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AUTOMATED PLASMA PARAMETER MEASURING SYSTEM  
USING ELECTRICAL PROBE

Mr. Surakarn Thitianan


A Thesis Submitted in Partial Fulfillment of the Requirements  
for the Degree of Master of Science Program in Metrological Science  
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Thesis Co-advisor             Montien Tienprateep, Ph.D.

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Accepted by the Faculty of Science, Chulalongkorn University in Partial  
Fulfillment of the Requirements for the Master's Degree


  
..... Dean of the Faculty of science  
(Professor Supot Hannongbua, Ph.D.)

THESIS COMMITTEE

  
..... Chairman  
(Assistant Professor Kajornyod Yodee, Ph.D.)

  
..... Advisor  
(Assistant Professor Boonchoat Paosawatyanong, Ph.D.)

  
..... Co-advisor  
(Montien Tienprateep, Ph.D.)

  
..... Examiner  
(Assistant Professor Kiranant Ratanathampan)

  
..... Examiner  
(Assistant Professor Rattachat Mongkolnavin, Ph.D.)

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เพื่อที่จะได้รับค่าของตัวแปรพลาสมา อาทิ ศักย์พลาสมา อุณหภูมิอิเล็กตรอน และความหนาแน่นพลาสมา การใช้หัววัดทางไฟฟ้าเป็นวิธีการหนึ่งซึ่งสามารถกระทำได้ โดยการวัดค่ากระแสที่ขึ้นกับฟังก์ชันของศักย์ไฟฟ้า ในงานวิจัยนี้ แหล่งกำเนิดศักย์ไฟฟ้าขั้วคู่ (bipolar voltage supply) ได้ถูกนำมาใช้ในฐานะที่เป็นแหล่งจ่ายศักย์ไฟฟ้าสำหรับหัววัดที่ใช้วัดกระแสไฟฟ้า ความละเอียดที่สามารถปรับได้ของแหล่งจ่ายศักย์ไฟฟ้าจะจ่ายไปยังหัววัดเพื่อที่จะให้ได้ข้อมูลของกระแสที่เพียงพอ ซึ่งสอดคล้องกันกับแต่ละช่วงของกราฟคุณลักษณะกระแส-ศักย์ ข้อมูลที่ได้นี้จะถูกบันทึกและประมวลผลโดยระเบียบวิธีการอัตโนมัติ ในระเบียบวิธีการดังกล่าว รูปแบบของกราฟกระแส-ศักย์จะถูกแบ่งออกเป็นสามช่วง ด้วยวิธีการหาอนุพันธ์อันดับหนึ่งและสองของกระแสเทียบกับศักย์ไฟฟ้า ลักษณะกราฟของอนุพันธ์อันดับที่หนึ่งสามารถนำไปใช้หาช่วงของไอออน และอิเล็กตรอนอิมพัลส์ ในขณะที่ช่วงสูงสุดถึงต่ำสุดของอนุพันธ์อันดับสองจะใช้กำหนดช่วงทรานซิชัน ในการทดลองเก็บข้อมูลจริงที่ได้จากระบบดิสชาร์จพลาสมาต่างๆ (plasma discharges) ระเบียบวิธีการนี้สามารถวิเคราะห์ผลได้เป็นอย่างดี อีกทั้งผลที่ได้ยังสอดคล้องกันกับผลการวิเคราะห์ด้วยมือ (manual)

สาขาวิชา, มาตรฐานวิทยา.....

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ลายมือชื่อนิติศ .....  
ลายมือชื่อ อ. ที่ปรึกษาวิทยานิพนธ์หลัก .....  
ลายมือชื่อ อ. ที่ปรึกษาวิทยานิพนธ์ร่วม .....

ลายมือชื่อ อ. ที่ปรึกษาวิทยานิพนธ์ร่วม .....

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KEYWORD: PLASMA PARAMETERS/ ELECTRICAL PROBE ANALYSIS/ I-V CHARACTERISTIC/ AUTOMATED ALGORITHM

SURAKARN THITIANAN : AUTOMATED PLASMA PARAMETERS MEASURING SYSTEM USING ELECTRICAL PROBE. ADVISOR : ASST. PROF. BOONCHOAT PAOSAWATYANYONG, Ph.D., CO-ADVISOR : MONTIEN TIENPRATEEP, Ph.D., 84 pp.


In order to obtain the value of plasma parameters, including the plasma potential, the electron temperature, and the plasma density, the use of electrical probes is one of the techniques which can be accomplished by measuring current as a function of voltage. In this work, a computer controlled bipolar power supply was setup as a voltage source for the probe current measurement. The adjustable potential of the source was supplied to the probe so as to acquire adequate current information which corresponds with each region in I-V characteristics. The measured I-V data were recorded and analyzed by an automated algorithm. In the algorithm, the I-V data were partitioned into three voltage intervals by using the first and second derivatives of the current signal. The characteristic of the first derivative curve was utilized to determine the ion and electron saturation regions, while the interval between the maximum and minimum of the second derivation could be defined as the transition region. In the analysis of actual experimentally acquired data obtained from different plasma discharges, the algorithm performed well and also yielded plasma parameters with good agreement to the results obtained by usual manual calculation.

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