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E-H mode detection and symmetry effects in ICP plasmas with bias power MICHAEL KLICK, Plasmetrex GmbH — ICP based plasma etchers are widely used in the semiconductor industry. Parameters from industrial chambers are usually not suited to detect different plasma modes. Here the Self Excited Electron Resonance Spectroscopy (SEERS) is extended to provide parameters which describe the electron heating and the symmetry of the plasma. During ignition and at lower power the plasma in a ICP chamber is in the E-mode. With increasing RF power the electron density increases, the inductive heating becomes more efficient. The investigations were focused on the dependency of the transition on the chamber hardware, pressure, ICP power, and phase angle in two commercial ICP chambers. The E-H mode transition is clearly identified and it shows a well pronounced dependence on the pressure. Due to the chamber geometry, the plasma shows a different symmetry in E and H mode. In the H mode at high source power, substrate and bias power play no role and the plasma shows the classical asymmetry. A phase shift shows a larger impact on the transition than the pressure. At lower source power, the power coupling at the driven substrate electrode dominates no influence of phase shift. One chamber shows always an earlier transition indicating here a higher efficiency of the inductive power coupling system.

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