A study of asymmetrical effects in a 3D Inductively Coupled Plasma discharge simulation of including multiphysics.

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A 3-dimensional plasma simulation for an inductively coupled plasma (ICP) discharge based on the fluid model in semiconductor manufacturing process is conducted in this study. Heat transfer and gas flow are merged to the plasma simulation for considering several physical phenomena simultaneously.

Electron energy distribution function (EEDF) has great role in determining important coefficients such as electron mobility, diffusion coefficient, electron-neutral reaction rates and so on. Therefore, EEDF was obtained by Two-term Boltzmann Solver using space-averaged plasma properties (electron density, electron temperature, gas temperature, ionization degree, molar fraction, etc).

The effects of asymmetrical structure of the antenna coil and that of the discharge chamber are investigated. 3D effects were observed, which could not be found in the 2D axisymmetric simulation. Changes by an insertion of metal plate between antenna and plasma, including Faraday shield effect, were also observed.

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