Experiment and simulation of pulsed DC-discharges with sharped tip electrodes in saline solutions

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DC-pulsed discharges created by a 1um diameter tungsten tip in saline solutions have been investigated using a Fast-Framing-Camera (FFC Photron SA-X2). A shadowgraph method was used to explore the initiating vapour formation, its evolution (Figure i, ii) and the subsequent discharges developing in that layer through a single voltage pulse [1]. Images without the shadowgraphy backlighting (Figure iii) when related to the current/voltage signals from the oscilloscope, indicate the temporal development of the plasma and its interaction with the surface of the tip [1].

Figures: i) vapour layer formation, ii) bubble collapse, iii) light emission from discharge region iv, v) Calculated electric field at times 133 and 167 us respectively after the initiation of (-300V) applied voltage Post-processed images provide a source of real vapour layer structures. These have been imported into COMSOL Multiphysics® for calculations of the electric field in those vapour layers, as shown in Figures iv and v. Simulations incorporating Comsol’s Plasma Module then make it possible to estimate discharge characteristics e.g. electron density and electron temperature. The existing vapour layer formation model [2] has also been adapted for this tip geometry. Comparisons of experimental measurements and simulations to compare the discharge development with rod electrodes used in [3] and the sharp tungsten tip used here are ongoing.

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