comparison of the emission intensity resulting from the quantity of radicals under different solution conductivity.

In the present study, the intensity of OH, H and O radicals were measured by optical emission spectrometry in different conductivity samples (5 to 1000 microS/cm). Argon gas was bubbled around the liquid phase discharge and was used as a chemical actinometer. Control experiments demonstrated that the addition of argon bubbling does not disturb the discharge and the argon emission intensity has a linear response to radical species intensity. Therefore, the argon peak can be used as a calibration reference under different solution conductivity. Radical species intensity, generation rates of $H_2$, $O_2$ and $H_2O_2$, discharge voltage and current waveforms and power characteristics were measured as functions of solution conductivity for electrical discharge directly in liquid water.

1. M. Sahni and B. R. Locke, "Quantification of Reactive Species Produced by High Voltage Electrical Discharge in Water." Plasma Process and Polymers, 2006, 3(4-5), pp. 342-354.
2. P. Lukes, M Lupek, V Babicky and P. Sunka, “Ultraviolet Radiation from the Pulsed Corona Discharge in Water”, Plasma Sources Science and Technology, 2008, 17, 02412.

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