

高电压技术

高频电压下交联聚乙烯中电树枝的形态特性

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摘要:

为研究高频电压下交联聚乙烯(cross-linked polyethylene, XLPE)中电树枝的形态特性,进行了不同电压、频率和电极间距下的电树枝生长显微观测实验,分析了局部电场强度和频率对电树枝形态特性的影响规律和影响机制,并引进了一个新的参数即能量阈值,来综合考虑电树枝的生长速度、分形维数与电树枝形态之间的关系。结果表明:局部电场强度和频率对电树枝形态的影响有明显的规律性。丛林状电树枝只在较高电压下形成,而且针尖附近小区域内的局部电场强度是形成丛林状电树枝的重要影响因素。纯藤枝状电树枝只在较高频率下出现,而且这个频率随着电压的升高而增大。双结构电树枝的结构转换位置的电场强度在不同的电压和电极间距下基本保持不变,但是随着频率的升高而明显增大。

关键词: 电树枝 电缆绝缘 交联聚乙烯 高频电压 局部电场强度

Electrical Tree Structure Characteristics in XLPE Power Cable Insulation Under High-frequency Voltages

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Abstract:

In order to investigate the electrical tree structure characteristics in cross-linked polyethylene (XLPE) under high-frequency voltages, the tree growing processes under various voltages, frequencies and pin-plane spacings were observed with a photomicrographic platform. The influences of local electric field and frequency on tree structures were analyzed and the corresponding influencing mechanisms were discussed. In addition, a new parameter, the energy threshold, was introduced to investigate the relations of growth rate and fractal dimension with tree structure characteristics. It has been found that the local electric field and frequency regularly affect tree structures. Bush-like trees only form under higher voltages; and the electric field in a very small zone near the needle tip is an important influencing factor for the formation of bush-like trees. Pure vine-like trees form only under high frequencies, which increase with the rise of voltages. For double-structure trees, the local electric field at the transition location almost stays constant under different voltages and pin-plane spacings, but obviously increases with the increase of frequency.

Keywords: electrical tree cable insulation cross-linked polyethylene (XLPE) high-frequency voltage local electric field

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