HV PULSED PLASMA GUN FOR GENERATION OF HIGH VELOCITY PLASMA BULLETS

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This contribution deals with the time resolved diagnostics of a non thermal plasma source initially developed at GREMI for biomedical applications. The set up, designed as Plasma Gun[1], consists in a cylindrical Dielectric Barrier Discharge reactor flushed with neon or helium at flow rates of a few tens of $cm^{-3}.min^{-1}$, and powered by fast rising voltage pulse of nanosecond duration ranging between few kV and few tens of kV in amplitude. At the DBD reactor output, transient plasma balls are generated which propagate over very long distances in a dielectric guide having very high aspect ratio (e.g.: a few tenths of millimeters in diameter and a few tens of cm in length) with velocities as high as $5\ 10^{8} cms^{-1}$. Very fast energy transfer occurs as the balls reach ambient air leading to the production of radicals and of nitrogen and nitric oxide excited molecular states leading to UV radiations.

To better understand formation, propagation in capillaries and in ambient air, nanosecond ICCD imaging including spectrally filtered imaging has been performed. The dynamics of the bullet is connected with current and voltage waveforms. The bullet expansion in air is associated with the generation of luminous filamentary micro structures revealing the field topography at the bullet boundaries. The comportment of filamentary structures has been evaluated by applying a dielectric or conducting surface at different distances from the capillary outlet, and by varying gas flow rates.

The possibility to generate and deliver non thermal plasma at atmospheric pressure and long distances from the main electric discharge reactor appears rather unique. The plasma gun may be versatile and opens up new possibilities of applications of such device for treatment of material or biomedical targets eventually difficult to reach. Plasma gun can also find application in many other domains such as, for example, decontamination and sterilization or ultrafast switching.

1. FR. WO2009050240 (2009), Centre National de la Recherche Scientifique (FR) and Université d'Orléans (FR), J.M. Pouvesle, C. Cachoncinlle, R. Viladrosa, A. Khacef, E. Robert, S. Dozias.

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