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Gas temperature and the degree of dissociation for different operating regimes of a nitrogen helicon plasma source COSTEL BILOIU, EARL SCIME, XUAN SUN, IOANA A. BILOIU, ROBERT HARDIN, ZANE HARVEY, West Virginia University, Physics Department, Morgantown, WV 26506-6315 — We report on the gas temperature and the degree of dissociation in E, H, and W operating regimes of nitrogen helicon plasma. The gas temperature was inferred from the fit of synthetically generated spectra to the recorded emission spectra of the 2-0, 1-0, and 0-0 bands of the first positive system of nitrogen. The dissociation degree was inferred from the relative population ratios of atomic to molecular nitrogen states determined experimentally from integrated emission intensities of atomic triplet lines (3s ^{4}P – 3p ^{4}S^0 at 742.36 nm, 744.23 nm, 746.83 nm) and the molecular band ($B^3\Pi_g$, v$'$=4 $\rightarrow$ $A^3\Sigma_u^+$, v$''$=2 at 750.39 nm). The computation took into account available published values of the transition probabilities and electron impact excitation rate coefficients. Electron energy distribution functions were obtained experimentally from the second derivative of Langmuir probe I-V characteristics. It was found that both the gas temperature and the dissociation degree increase as the discharge transitions from capacitevely coupled (E) to inductively coupled (H) and then to helicon mode (W) operational regimes.

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