سامية محمد مصطفى

شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم

سامية محمد مصطفى

شبكة المعلومات الجامعية

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التوثيق الالكتروني والميكروفيلم

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جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

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بالرسالة صفحات لم ترد بالأصل

Alexandria University
Faculty of Engineering

Study and Investigation of the Plasma Behavior in a Radio-Frequency Plasma Discharge

"Calculation of the Electron Energy Distribution Function in A Radio-Frequency Argon Discharge"

A thesis submitted to the
Department of Mathematics and Eng. Physics

in partial fulfillment of the requirements
for the degree of

Master Of Engineering Physics

By :
Mohamed Abdel Halim El Sawi
B. Sc. Nuclear Eng.

1995

We certify that we have read this thesis and that in our opinion, it is full adequate, in scope and quality, as a dissertation for the Master degree in Engineering Physics.

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ABSTRACT

A Particle-In-Cell with Monte Carlo collision (PIC-MCC) simulation is used to model the plasma generated in a parallel plate radio-frequency (RF) capacitively coupled discharge in argon at low pressure.

The boundary conditions include surface charge on the electrodes, which are connected to a series RLC circuit with driving term V(t), and the electric field and particle motion are obtained by finite difference methods leading to the self-consistent-creation of sheaths on the boundaries.

The collisions included in the simulation are those between charged particles and neutral background gas atoms, other interactions are neglected at low pressure.

Electric field, electron density, total charge density and the electron energy distribution function (The EEDF) profiles obtained from this simulation were found to be in good agreement with those obtained from other simulations using continuum models.

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CHAPTER 1

INTRODUCTION

"According to my opinion, the same force and vigor remain always in the world, and only pass from one part of matter to another, agreeably to the laws of nature, and the beautifully pre-established order. And I hold, that when God works miracles, he does not do it in order to supply the wants of nature, but those of grace."

Gottrfied Wilhelm Von Leibntiz

Plasma-Aided Manufacturing has a direct impact in the world economy in virtually every aspect of high-technology industry as well as many of the more traditional industries of our world. Industries in US, Japan, and Western Europe have made major inroads into the plasma-aided manufacturing markets, which have drastically improved their competitive position. Industrial experts confirm that if we can further develop the potential of plasma-aided manufacturing, it can make a significant contribution to the creation of markets worth billions of dollars and substantial increases in jobs.

Plasma-aided manufacturing encompasses a vast range of industrial applications, from thin-film sputter deposition, plasma polymerization and microcircuit-fabrication to welding , tool hardening, arc melting, plasma spraying, and microwave generation [1].

The present and potential applications of plasma-aided manufacturing include :

* Fabrication of semiconductor integrated circuits and other electronic devices
* Hardening of tools, dies and industrial metals
* Production of bio-compatible and packaging material for pharmaceuticals
* Anti correction and other coatings deposited on surface
* High-performance ceramics,, including super conductors
* Production of new chemical and materials
* Refining of metals
* Printing of polymer films
* Hazardous waste removal