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Multi-zone Equilibrium of ICP Discharge for Plasma Processing. Mechanism of Electron Heating VLADIMIR NAGORNY, Applied Materials Inc — ICP discharges and plasma sources are quite common in semiconductor plasma processing. Many observations, plasma measurements and simulations were published through the years. However theoretical considerations are limited to a case when plasma equilibrium can be characterized as quasi-global. In a real processing plasma this kind of equilibrium is unstable. Here we analyze a situation when equilibrium consists of at least two zones. In a cylindrical case a thin, band-like zone confining all hot electrons, where efficient electrons heating and plasma generation occurs, absorbs almost all the energy from the coil and is linked on one side to the wall adjacent to induction coil. On the other side this band is linked to the second - plasma transfer zone, which is fed by the energy and particles escaping from the first zone. The second zone is also linked to surrounding walls. In a way, this structure of ICP discharge reminds a glow discharge structure. The self-sustaining plasma generating zone functions similar to a cathode fall, and the plasma transfer zone - similar to a positive column. The number of plasma generating zones depends on the number of coils and construction of the coil, and usually more than one plasma generating zones are linked to a common plasma transfer zone.

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