

Abstract Submitted
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Time averaged negative ion density measurements in a reactive pulsed DC magnetron using the eclipse photodetachment method
ROBERT DODD, SHAODON YOU, PAUL BRYANT, JAMES BRADLEY, University of Liverpool — Using Langmuir probe assisted laser photodetachment technique time averaged negative ion density in the bulk plasma of a reactive pulsed DC magnetron has been determined. Experimental results are shown for various oxygen / argon gas mixtures (0 - 100%), applied power (300 - 600 W), magnetron frequency (5 – 100 kHz) and total discharge pressure (2 - 25 mTorr). Laser photodetachment measurements showed the O^- ion to dominate over O_2^- . The maximum ratio of the negative ion to electron density, α , was found to be 0.2, weakly electronegative plasma ($\alpha < 1$). Variation of the operating parameters showed clear trends in the negative ion densities with maximums observed with increasing power (at 318 W) and oxygen partial pressure (30% O_2). With variation of operating parameters clear trends in α were seen. For instance, with increasing magnetron power α was found to decrease from 0.2 to 0.01. This trend was accompanied by a steady rise in the electron density. This observation was attributed to the enhanced detachment (destruction) rate of O^- ions as the energy of secondary electrons from the cathode increased with increased target voltage. These new results show significant concentrations of negative ions are present in the bulk magnetron plasma when operated in argon / oxygen gas mixtures during pulsed DC sputtering.

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