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Two-dimensional simulation of inductively coupled large-area plasma source

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The plasma in an inductively coupled plasma discharge, especially a large size plasma source with 13.56MHz, is inherently non-uniform and the density distribution depends strongly on the manner in which the power is delivered to the system and on the electrical and geometric configurations of the system[1]. In order to investigate the discharge phenomena in such a system for semiconductor processing and to optimize the process, we have developed 2-D fluid code and investigated plasma parameter, such as plasma density, electron temperature, absorbed power, electric field distribution (z-direction), for inductively coupled large-area plasma source driven by a 13.56 MHz power supply. Our model is based on the solution of transport equation (continuity equation, momentum transfer equation in drift-diffusion approximation and energy equation for electron), Poisson's equation and wave equation for induced electric field by embedded antenna coil. This code can incorporate various geometry and boundary conditions (dielectric and conductor). Using this code, we can obtain that the distribution of electric field (z-direction), absorbed power and plasma density change as the manner of driven power. If this parameter is adjusted well, a good plasma uniformity can be obtained. Moreover, we have investigated plasma parameter with not only the manner of driven power but also the variation of antenna location.

[Reference]
1. Y. Wu and M. A. Lieberman, Plasma Sources Sci. Technol. **9**, 210 (2000)