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Electron Temperature Modification in Gas Discharge Plasmas[1]

VALERY GODYAK, University of Michigan and RF Plasma Consulting — In gas discharge plasma with a Maxwellian electron energy distribution function (EEDF), the ionization balance results in the electron temperature Te being solely a function of the product of gas pressure p and plasma characteristic size d, Te = Te(pd), independently on plasma density and electron heating mechanism. This common feature of gas discharge plasma takes place in self-sustained discharges where ionization is locally coupled with electron heating, usually in a uniform heating electric field. At such condition, there is no room for electron temperature change at fixed pd. Variety of non-equilibrium phenomena observed in self-organized dc and rf discharge structures, and in relaxation process therein suggests the way to EEDF and Te modification. At such conditions, the electron heating can be separated (in space or/and in time) from the ionization. Few examples of such discharge structures in well know stationary dc and rf discharges and in plasma transient processes, leading to considerable mean electron energy reduction, will be considered in the presentation together with abbreviated review of existing methods and experimental results on EEDF control in laboratory plasmas.

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