**Specificities of plasma diagnostics using ultrashort laser induced fluorescence techniques**

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Non-equilibrium high-pressure plasmas are often confined with characteristic dimensions of less than a millimeter (e.g. capillary microwave discharges), and can exhibit transient behaviors (e.g. nanosecond discharges) with characteristic times below one nanosecond. Spectroscopic diagnostics such as fluorescence techniques functioning with cw to ultrashort lasers are employed for *in situ* species density measurements of key plasma radicals. Focusing laser beams at micrometer scale for spatially resolved measurements or using ultrashort lasers (e.g. pico & femtosecond lasers) for temporal resolved measurements tremendously increases the photon flux (up to PW/cm2) and induces several phenomena (e.g. power saturation, photolytic effects, Stark detuning, Rabi oscillations), which must be taken into account for a correct evaluation of the plasma parameters.

In this contribution, the phenomena, principles and peculiarities of laser induced fluorescence techniques (e.g. quenching, photolysis, photon statistics) will be discussed. Using the two-photon absorption laser induced fluorescence technique (TALIF) as example, the classical and the VUV calibration methods applied for femtosecond TALIF will be presented along with temporal and spatial plasma characterizations.

Key words

spectroscopic plasma diagnostics

atmospheric pressure plasma

femtosecond TALIF