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The Role of Helium Metastable States in Radio-Frequency Helium-Oxygen Atmospheric Pressure Plasma Jets: Measurement and Numerical Simulation KARI NIEMI, JOCHEN WASKOENIG, Centre for Plasma Physics, School of Mathematics and Physics, Queen's University Belfast, Northern Ireland, UK, NADER SADEGHI, Laboratoire de Spectrometrie Physique, University Joseph Fourier and CNRS, Grenoble, France, TIMO GANS, DEBORAH O'CONNELL, York Plasma Institute, Department of Physics, University of York, York YO10 5DD, UK — Absolute densities of metastable He atoms were measured line-of sight integrated along the plasma channel of a capacitively-coupled radio-frequency driven atmospheric pressure plasma jet operated in helium oxygen mixtures by tunable diode-laser absorption spectroscopy. Dependencies of the He metastable density with oxygen admixtures up to 1 percent were investigated. Results are compared to a 1-d numerical simulation, which includes a semi-kinetical treatment of the electron dynamics and the complex plasma chemistry (20 species, 184 reactions), and very good agreement is found. The main formation mechanisms for the helium metastables are identified and analyzed, including their pronounced spatio-temporal dynamics. Penning ionization through helium metastables is found to be significant for plasma sustainment, while it is revealed that helium metastables are not an important energy carrying species into the jet effluent and therefore will not play a direct role in remote surface treatments.

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