PSEUDOSPARK DISCHARGE CHARACTERISTICS IN RADIAL MULTI-CHANNEL CONFIGURATION

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Abstract

High current pseudospark switches are of paramount importance and have been researched for different strategic and industrial application since last few decade. In this work, spatial and temporal characteristics of pseudospark discharge in radial multi-channel configuration fed through common hollow cathode have been investigated through simulations using COMSOL multi-physics code. The different phases of the discharge inside this geometry have been analyzed. In the triggering or pre-breakdown phase, each channel in radial setup receives its respective beam current for ionization of all channels from trigger source placed at central axis of the hollow cathode. After triggering, the breakdown occurs in the form of hollow cathode discharge and is further taken by bore hole discharge. In the bore hole discharge current density is confined to the aperture regions. It is inferred that the current density confined in the aperture regions may erode the exposed electrodes if not shifted to other areas, as happens in the coaxial geometries. Particularly, in radial geometry, the discharge from all channels shifts from the aperture regions and move in the high voltage gap towards the top of hollow cathode under the effect of Lorentz forces. To reduce the energy density and the erosion around the channel aperture areas, linear apertures created around the periphery of the hollow cathode instead of round apertures are found to be suitable for high current plasma switching. In fact, with linear aperture creation, more discharge channel emission area is utilized for passing the current for comparable geometrical potential penetration through the apertures. The plasma simulations and post experimental diagnosis of discharge exposed regions of electrodes have shown good co-relation and results of these efforts will be presented.

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