บทคัดย่อ

Low-temperature atmospheric plasmas (LTAP) have found their utilization in many of the modern technologies such as industrial material's surface coating and modification, medical sterilization, and chemical processing. The low-temperature property allows the LTAP to interact with various low-heat-resistant materials without damaging them, while the atmospheric property allows the plasma to be generated and controlled without a cumbersome vacuum system. Many of the current LTAP researches focus on identifying the discharge mechanisms and evaluating the LTAP's effects on various materials.

In this research, the LTAP generated in a DBD plasma source will be numerically simulated. The goal is to create a software that enables more understanding of the discharge mechanisms in a DBD, specially the microdischarge, which is one of the discharge characteristics of a DBD, and the interactions between the charged particles in the plasma and the neutral particles in air, which are non-negligible at atmospheric pressure. The simulation will utilize the particle-in-cell (PIC) and the Monte Carlo (MC) methods in order to follow various microscopic and localized interactions that can occur in the plasma. For instance, the PIC method is used to model the interactions between the charge particles and the local electric field, whereas the MC method is used to model the collisions between the plasma's charged particles and the air's neutral particles. Both methods must be solved simultaneously in order to obtain a "more" complete model of the discharge.

While the software will initially be created for only a specific case, i.e. LTAP in DBD, it will be designed with an ability to allow for further expansion to model more general cases in mind. Ultimately, the long-term goal is to upgrade the software so that it can be used for both educational purposes (e.g. for students studying plasmas) and other general purposes (e.g. for designing industrial plasma sources).