Atmospheric pressure plasmas for environmental, chemical and biomedical applications

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During the last decade non-equilibrium atmospheric pressure plasmas have received a tremendous increase of attention in view of their potential in biomedical, environmental, chemical and material processing applications. This evolution coincides with a strong need for improved diagnostics to increase the understanding of these fundamental plasma processes.

The typical low temperature atmospheric pressure plasmas exhibit strong non-equilibrium behavior, are highly transient in nature up to nanosecond timescales, can obtain strong species density gradients up to a micrometer length scale and have mostly an extremely rich and complex chemistry. This complexity is reflected in state of the art diagnostics with often intrinsic complications of the interpretation of the experimental data. This contribution will review various experimental techniques to obtain the key plasma properties such as electron density and temperature, gas temperature, ionic species and radical densities.

The diagnostics will be presented for a glow discharge, a filamentary discharge and a plasma jet investigated at TU/e. These three types of discharges are representative for a larger range of non-equilibrium atmospheric pressure discharges. The presented techniques allow shedding some light on the complex plasma chemistry in these discharges.