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Study on Surface Trap and Vacuum Surface Flashover Characteristics of Typical Polymeric Materials

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In present theory of vacuum surface flashover, secondary electron emission avalanche (SEEA) plays the dominant role in surface flashover development. But more and more researchers have the opinion that surface trapping can participate in the SEEA development and significantly affect the surface flashover characteristics of insulation materials in vacuum. The trap parameters of several typical polymeric materials were deduced based on the isothermal relaxation current (IRC) theory. The surface charging was fulfilled by needle-to-plane corona discharge, and the surface potential was measured by the method of static capacitance probe. The experiment of vacuum surface flashover in direct current (DC) and pulsed voltage was developed, and the relationship between trap parameter and flashover voltage was analyzed. The research results indicate that the trap energy level and trap density of polymeric materials have relation to their flashover characteristics. The shallow trap parameter has more important effect on the flashover voltage, and the flashover voltage decreases with the increase of shallow trap density. The deep trap parameter mainly affects the flashover characteristics after several times of discharges, namely conditioning. The trap parameters have more important effect on the flashover characteristics in DC voltage than in pulsed voltage. The results can not only help to understand the mechanism of vacuum surface flashover but also be used to guide the surface modification and improve the insulation performance of polymeric materials by modifying trap parameters.

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