IEEE Transactions on Plasma Science, vol.44, no.12, pp.3409-3419, December, 2012.

Experimental study of breakdown time in a pulsed 2.45-GHz ECR hydrogen plasma reactor

O.D. Cortázar; A.M. Megia Macías; A. Vizcaíno de Julián

Abstract-

An electron cyclotron resonance (ECR) plasma reactor developed at the European Spallation Source Bilbao has been operated in pulsed mode at 50 Hz to study the breakdown-process dynamics by time-resolved diagnostics. Injected power, reflected power, electrical-biased probe saturation current, and light emission were measured simultaneously for three different magnetic fields: under ECR, ECR, and asymmetric over ECR profiles. Gas pressure, power, and duty cycle have been used in a parametric study obtaining information about microwave (MW) coupling and plasma formation stages during the breakdown process. The study is relevant for designers that need to extract short beam pulses from a 2.45 ECR ion source for any application because the total breakdown time measured is defined as corresponding to reach the steady-state plasma parameters. A simple model of residual electron density evolution between pulses is proposed to describe the MW coupling as a function of incoming power and duty cycles.

Index Terms- Electron cyclotron resonance (ECR) plasma source, plasma breakdown, pulsed ECR ion source.

Citation:
Cortázar, O.D.; Megia-Macías, A.; Vizcaíno-de-Julián, A. "Experimental study of breakdown time in a pulsed 2.45-GHz ECR hydrogen plasma reactor", IEEE Transactions on Plasma Science, vol.44, no.12, pp.3409-3419, December, 2012.