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Automated system for DC and RF plasma parameter determination by guard double electric probes

Rosendo Pena-Eguiluz¹, Israel Alejandro Rojas-Olmedo², Regulo Lopez-Callejas³, Anibal de la Piedad-Beneitez⁴, Raul Valencia-Alvarado³, Antonio Mercado-Cabrera³, Samuel Roberto Barocio Delgado³, Arturo Eduardo Muñoz-Castro³, Benjamin Gonzalo Rodriguez Mendez³

¹Inst. Nac. de Investigaciones Nucleares, ocoyoacac, Mexico, Mexico ²Instituto Tecnologico de Toluca, Metepec, Edo de Mexico, Mexico ³Instituto Nacional de Investigaciones Nucleares, Ocoyoacac, Mexico, Mexico ⁴Instituto Tecnologico de Toluca, Metepec. Mexico, Mexico

regulo.lopez@inin.gov.mx

Monitoring basic plasma parameters such as temperature (T), density (n), floating potential (V_f) or Debye length (λ_d) provides indispensable knowledge during the ion implantation processing of materials immersed in plasmas (PIII or PSII) generated by either by DC or 13.56 MHz RF sources. Thus, a fully automated electromechanical system has been designed and constructed on the basis of guard double electric probes in order to prevent both probe erosion of plasma contamination. The electronic components of the system comprise a $\pm 150V$ triangular and ramp wave form generator capable of supplying $\pm 50\mu A$ to $\pm 100mA$ currents at 1-1000 Hz frequencies and a DAQ PCI-6023E data acquisition board with a 12 bit resolution compatible with LabVIEW graphic language. A program has been specifically developed for the latter in order to control the probe position within the discharge vessel and to capture, filter, visualise, process and store the respective information. The system has been experimentally applied to DC and RF plasmas from helium, argon, nitrogen, oxygen, and multiple gas mixtures with great success, inside several PIII reactors. Results are presented free from RF interference from the process itself or other surrounding sources.

Keywords

Diagnostic
double electric probes
PIII
plasma parameters
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