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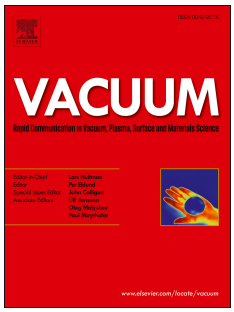

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Plasma diagnostic of cup-like magnetron source for transparent conductive oxide thin films

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Novel designs of magnetron sputtering sources provide desired control over plasma parameters for efficient use of mass and energy transport during the deposition of thin films. Here, a cup-like magnetron source, comprising a base and a cylinder part, is developed and diagnosed for deposition of transparent conductive Al doped ZnO thin films. The coupling of the base or/and cylinder parts, applied power and working pressure are systematically varied and consequent effects on the plasma density, electron temperature, and substrate temperature are studied. The sensitive optical emission and absorption spectroscopic results of plasmas reveal that base source mainly delivers the Zn ionic species whereas coupling of cylinder source induces higher ion-electron recombination and lowering the substrate temperature. The present source is capable of producing Al doped ZnO thin films with resistivity in the range of 5 x10^{-2} Ωcm to 12.1 Ωcm and process throughput close to 40 nm/min under conditions of plasma induced substrate temperature ≤ 60 ^{o}C. The obtained values have promising applications for flexible electronics.

Keywords: optical spectroscopy; sputtering; thin films; electrical resistivity; zinc oxide.