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High sensitivity ultra-broad-band absorption spectroscopy applied to inductively-coupled plasmas in Cl/O MICKAËL FOUCHER, LPP-CNRS UMR 7648, EMILE CARBONE, CEA grnoble, JEAN-PAUL BOOTH, PASCAL CHABERT, LPP-CNRS UMR 7648, LPP-PLASMAS FROIDS TEAM —
Broad-band absorption spectroscopy is a powerful diagnostic for reactive plasmas, allowing measurement of the absolute densities of numerous atoms, molecules and free radicals in ground and various excited states. Previously Xe arc lamps have been used as the continuum light source, but these suffer from spatiotemporal fluctuations which limit the sensitivity to about 10^{-3} in absorption. More recently UV light-emitting diodes have been used, but these only emit over a very limited spectral range. Our new absorption spectroscopy setup uses a laser-driven plasma light source, achromatic optics and an aberration free spectrograph. This light source has ideal characteristics for absorption spectroscopy (high intensity, stability and a wide spectral range (200-1000nm)), overcoming previous limitations. Noise levels as low as 10^{-5} can be achieved in single-pass absorption, covering up to 250nm in a single spectrum. Measurements were made in a 13.56 MHz inductively-coupled plasma reactor in O, Cland Cl/Omixtures. We observed absorption by Cl, Oand ClxOy molecules, and excited state atoms. Whereas the Clvibrational distribution is close to equilibrium with the gas translational temperature, Omolecules show high vibrational excitation (up to v=18, T_{vib}12,000K). However, high resolution spectra of Oindicated rotational temperatures up to only 500 K. Many oxychloride molecules were detected in Cl/Omixtures.

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