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**Time dependent Volumetric measurements of key plasma parameters during pulsed plasma operation**\(^1\)** JIA HAN, PATRICK PRIBYL, WALTER GEKELMAN, University of California Los Angeles, ALEX PATTERSON, Lam Research Corporation — Volumetric measurements are done in an industrial plasma etch tool modified for accessibility using a computer-controlled probe drive. Plasma is generated by a three-turn stove-top type circular antenna mounted on a ceramic lid on the top of the device. A 2 MHz RF generator powers the antenna. Plasma is pulsed on/off at different repetition rates. The 3D magnetic field is measured using a three-axis magnetic probe. A swept Langmuir probe measures \(n\) and \(T_e\) as functions of time over the 3D volume. An emissive probe is used to measure the plasma potential, and the space charge field \((-\nabla V_p)\) is derived. The bulk electron density forms under the antenna, with its peak eventually migrating to the middle of the machine. The antenna current turns on in less than 100 microseconds. However, it takes 2 to 5 milliseconds for the density to reach steady state. Spatial and temporal dependence of the current density inside the plasma are derived from the magnetic field measurements using \(\nabla \times \vec{B} = \mu_0 \vec{J}\). The bulk plasma current forms close to the antenna, then diffuses into the plasma volume. This work describes evolution of these quantities toward steady state during the pulse.

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