Plasma Diagnostics and Plasma Control with the Multipole Resonance Probe: New Developments

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Of the many diagnostic techniques available or proposed for low temperature plasmas, only a few are industry compatible. In order to be useful for supervision and control of technical plasma processes, a diagnostic must be (i) robust and stable, (ii) insensitive against perturbation by the process, (iii) itself not perturbing to the process, (iv) clearly and easily interpretable without the need of calibration, (v) compliant with the requirements of process integration and, last but not least, (vi) economical in terms of investment, footprint and maintenance. One very promising approach to industry compatible plasma diagnostics is plasma resonance spectroscopy, i.e. the attempt to exploit for diagnostics purposes the natural ability of plasmas to resonate on or near the electron plasma frequency $\omega_{pe}$. This approach is especially suited for depositing plasmas. A particular realization of that concept is the multipole resonance probe (MRP), where the excited resonances can be mathematically classified using the technique of multipole expansion. The purpose of this communication is to report recent progress in the modeling of the probe: A fully kinetic description was established which will allow extending the validity of the evaluation algorithm into the low pressure range of $p<1$Pa.

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