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Numerical Study on Self-Confined Plasmoid Transport Phenomena in an Electrodeless Plasma Thruster for Space Propulsion

Authors : Xiaodong Wen, Lijuan Liu, Xinfeng Sun

Abstract : A high power electrodeless plasma thruster is being developed at Lanzhou Institute of Physics. In this thruster, a rotating magnetic field (RMF) driven by two radio-frequency coils which dephased by 90 degrees are applied both for propellant ionization and plasma acceleration. In the ionization stage, a very high azimuthal current can be driven by RMF and then makes plasma forms a field reversed configuration, namely self-confined plasmoid. Profoundly understanding the transport characteristics of the plasmoid in the following acceleration stage is the key to improve the thruster performances. In this paper, a 3D MHD model is established and the influences of the RMF and an applied magnetic field on the self-confined plasmoid acceleration are investigated. The simulation results show that, by applying a RMF with strength and frequency of 250 G and 370 kHz, the plasmoid can be accelerated to an average velocity of 17 km/s at the exit of the thruster.

Keywords : electric space propulsion, field reversed configuration, rotating magnetic field, transport phenomena
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