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Ar + CO_2 and He + CO_2 Plasmas in ASTRAL R.F. BOIVIN, A. GARDNER, J. MUNOZ, O. KAMAR, S. LOCH, Physics Department, Auburn University, 206 Allison Laboratory, Auburn, AL 36849-5311 — Spectroscopy study of the ASTRAL helicon plasma source running Ar + CO_2 and He + CO_2 gas mixes is presented. ASTRAL produces plasmas with the following parameters: $n_e = 10^{10}$ - 10^{13} cm^{-3}, $T_e = 2$ - 10 eV and $T_i = 0.03$ - 0.5 eV, B-field ≤ 1.3 kGauss, rf power ≤ 2 kWatt. A 0.33 m scanning monochromator is used for this study. Using Ar + CO_2 gas mixes, very different plasmas are observed as the concentration of CO_2 is changed. At low CO_2 concentration, the bluish plasma is essentially atomic and argon transitions dominate the spectra. Weak C I and O I lines are present in the 750 - 1000 nm range. At higher CO_2 concentration, the plasma becomes essentially molecular and is characterized by intense, white plasma columns. Here, spectra are filled with molecular bands (CO_2, CO_2^+, CO and CO^+). Limited molecular dissociative excitation processes associated with the production of C I and O I emission are also observed. On the other hand, He + CO_2 plasmas are different. Here, rf matches are only possible at low CO_2concentration. Under these conditions, the spectra are characterized by strong C I and O I transitions with little or no molecular bands. Strong dissociative processes observed in these plasmas can be link to the high T_e associated with He plasmas. An analysis of the spectra with possible scientific and industrial applications will be presented.

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