Atmospheric Microwave Plasma

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Abstract

Plasma gasification of biomass is emerging as an efficient way to reduce the carbon foot print of waste management while generating renewable energy. In general, gasification is a process where electromagnetic wave energy is used to heat biomass sufficiently to convert the bio-mass to synthesis gas (syngas). A negative byproduct of gasification is tar which shortens component life of gensets which are used to convert the syngas into electricity. A 2.45 GHz microwave driven plasma (MDP) gasification process is examined as a way to improve the conversion efficiency and eliminate tar content of synthesis gas. Simulation of the MDP process opens new doors for the optimization of this green technology. The first step in simulating is validating an experiment already conducted to have a ground state model to improve upon. The adjustable parameters of this system are microwave power, plasma carrier gas flow rate, frequency, and plasma carrier gas. The plasma modeled is characterized as non-electron resonance cyclotron plasma as it exists in atmospheric pressure. The simulation is performed using the Microwave Plasma interface to model wave heated discharges. From the application gallery In-Plane Microwave Plasma, Atmospheric Pressure Corona Discharge in Air, GEC ICP Reactor, Oxygen Boltzmann Analysis, and Argon Boltzmann Analysis were referenced. An experimental design using the geometric constraints defined in a similar model will further validate MDP system design and provide a foundation for more efficient future commercial designs. The expected results from the simulations would be a proportional relationship between microwave power, electron density, and surface temperature.

Figures used in the abstract

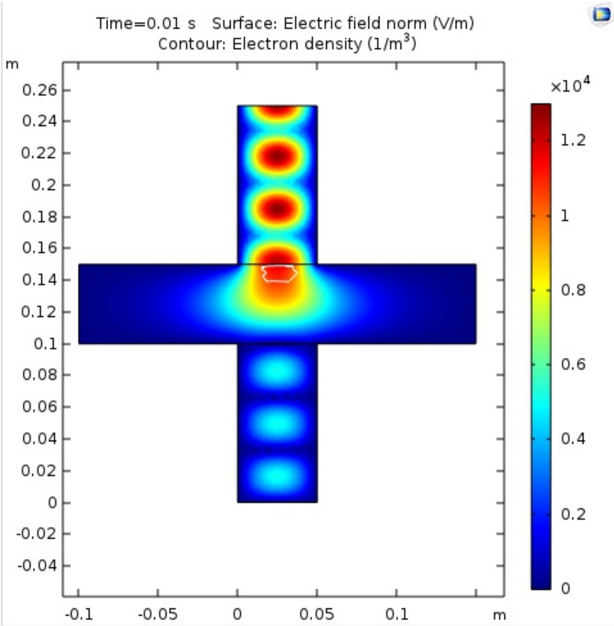

Figure 1: Electric Field is an important factor regarding ignition of the plasma flame and sustainability. When critical electron density is reached, waves no longer penetrate that area.