OPTICAL EMISSION SPECTROSCOPY OF A GLIDING ARC TORNADO DEVICE

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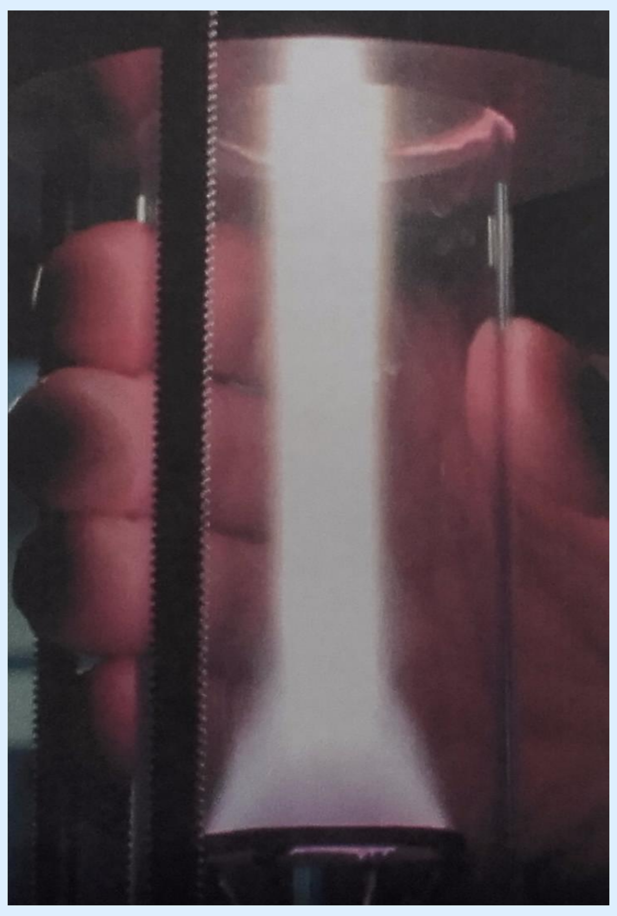
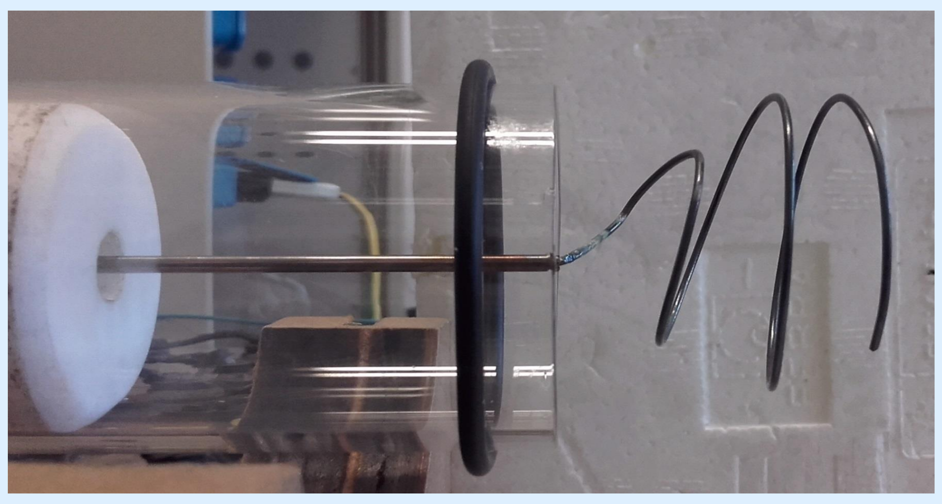
GAT Plasma Device

The Gliding Arc Tornado (GAT) was proposed long ago to improve properties of gliding arcs reactors, in particular a better insulation of the device walls from the discharge, with a higher level of non-equilibrium and much larger residence times (see Kalra et al. 2005).

