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Biomedical Applications of Gliding Arc Plasma: From Produce Washing to Stimulation of Plant Growth

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Presentation is focused on physics and bio-medical applications of non-equilibrium gliding arc discharges stabilized in reverse vortex Tornado flows and submerged in water, water solutions, and other liquids. New results related to physics of gliding arcs operating in the transitional equilibrium – non-equilibrium regimes were obtained demonstrating fast jump of electric field in a middle of arc channel during the FENETRE transition. This phenomenon has been initially observed in the flat 2D gliding arcs, and now confirmed in the non-equilibrium gliding arc discharges stabilized in reverse vortex Tornado flows. Optimal parameters of the FENETRE transitional gliding arc regime have been determined. Effect of submerging the gliding arc plasma in different liquids on the parameters of the FENETRE transition is discussed.

Plasma chemical processes stimulated in water and water solutions by the non-equilibrium gliding arc discharges stabilized in reverse vortex Tornado flows are discussed. Especial attention is paid to effect of organic load (concentration of organic additives) in water on sterilization ability of the gliding arc plasma activated water. Effect of non-oxidative washing ability of the gliding arc plasma activated water is analyzed.

Stimulation of plant growth by water activated in the non-equilibrium gliding arc discharges stabilized in reverse vortex Tornado flows is considered. Different regimes of water activation are compared. Mechanisms of the gliding arc plasma water activation for the purpose of plant growth stimulation are discussed.

Especial attention is paid to analysis of physical kinetics and energy efficiency of nitrogen fixation (formation of nitrogen oxides from air) in such plasma-chemical systems. Low energy cost of NO production from air in the non-equilibrium gliding arc discharges stabilized in reverse vortex Tornado flows is experimentally demonstrated, and compared with results of theoretical kinetic analysis of this non-equilibrium plasma-chemical process, which can be effectively stimulated by vibrational excitation of nitrogen.