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Temporal Imaging and Measurement of a High Pressure He/Ar Microplasma for DPRGL ANDREW WALSTEN, GABE XU, University of Alabama in Huntsville, CARL SANDERSON, CHARLES BALLMANN, UAH Systems Management and Production Center, DANIEL MATYAS, US Army SMDC/Army Forces Strategic Command — Diode-pumped rare gas lasers (DPRGLs) are being researched and developed due to their ability to operate at high power with high quantum efficiencies. DPRGLs use a rare gas plasma mixture for the gain medium which operates at near atmospheric pressure for efficient lasing. Their performance is dependent on the metastable population of the lasing species. Thus, a stable plasma that is capable of sustaining the metastables for sufficient periods of time is needed. This work seeks to use temporal imaging and measurements of a high pressure He/Ar microplasma in order to better understand the behavior of the plasma. The plasma was generated in a vacuum chamber between two parallel plate style electrodes with a dielectric material covering one electrode. Imaging was done with an ICCD camera. An ICCD spectrometer and diode laser were used to perform OES techniques and absorption spectroscopy in order to measure the temperature and density. The plasma is generated by an initial ionization wave that propagates from one electrode to the other and is followed by a secondary return stroke. The occurrence of this return stroke is controlled by the electric field. The electron temperature remains nearly constant throughout the plasma's lifetime. The results show that maximizing the electric field and voltage increases the plasma peak intensity and duration leading to increased metastable population and improved DPRGL performance.

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