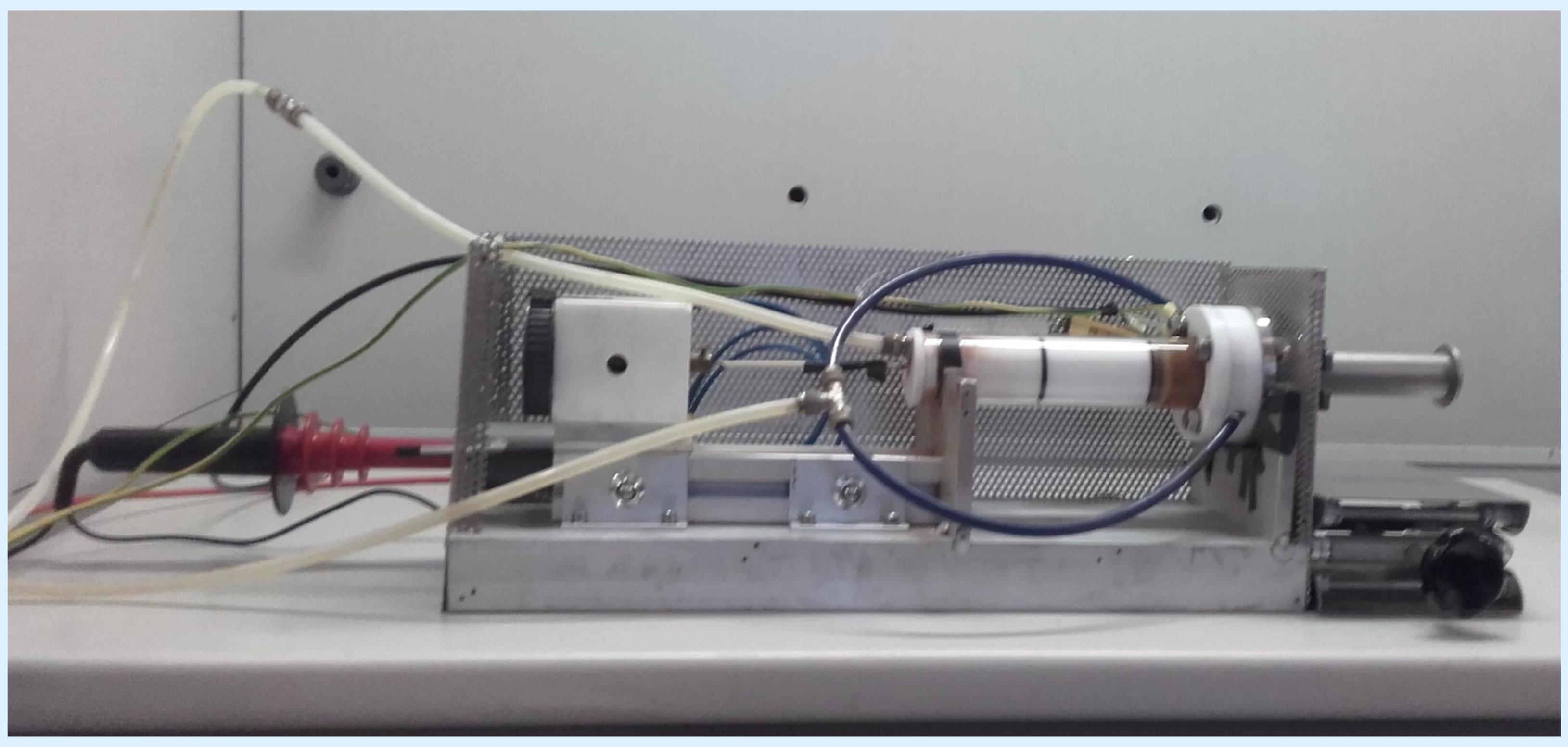
- Molybdenum wire coil electrode
- Teflon tangential pipe inlets
- Pyrex tube with hollow disk
- DC supply, (6 kV, 1.5 A), R=4 kOhm



