2018 IEEE International Power Modulator and High Voltage Conference



Contribution ID: 50

Type: Oral Presentation

Trap distribution of aging polymeric materials and its effect on surface flashover in vacuum

Monday 4 June 2018 11:00 (15 minutes)

Surface trap parameter and distribution can significantly affect the development of the secondary electron emission avalanche (SEEA), the most widely accepted mechanism for flashover in vacuum. To further understand the influence of traps on the flashover of polymeric materials under different degrees of aging, polytetrafluoroethylene (PTFE), polymethylmethacrylate (PMMA) and polyamide (PA6) were aged by repeated single-shot flashover, which was excited by a microsecond pulsed generator. The finger-like plane-electrodes were used in this experiment with 1.2 mm gap. The trap parameters of specimens experienced 1000, 2000, 3000 times of flashovers, were respectively tested by means of isothermal surface potential decay (ISPD) and the flashover voltage was also recorded. The results show that the deeper energy level trap occurs and the trap charge density is lower after 1000 times of flashovers for PTFE and PA6. The deep trap and shallow one exist simultaneously in three materials. The trap parameters of PMMA don't change obviously compared with PTFE and PA6. The trap energy level is deeper and the trap charge density is higher after 3000 times of flashovers for three materials. In order to analyze the effect of trap parameters on discharge development, the dynamics process of charge trapping and detrapping were analyzed based on the charge transport model in dielectrics with single trap level and two discrete trap levels. The simplied calculation results show that the deeper the trap level is, the quantity of trapped charges is more in polymeric materials. The trapped probability of charged particles for shallow level trap is small in insulating materials.

Authors: Mr HU, Duo (Institute of Electrical Engineering, Chinese Academy of Sciences); REN, Chengyan (Institute of Electrical Engineering, Chinese Academy of Science); Prof. SHAO, Tao (Institute of Electrical Engineering, Chinese Academy of Sciences); ZHANG, Cheng (Institute of Electrical Engineering, Chinese Academy of Sciences); ZHANG, Cheng (Institute of Electrical Engineering, Chinese Academy of Sciences); Prof. YAN, Ping (Institute of Electrical Engineering, Chinese Academy of Sciences)

Presenter: REN, Chengyan (Institute of Electrical Engineering, Chinese Academy of Science)

Session Classification: Oral 1 - Dielectrics

Track Classification: Dielectrics, Insulation, and Breakdown