Exhibitors Keynote Lecture

Room Town & Country A - Session EX-TuM

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Moderator: Johanna Rosen, Linköping University, Sweden

11:00am **EX-TuM-1 Design, Implementation and Production Upscaling of Magnetron Sputtering Cluster Technology for Future Applications*, Hailin Sun [hailin.sun@teercoatings.co.uk],*** Teer Coatings Ltd., UK **INVITED**

Cluster beam deposition offers advantages such as narrow size distribution and environmental benefits over wet chemical methods, but adoption has been limited by low deposition rates. This work presents the design and optimisation of a magnetron sputtering-based aggregation system to enhance cluster production. Gas dynamics simulations and magnetic field modelling were used to guide improvements in both chamber geometry and magnetic configuration.

We explored how gas aerodynamics within the condensation chamber influence cluster throughput. Specifically, varying the carrier gas inlet position revealed that introducing gas at the magnetron head significantly increased cluster flux under constant pressure and power, a result supported by simulation. Additionally, four chamber geometries were modelled, with experimental validation on two. A conical chamber with a narrower cross-section showed an order-of-magnitude increase in throughput (~20 mg/hour).

Further enhancement was achieved by unbalancing the magnetron's magnetic field. A configuration with reduced plasma density at the magnetron axis favoured dimer formation and cluster growth, leading to a 150-fold increase in cluster flux.

An application of this technology is demonstrated through the production of antimicrobial coatings for aerospace. We compared amorphous carbon coatings doped with silver or silver clusters. The cluster-based coatings, created using a separate cluster source, showed similar antibacterial efficacy but greater longevity due to reduced metal diffusion. These coatings were tested under both terrestrial and microgravity conditions, indicating suitability for space applications.

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