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Optical Emission Diagnostics of a Non-equilibrium Helium Plasma Jet at 1 atm in Ambient Air[1] VINCENT M DONNELLY, TAM NGUYEN, DEMETRE J ECONOMOU, University of Houston — We studied a He 200 kHz rf plasma jet emerging into open air from a quartz tube wrapped by a grounded and an rf-powered electrode. The jet impinged on a dielectric substrate (MgF_2 or fused silica). VUV to near IR emission spectra were recorded through the substrate either along the discharge axis, or at a steep angle to isolate emission close to the surface. Time-resolved emission was observed close to the surface only during a brief period near to just past the peak in the positive applied rf voltage. No emission was observed during the negative voltage with the exception of a weak emission from $N_2(C^3\Pi_u \rightarrow B^3\Pi_g)$ just prior to peak negative voltage. With the exception of $N_2(C^3\Pi_u)$, emissions along the discharge axis from impurities mixing into the He flow just outside the nozzle were dominated by dissociative excitation via He metastables (He*). Axial emission from N_2^+ was also produced by collisions with He* (i.e. Penning ionization of N_2). These emissions were only modulated to a small degree during the rf period, and were shifted in phase with respect to the peak positive and negative voltages, reflecting the lifetime of He*. Detailed analysis of the emission temporal dependences revealed details of discharge kinetics.

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