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COMPUTATIONAL MODELING AND CHARACTERIZATION OF PLASMA PULSED GUN FOR PLASMA WALL INTERACTION APPLICATIONS

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Previous research has demonstrated that linear plasma accelerators can achieve the energy, temperature and densities necessary to reproduce the conditions of plasma impact in a divertor plate [1]. Some initial experiments have been performed with plasma foci at University of Mexico [2]. At the Instituto Politecnico Nacional a new device, a flexible Plasma Gun that can be operated in snowplow and in deflagration mode is under development. The first step is to tailor the design in such a way that the parameters of the ejected plasma fall within the desired range. It is therefore of great importance to develop a computational model that can predict plasma parameters as a function of input parameters such as the electrical input circuit characteristics, the electrodes geometry, the operating gas pressure, the gas feed, the distance to the exposed sample, among others. Using a snowplow model such as the one developed originally by Hart as a starting point [3-4], a 2D-axisymmetric model for a coaxial plasma gun is constructed. This model includes circuit effects and calculates expansion of the plasma plume and its density and temperature, so reasonable mechanisms of the interaction of the sample with this plasma can be predicted and later be contrasted against experimental measurements once the physical device is constructed.

[1] J. Rapp, T.M. Biewer, J. Canik, J.B.O. Caughman, R.H. Goulding, D.L. Hillis, J.D. Lore, L.W. Owen, "The development of plasma-material interaction facilities for the future of fusion technology," Fusion Science and Technology, vol. 64, Issue 2, p. 237-244, 2013.

[2] G. Ramos, M. Martinez, J.J.E. Herrera, F. Castillo, "The plasma focus as a tool for plasma-wall-interaction studies", Journal of Physics: Conference Series, vol. 591, art. 012031, 2015.

[3] P. J. Hart, "Plasma Acceleration with Coaxial Electrodes," Phys. Fluids, vol. 5, Issue 1, p. 38, 1962.

[4] P. J. Hart, "Modified Snowplow Model for Coaxial Plasma Accelerators," J. Appl. Phys., vol. 35, no. 12, p. 3425, 1964.

Eligible for student paper award?

Yes

Author: Mr GÓMEZ-SAMANIEGO, Christian (CICATA Queretaro-IPN)

Co-authors: Dr NIETO-PEREZ, Martin (CICATA Queretaro-IPN); Dr RAMOS, Gonzalo (CICATA Queretaro-IPN)

Presenter: Mr GÓMEZ-SAMANIEGO, Christian (CICATA Queretaro-IPN)

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