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Numerical Characterization of Ar and He/N2 RF Atmospheric Pressure Plasma Discharges STEVEN MARCINKO, DAVIDE CURRELI, Univ of Illinois - Urbana, SANGWON LEE, POSCO, SE YOUN MOON, Chonbuk National University — Atmospheric Pressure Plasma Discharges (APPD) are attractive for a number of industrial applications in surface processing due to the absence of vacuum systems found in traditional plasma processes, lowering costs and permitting continuous operation. Helium has traditionally been used in these discharges due to the stability granted by the long-lived metastable of both the singlet and triplet states, and considerable Penning ionization. However, the cost of helium is becoming prohibitive at industrial scales. Argon is cheaper, abundant, and well characterized, but it is comparatively less efficient due to shorter-lived metastable states. In this work, the discharge characteristics of APPD operating with pure argon, helium with trace nitrogen impurities, and helium-nitrogen gas mixtures ranging from 10-20% N2 are systematically studied under applied RF voltages of amplitude 200-300V and RF frequencies of 13.56 MHz. Resulting data sets are compared to analyze the effect of voltage and gas composition on discharge parameters including spatially-dependent electron densities, temperatures, voltages, and densities of relevant ionized and excited heavy species. Expected surface fluxes of charged particles are computed and used to infer deposition rates of heavy species onto the target.

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