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Spectroscopy Study of Ar + CO_2 Plasmas in ASTRAL. JORGE MUNOZ, ROBERT BOIVIN, OLA KAMAR, STUART LOCH, Department of Physics, Auburn University, 206 Allison Laboratory, Auburn, Alabama 36949-5311, CONNOR BALLANCE, Department of Physics, Rollins College, White Park, Florida 32789 — A spectroscopy study of the ASTRAL (**A**uburn **S**teady s**T**ate **R**esearch f**A**ci**L**ity) helicon plasma source running Ar + CO_2 gas mix is presented. ASTRAL produces Ar plasmas: $n_e = 10^{10}$ to 10^{13} cm^{-3}, $T_e = 2$ to 10 eV and $T_i = 0.03$ to 0.5 eV. A series of 7 large coils produce an axial magnetic field up to 1.3 kGauss. A fractional helix antenna is used to introduce rf power up to 2 kWatt. A spectrometer which features a 0.33 m Criss-Cross monochromator and a CCD camera is used for this study. Very different plasmas are produced following the relative importance of CO_2 in the gas mixture. At low CO_2 concentration, the plasmas are similar to those obtained with pure Ar with weak CO_2, CO_2^+, CO and CO^+ bands. The usual blue plasma core associated with intense Ar II transitions is observed with however a significant white glow coming from the outer plasma regions. At higher CO_2 concentration, the plasma becomes essentially molecular and can be described as an intense white plasma column. Molecular dissociative processes associated with the production of strong C and O atomic lines are observed under specific plasma conditions. The atomic spectral lines are compared with ADAS modeling results. This study indicates the possible advantages of using a helicon source to control the CO_2 plasma chemistry for industrial applications.

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