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绝缘材料及其参数对绝缘子表面电场强度和电位分布的影响

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摘要：

为研究材料类型和参数对绝缘子电场强度和电位分布的影响，采用有限元法以支柱绝缘子为对象研究了柱体和伞裙材料分别为电瓷、玻璃、高温硫化(high temperature vulcanization, HTV)硅橡胶时绝缘子及附近场强、电位分布以及沿面和干弧路径上场强和电位，同时研究了材料的电阻率和相对介电常数对绝缘子附近场强和电位分布的影响。结果表明：支柱绝缘子场强度、电位分布极不均匀，上金具附近场强大、电位集中，从上到下沿面场强、电位下降速度有下降趋势，材料类型基本不影响整体场强和电位以及等位线；从最大场强和电位集中程度来看HTV>电瓷>玻璃；伞裙存在会畸变其附近场强，伞裙上表面与柱体交汇处、伞裙下表面各棱底部附近场强畸变相对严重。正常范围内绝缘材料的体积电阻率对场强和电位分布未见影响；随着相对介电常数的增加最大场强减少，沿面和干弧路径上电位分布更均匀，但伞裙附近场强畸变加剧。

关键词： 绝缘子 电场强度 电位 电阻率 介电常数 绝缘材料

Influence of Insulating Materials and Their Parameters on Surface Electric Field Intensity and Potential Distribution of Insulators

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Abstract:

To research the influences of types and parameters of insulation material on electric field intensity and potential distribution of insulator, utilizing finite element method (FEM) and taking post insulator as the research object, the electric field intensity and potential distribution of insulator and adjacent region as well as the electric field and potential along insulator surface and dry arc path are researched while the material for the cylinder and shed of insulator is electric ceramics, glass and high temperature vulcanization (HTV) silicon rubber respectively. Meanwhile, the influences of resistivity and relative dielectric constant of insulation material on the field intensity and potential distribution at the region nearby the insulator are researched as well. Research results show that the distribution of field intensity and potential of post insulator is extremely non-uniform, at the position near upper flange the highest field intensity exists and where the potential is concentrated; from the top of the insulator to its bottom, there is a downward trend to the descent velocity of both field intensity and potential along insulator surface; basically, the integral field intensity, potential and equipotential line are not influenced by insulation material; according to the decreasing order of maximum insulator field intensity and potential concentration degree, the ranking of insulation material is as following: HTV, electric ceramics and glass. Shed makes nearby electric field distorted: at the junction of upper surface of insulator shed with the cylinder as well as at the position near the bottom of edges of the lower surface of the shed the distortion is relatively severe. Within normal range of volume resistivity of insulation material, its influence on field intensity and potential distribution are not observed; along with the increase of relative dielectric constant the maximum field intensity decreases, and the potential distribution along insulator surface and dry arc path becomes more uniform, however the electric field near the insulator shed is more distorted.

Keywords: insulators electric field intensity potential resistivity dielectric constant insulation material

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