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Characterization of a plasma photonic crystal using a multi-fluid plasma model[1] W.R. THOMAS, U. SHUMLAK, Univ of Washington, B. WANG, F. RIGHETTI, M.A. CAPPELLI, Stanford Plasma Physics Laboratory, S.T. MILLER, Sandia National Laboratories — Plasma photonic crystals have the potential to significantly expand the capabilities of current microwave filtering and switching technologies by providing high speed (μs) control of energy band-gap/pass characteristics in the GHz through low THz range. While photonic crystals consisting of dielectric, semiconductor, and metallic matrices have seen thousands of articles published over the last several decades, plasma-based photonic crystals remain a relatively unexplored field. Numerical modeling efforts so far have largely used the standard methods of analysis for photonic crystals (the Plane Wave Expansion Method, Finite Difference Time Domain, and ANSYS finite element electromagnetic code HFSS), none of which capture nonlinear plasma-radiation interactions. In this study, a 5N-moment multi-fluid plasma model is implemented using University of Washington's WARPXM finite element multi-physics code. A two-dimensional plasma-vacuum photonic crystal is simulated and its behavior is characterized through the generation of dispersion diagrams and transmission spectra. These results are compared with theory, experimental data, and ANSYS HFSS simulation results.

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