Abstract Submitted
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2D electromagnetic modeling of a microwave plasma torch R. ALVAREZ, L.L. ALVES, CFP, IST — This work models the 2D electromagnetic field distribution, produced within a metallic reactor by a microwave driven Axial Injection Plasma Torch. The coaxial torch imposes a TEM mode to excite the device, which leads to the development of a symmetric TM mode inside the cylindrical reactor. Maxwell's equations were discretized on a variable grid, featuring smaller cells near the torch tip (around which the plasma density is higher) and at the reactor walls. Special attention was given to boundary conditions. At the reactor axis, symmetry considerations impose a zero value for the azimuthal component of the magnetic field. The reactor walls were assumed to be perfect conductors, thus leading to zero tangential electric fields. Finally, at the excitation boundary, the incident field was set equal to the theoretical solution inside a coaxial wave-guide, with a first-order Absorbing Boundary Condition imposed to the reflected field component. The resulting linear system was solved using a Gauss-Seidel algorithm combined with a Successive Over-Relaxation iterative method. Solutions were obtained by imposing a spatial distribution of the plasma permittivity, obtained from the experimental observations of the electron density profile within the device. In the future, the electromagnetic code is to be coupled with a transport model for charged particles, in view of the self-consistent description of this microwave plasma torch.

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