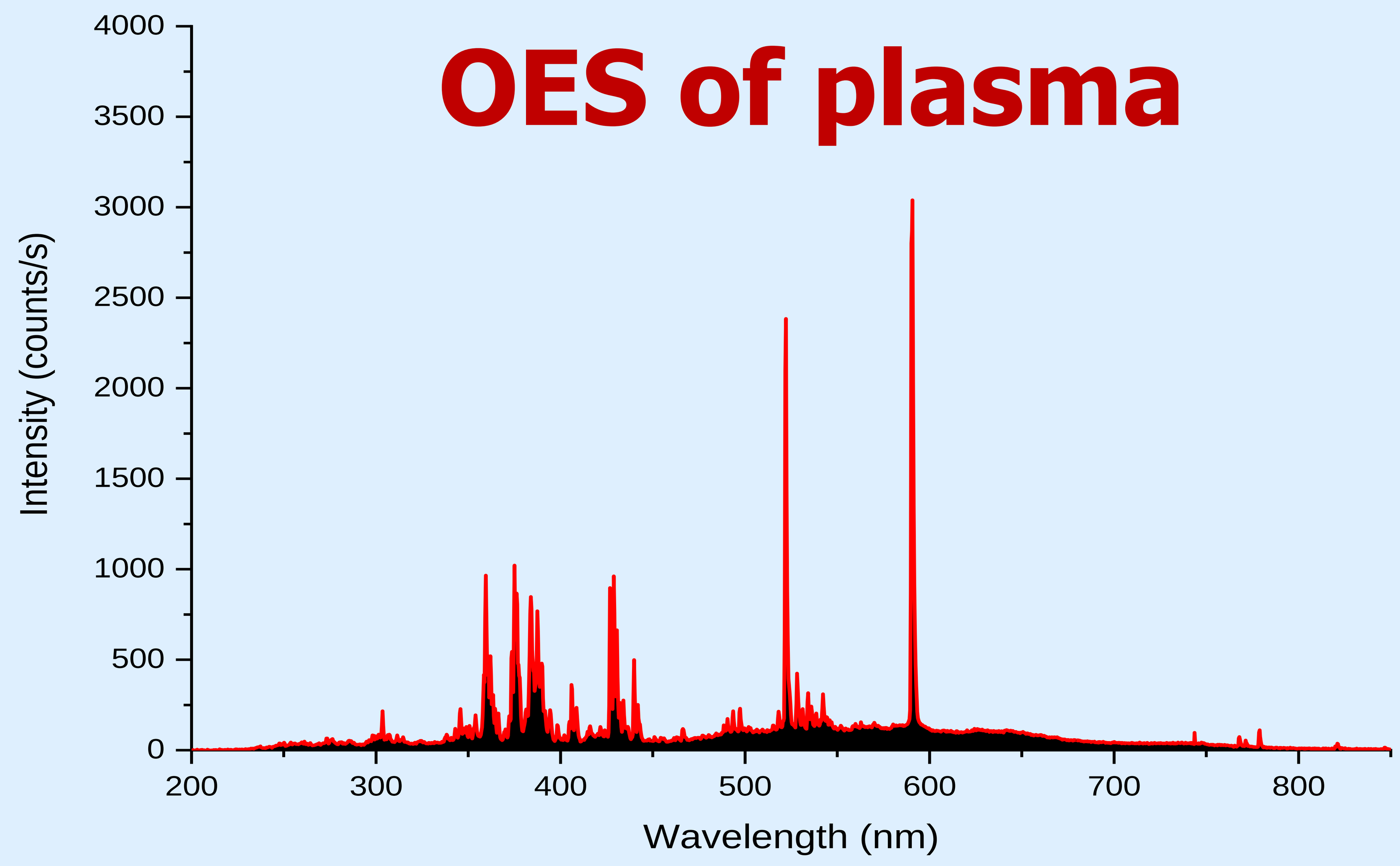


Their name refers to the formation of a reverse vortex flow configuration, a tornado, usually achieved by tangential gas injection near the walls in a cylindrical chamber.

