Temperature estimation from molecular nitrogen UV spectra in atmospheric pressure plasmas

KEENAN PEPPER, Florida State University, YONGHO KIM, Los Alamos National Laboratory, JIHUN KIM, Seoul National University — Atmospheric pressure plasmas have many potential applications to fuel processing, surface treatment, and manipulation of chemical reactions. These plasmas are often non-thermal, which means different species are not in equilibrium and have different effective temperatures. This is critical for many applications because it allows high concentrations of reactive species to be produced without using a prohibitive amount of power. In the present work, numerical software was developed to estimate the vibrational and rotational temperatures ($T_{\text{vib}}$ and $T_{\text{rot}}$) of N$_2$ molecules from their ultraviolet emission spectra. The electron temperature $T_e$ can also be estimated by comparing the N$_2$ spectrum to that of the N$_2^+$ molecular ion. This technique is applied to several plasma sources including audio frequency, RF, and microwave devices. The results are presented and their implications for practical applications are discussed.

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