Seminar

Institute for Plasma Research

Title : Geometric effects in Thin-film Deposition & DC Glow Discharge Sheath Code development

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Date : 04th March 2021 (Thursday)

Time : 03:30 PM

Venue : Online - Join the talk:
https://meet.ipr.res.in/Dr.Srinivasarao_PDFExtensiontalk

Abstract :

Two-dimensional simulations of thin-film deposition at oblique angles (10° - 80°) have been carried out. In Oblique Angle Deposition (OAD), particles arriving at the substrate at later stages will be shadowed by particles deposited earlier [1]. This shadowing effect increases with the increase in the angle of deposition. For the smaller angles of deposition (10°- 50°), the thin-films appear continuous. For larger angles of deposition (60°- 80°), thin-film deposits appear as tilted columns due to the increased shadowing effects. The angles of growth of deposited thin-films are measured and are compared with the available theoretical and experimental results. Porosity and RMS surface roughness of the thin-film deposits in the present study are in good agreement with the experimental results. These values increase with the increase in the angle of deposition and size of the deposited particles. The thin-film deposition code developed in the present study has been applied to a collimated glancing angle deposition (C-GLAD) experiment [2]. A good match in the microstructure of the thin-films has been obtained.

A DC glow discharge sheath code has been developed to study the flux-energy distributions of ions, electrons and neutrals in a glow discharge sheath formed by single elemental species. The program considers charge-exchange, secondary electron emission and ionization. In the plasma sheath, ions are accelerated towards a negative cathode and charge-exchange occurs between the ions and the background neutrals. Secondary electron emission takes place when the ions and the energetic neutrals created by charge-exchange, hit the cathode. These electrons are accelerated away from the cathode and ionize the background neutrals in their path. This program is validated by comparing with the published results [3]. The sheath code will be further modified to include multiple atomic species and plasma surface interactions like back-scattering, sputtering, etc.

References:
1. A. Barranco, A. Borras, A. R. Gonzalez-Elipe, A. Palmero, Progress in Materials Science 76 (2016) 59–153.
2. S. M. Haque, R. De, A. Mitra, J. Misal, C. Prathap, P. V. Satyam, K. Divakar. Rao, Surface and Coatings Technology 375 (2019) 363–369.
3. Abril, Isabel. "Alacant: modeling of glow discharge sputtering systems." Computer physics communications 51, no. 3 (1988): 413-422.