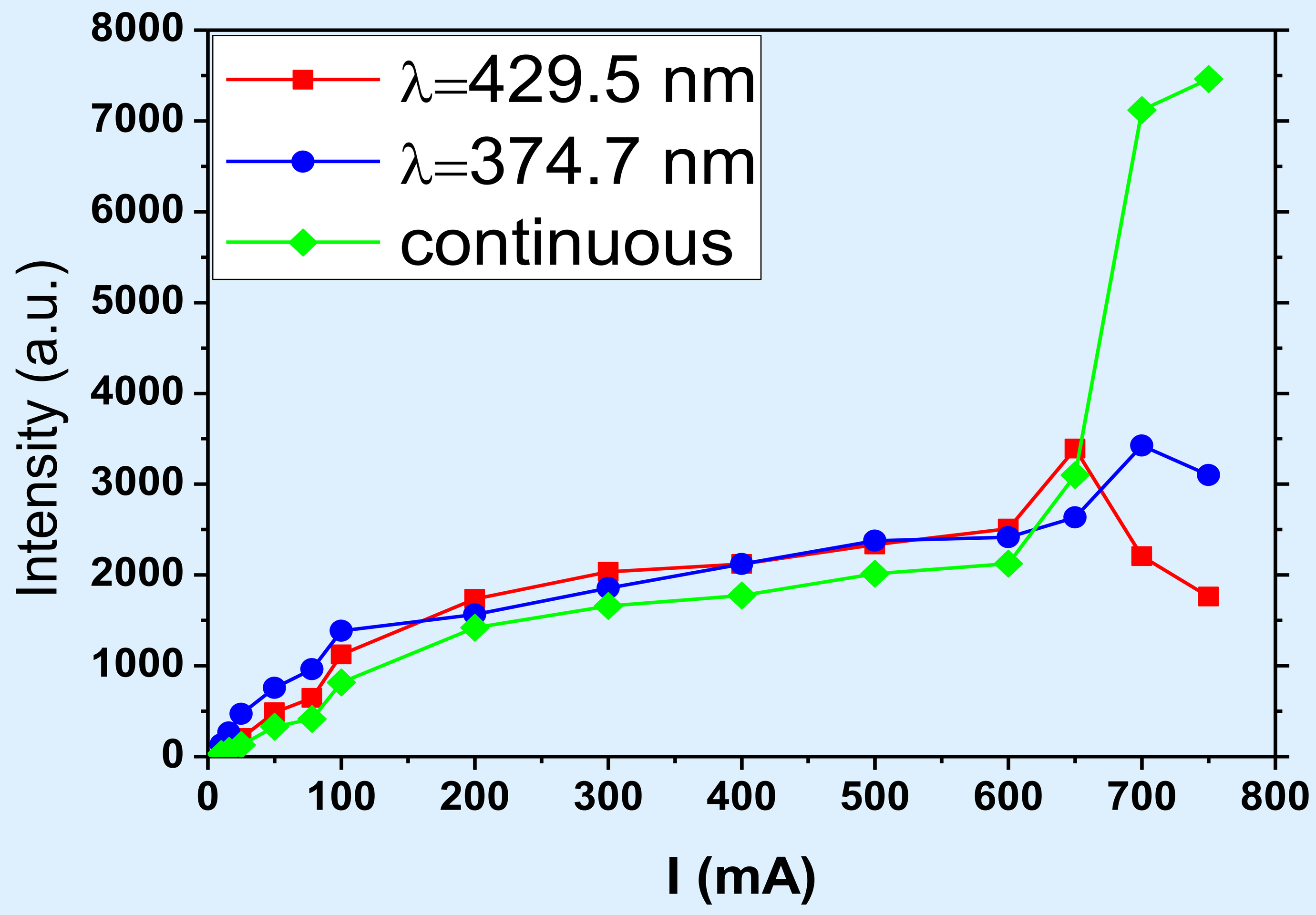
A Tornado Gliding Arc and our device



OES of plasma

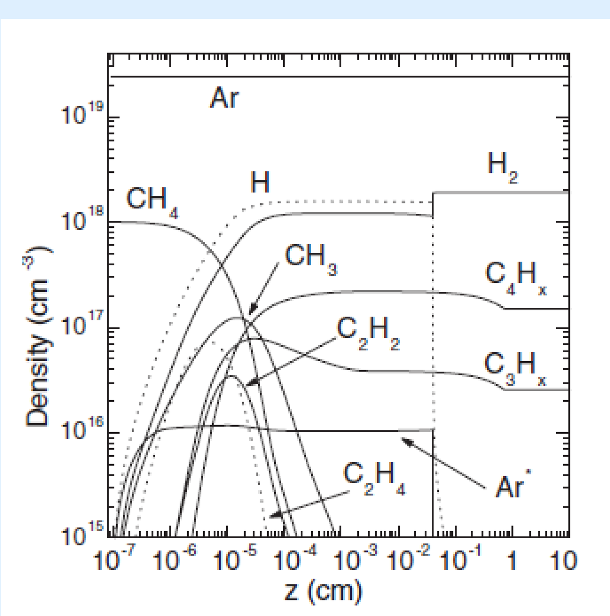


Spectra of the light emitted from the discharge show a broad continuum peaking at about 500-550 nm, with superimposed a rich structure of lines. As the mean current setting is increased the continuum contribution increases at expenses of the lines, until transition to arcing is achieved and the spectra approaches a structureless shape. The transition could be clearly appreciated by the intensity data reported in the graph.



