Laser induced fluorescence system for measurement of argon ion temperature in an atmospheric-pressure plasma jet

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Technique of laser induced fluorescence (LIF) system based on a tunable diode laser and its measurement of argon ion temperature in an atmospheric-pressure plasma jet with argon gas, which is the type of a dielectric barrier discharge source to generate a plasma jet for plasma application in industry, are presented. The LIF system composes of a diode laser with master oscillator power amplifier (MOPA) to pump Ar II transition $3d^4F_{7/2}$ metastable level to the $4p^4D_{5/2}$ level at 668.43 nm. Specifications of the LIF system has a typical output power= 20 - 40 mW at 668.61 nm, line width = 1 MHz, coarse tuning range = 665- 675nm with a rotating grating, fine tuning range = 0.45 nm with piezo-electric actuator control from 0 to 100 Volt, and a mode-hop free tuning region > 16GHz, with current coupling method. An iodine cell spectrum is measured by a photo-transistor,which uses reference peaks for wavelength calibration. To measure argon ion temperature (T_i) with drift velocity in a plasma jet, the 442.60 nm fluorescence light emitted from $4p^4D_{5/2}$ level to $4s^4P_{3/2}$ level is collected by the photomultiplier tube (PMT) with 1 nm band-width filter.