INVESTIGATION OF A TOROIDAL AIR PLASMA UNDER ATMOSPHERIC CONDITIONS

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The University of Missouri-Columbia has recently been studying methods of generating large volume high density toroidal air plasmas. Stable, large volume high density plasma discharges in air at atmospheric pressure are difficult to achieve due to electron recombination, diffusion, and attachment as well as the high number of neutral particle collisions. In order to achieve steady state, the plasma must satisfy the continuity equation where electron generation must equal electron loss rates. This can be achieved with or without electron generation from an external source.

A multi-millisecond duration, exploding wire air plasma with electron density of at least 10^{14} /cm^3 has been developed and is presented in this study. Confining the radial expansion of an exploding wire discharge has resulted in interesting magnetohydrodynamic effects, producing a toroidal air plasma, or TAP. The critical factors of the expansion and duration of this exploding wire plasma source have been experimentally investigated and are presented in this study. The interaction with surfaces is also discussed including the ability of the plasma to adhere to surfaces for millisecond time periods.

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