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Designing resonance microwave cavities to optimize plasma generation

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Abstract-

Methodology for designing the 2.45-GHz microwave (MW) coupling system to optimize the hydrogen plasma density in an electron cyclotron resonance (ECR) plasma reactor is presented. Two different plasma generator systems have been studied by experiments and 3-D simulations to find the criteria to reach an optimized design. The experimental work includes the detailed measurements and calculations of the electron energy distribution functions (EEDF) and ultrafast photography diagnostics to estimate the spatial distributions of plasma unbalanced charge density, potential, and electric field for both cases. It demonstrates that to simulate in 3-D, the distribution of the resonant stationary electric field along the entire MW driver system can be used to improve the design in order to reach higher plasma densities and temperatures.

Index Terms- Microwave (MW) coupling, MW design optimization, MW plasma, MW plasma reactor, MW resonance, plasma design optimization.

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