AAPPS-DPP2022 Invited/Plenary Nomination Form

0. Recommender's name, E-mail and affiliation

Name: Yue Niu E-mail: 18434365800@163.com Affiliation: Xidian University

1. **Session category:** B
2. **Type:** Plenary
3. **Speaker:** Yue Niu**;**
   E-mail 18434365800@163.com**;**
   Affiliation Xidian University;
4. **Rationale**:
   Learn and communicate about basic plasma

5. **Short abstract for 5th Asia-Pacific Conference on Plasma Physics**

Authors: Yue Niu, Weimin Bao, Donglin Liu, Xiaoping Li, Yanming Liu

Title: Comparative Study on Morphology and Formation Mechanism of Argon and Air Inductively Coupled Plasma Discharge

Abstract:

This paper takes the near-space high-speed target plasma electromagnetic science experiment generation device as the research object, the heat transfer and flow characteristics of the inductively coupled plasma discharge under the typical working conditions of argon and air are compared and studied. This is under the condition that the operating frequency is 440kHz and the power is 300kW. It is found that the simulation results of the plasma shape in this working state are consistent with the experimental phenomenon. From the point of view of temperature distribution, the high temperature area of air plasma is concentrated near the axis, which is a shuttle shape, and the high temperature surrounding area of argon plasma appears near the tube wall in the coil coverage area, which is forming a ring-shaped maximum temperature zone. At the same time, the resistivity, heat capacity and thermal conductivity of argon plasma are lower than those of air. The low thermal conductivity can reduce the energy loss caused by thermal conduction and heat dissipation, and improve the thermal efficiency of the plasma. The level of thermal conductivity is extremely important for the formation of stable plasma. In the distribution of the flow field, the maximum velocity of the argon plasma is located at the inlet, and a reflux vortex is formed at the front; The air plasma expands dramatically as the fluid is heated, and the thermal compression effect of cold fluid on hot fluid. The high-speed regions of the flow field of air plasma are also located near the axis, and two vortices with opposite vortices are formed. In the temperature distribution of the inner wall of the quartz tube, the peaks are all located at the coil position of the ICP generator, and the inner wall temperature of the middle three-turn coil position is about 400K higher than that of the air plasma when the argon plasma discharges. The model can be used to estimate the inner wall temperature of the quartz tube in the working state of the plasma generator, providing a theoretical basis for the safe operation of the protection device.