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Gas Temperature and Metastable Density Measurements in Ar/H_2DBD Using Diode-Laser Absorption Spectroscopy ROBERT LEIWEKE, BISWA GANGULY, Air Force Research Laboratory WPAFB — Short-pulse excited DBDs are viable sources of UV, VUV radiation and radical flux at low gas temperatures for material processing applications. In this work, a 20% H_2/Ar short-pulse (15 ns FWHM) excited DBD was operated between 5-50 Torr, 6-8 kV, and 5 kHz repetition rate. Diode-Laser Absorption Spectroscopy was used to obtain Ar $1s_3 \rightarrow 2p_2$ transition profiles near 772.4 nm for bulk gas temperature and metastable line density measurements which are important for estimating both the power deposition efficiency into electronic states and the E/n. Absorption profiles obtained below 30 Torr were used to extract gas temperature, collisional Lorentzian linewidth, and absolute Ar line densities using standard iterative lineshape fitting techniques. In accordance with Lindholm-Foley $T^{0.3}$ scaling law for van der Waals interactions, we used the Lorentzian linewidths to obtain the pressure broadening coefficient for this gas mixture, which was found to be in agreement with the value for pure argon. Temperature and Ar* density were extracted from the pressure-broadened 50 Torr profile using an accurate method which self-consistently incorporates knowledge of the collisional line broadening parameter, the Doppler component, and the Voigt linewidth. At 50 Torr, we also estimated the energy deposition efficiency of direct electron impact metastable production based upon time-resolved power measurements and absolute Ar metastable line density.

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