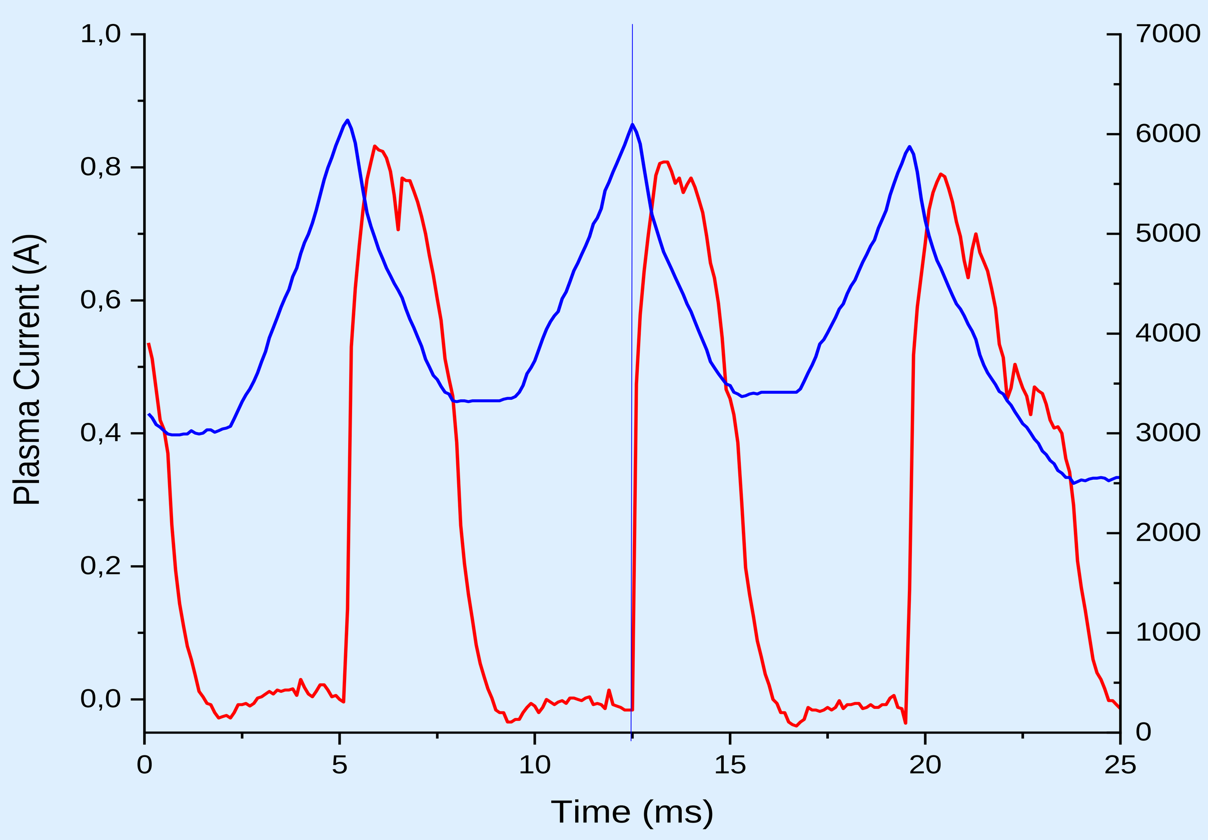
Modeling

Modeling of the chemical kinetics of reactive plasmas can be employed to simulate the evolution of the gas-phase and to optimise the performances of the device [see R.Barni, Eur. Phys. J. Appl. Phys. 35, 135 (2006)]. They should be coupled to advanced hydrodynamical simulation of the complex flow in the reverse vortex mode of the GAT.



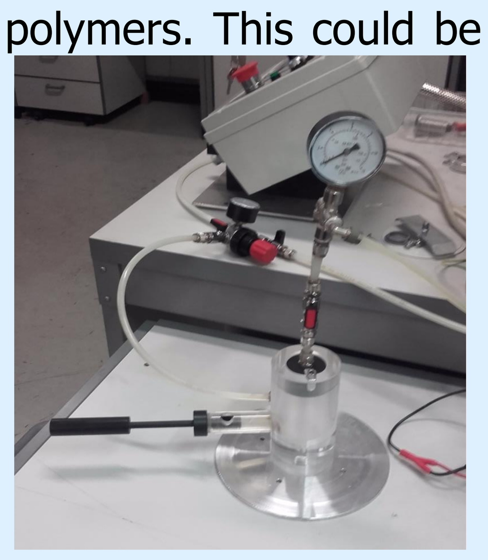
Electrical characteristics

It could be grasped that the system shows intense current bursts with a limited duration, separated by dead times, corresponding to a sequence of spark discharges. Although not exactly constant, the shape, the amplitude, the duration, and the repetition rate of bursts were comparable and fairly cyclic. These parameters were measured and averaged using long time series (10 MSamples) with a digital scope and their statistical properties were studied.



Applications

Lignocellulosic fibers are composite materials of lignin, cellulose, hemicellulose and extractives, in which lignin is situated as filler between the highly ordered cellulose microfibrilles. This material could be used to develop eco-friendly polymers. This could be achieved through plasma technology, by functionalization, which we proposed to investigate.



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