

ABSTRACT

A deposition system in a semiconductor fabrication system provides at least one electron gun which injects energetic electrons into a semiconductor fabrication chamber to initiate and sustain a relatively high density plasma at extremely low pressures. In addition to ionizing atoms of the extremely low pressure gas, such as an argon gas at 100 microTorr, for example, the energetic electrons are also believed to collide with target material atoms sputtered from a target positioned above a substrate, thereby ionizing the target material atoms and losing energy as a result of the collisions. Preferably, the electrons are injected substantially tangentially to the walls of a chamber shield surrounding the plasma in a magnetic field generally parallel to a central axis of the semiconductor fabrication chamber connecting the target to and the substrate. As the injected electrons lose energy ionizing the target material atoms, the electrons spiral inward toward a central region of the semiconductor fabrication chamber surrounding the central axis, forming an electron cloud in the central region. An arrangement of electromagnets may be positioned adjacent the walls of the chamber shield surrounding the plasma to generate the magnetic field. It is believed that the configuration of magnetic fields also keeps electrons from colliding with the walls of the chamber shield surrounding the plasma.

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