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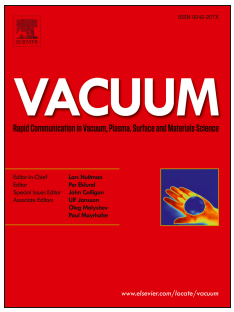

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Cathode sheath processes in a non-sputtering magnetron discharge[1]

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Abstract

The properties of cathode sheath in a non-sputtering magnetron discharge are discussed involving the theoretical assumptions based on the classical glow discharge description, and magnetron specific effects. It is shown that in a wide range of experimental conditions (gas pressure p from 1 to 100 Pa, discharge current I_d from 10 to 1500 A), the trends for principal plasma parameters (electron density n and temperature T_e) remain the same. Nevertheless, there is crucial difference in dominant supply of electrons between low pressure and elevated pressure non-sputtering magnetron regimes. Both secondary electron emission at low pressures and thermal ionization at high pressures result in sufficiently high electron source for sustaining dense non-sputtering magnetron plasmas at characteristically low voltage V_d ~ 80–120 V.

Keywords: cathode sheath; pulsed magnetron discharge; sputtering yield; ion induced electron emission

1. Introduction

Non-sputtering magnetron discharge (NSMD) is a peculiar form of high-power pulsed magnetron discharge that is characterized by low operating voltage (discharge voltage V_d < 120 V) and relatively high plasma density ($n \sim 10^{18}$ m^{-3} at p ~ 1 Pa; $n \sim 10^{21}$ m^{-3} at p ~ 100 Pa) accompanied with nearly uniform spatial distribution of electron

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