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Spectroscopic T_e and n_e measurements in a recombining divertor region and in MARFEs in NSTX using D I and He II high-n series line emission. V.A. SOUKHANOVSKII, LLNL, R.E. BELL, R. KAITA, A.L. ROQUEMORE, PPPL, R. MAQUEDA, Nova Photonics — Spatially resolved measurements of Balmer and Paschen series D I line emission, and for the first time, Pfund and Humphreys series He II emission, have been performed in the divertor and MARFE regions in 2-6 MW NBI-heated deuterium and helium plasmas in NSTX. We analyze relative intensities and Stark broadening of the ultraviolet, visible and near infrared lines corresponding to the $2-n$, $3-m$ transitions (D I) and $5-k$, and $6-l$ (He II) with upper principal quantum numbers n =7-13, m =5-12, k =10-19, and l =12-16. Temperatures in the range 0.5-1.5 eV and densities in the range $(0.5-5)\times10^{20}$ m^{-3} are inferred using collisional-radiative modeling and published tabulated line shape calculations, confirming the important role of the three-body recombination process as an ion momentum loss mechanism in the detachment and radiative instability development. The diagnostic potential of the spectroscopic techniques for a divertor of a burning plasma device will be discussed. This work is supported by U.S. DoE under contracts W-7405-ENG-48 and DE-AC02-76CH03073.

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