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Picosecond TALIF to quantify collisional quenching of laser-excited states in atmospheric pressure plasmas[1] SANDRA SCHROETER, JEROME BREDIN, KARI NIEMI, TIMO GANS, DEBORAH O'CONNELL, York Plasma Insitute, University of York — The accurate quantification of reactive oxygen species produced in atmospheric pressure plasmas is of great interest in various applications, such as surface modification and biomedicine. A technique commonly used for the detection of atomic ground state species is Two-photon Absorption Laser Induced Fluorescence (TALIF). For the measurement of absolute species densities, this technique relies on the knowledge of the laser-excited state lifetime. However, typical TALIF systems operate on timescales of nanoseconds, which is in the same order as the lifetimes of the laser-excited states due to their enhanced collisional de-excitation (quenching) at atmospheric pressure. Therefore, the effective lifetimes have to be calculated using quenching coefficients from the literature and an estimate of the gas mixture, which is particularly challenging taking into account complex gas mixing with ambient air in the plasma effluent region. In this work, we present measurements of the decay rates of the laser-excited states in the effluent of an rf atmospheric pressure plasma operated in helium with small molecular admixtures using TALIF with a sub-nanosecond temporal resolution. Quenching coefficients of the excited state $O(3p\ ^3P_{1,2,0})$ with various gases such as Ar, O_2, N_2, CO_2, and H_2O are measured and compared to literature values. The active measurement of decay rates is used to map the gas entrainment of ambient air into the plasma effluent region.

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