Contribution ID: **204** Type: **Poster**

Improvement of Magnetic Structure of Sputtering Ion Pump

Tuesday 19 June 2018 18:00 (20 minutes)

Sputtering ion pump, a kind of vacuum acquisition equipment applied in the field of ultrahigh vacuum, has the characteristics of simple structure, zero noise, no vibration, no oil pollution and no cooling agent, which is playing a more important role with the increasing demand of ultra-high vacuum environment in advanced scientific equipment and national major projects. This paper analyzes the phenomenon of penning discharge from discharge theory to improve the extraction theory and the pumping performance of sputter ion pump. Combined with the simulation of electric field distribution in pumping unit, we analyze a series of physical processes of particle generation, motion, collision, ionization, sputtering, deposition and adsorption. According to the results of the discussion and the related theory of gas discharge, material sputtering and gas adsorption, we derive the correlation between the extraction performance and the parameters according to determine the relationship between the sputter ion pump parameters and the pumping performance. Corresponding exhaust velocity curve was drawn and compared with the known experimental pumping curve modified by Hartwig, determining the rationality of the derivation formula. We analyzed the influence of the parameters of anode voltage, magnetic induction intensity, pumping unit structure and cathode plate materials on the pumping speed curve. The results show that pumping unit has a good pumping effect and stable pumping speed when the radius of the anode cylinder is 10mm, the anode voltage is 7000V, the magnetic induction intensity is 1200Gs and the cathode plate material is metal titanium. In addition, we propose several improvement schemes for materials and structures, which are conducive to improve the pumping performance by calculation and analysis.

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Session Classification: Poster Session Tuesday

Track Classification: Vacuum Science & Technology