

特高压设备

空间电荷对油纸绝缘体击穿强度和沿面闪络的影响

周远翔¹,孙清华¹,李光范²,王云杉¹,姜鑫鑫¹,仇宇舟¹,李金忠²,王宁华²

1. 电力系统及发电设备控制和仿真国家重点实验室(清华大学电机系),北京市 海淀区 100084; 2. 中国电力科学研究院,北京市 海淀区 100192

摘要:

换流变压器是直流输电工程的核心设备之一,其结构和工作状况比传统交流变压器更为复杂。针对换流变压器的特点,设计了相应的试验装置,初步对油纸绝缘中的体击穿和沿面闪络进行了试验研究。试验结果表明,极性反转现象同样存在于油纸绝缘系统中。即在直流电压下油纸绝缘中积聚的空间电荷畸变了周围的电场,导致油纸绝缘的直流击穿强度发生改变。同时,对油纸绝缘进行的沿面闪络试验表明,空间电荷的存在同样会影响油纸绝缘的沿面闪络。通过对上述试验结果进行讨论,发现传统交流变压器的设计理论和经验已不能满足换流变压器的要求,在换流变压器设计和制造中应给予空间电荷问题足够的关注。

关键词: 体击穿;换流变压器;沿面闪络;油纸绝缘;空间电荷

Effects of Space Charge on Breakdown Strength and Creeping Flashover in Oil-Paper Insulation

ZHOU Yuan-xiang¹, SUN Qing-hua¹, LI Guang-fan², WANG Yun-shan¹, JIANG Xin-xin¹, QIU Yu-zhou¹, LI Jin-zhong², WANG Ning-hua²

1. State Key Lab of Control and Simulation of Power Systems and Generation Equipments (Department of Electrical Engineering, Tsinghua University), Haidian District, Beijing 100084, China; 2. China Electric Power Research Institute, Haidian District, Beijing 100192, China

Abstract:

As one of the most important apparatuses used in HVDC transmission, converter transformer has complex structures and operates in an inclement circumstance. Therefore, more knowledge about the behavior of its insulating systems is required. In this paper, experiments were designed according to the operating state of converter transformers, and processes of breakdown and creeping flashover in oil-paper insulation were studied. The results show that, polarity reversal effect exists in oil-paper insulation systems. In other words, space charge accumulated under DC electrical field has impacts on DC breakdown process of oil-paper insulation systems. Moreover, these experiments show that space charge could also affect the creeping flashover significantly. At the end, it is concluded that theory and experience in designing traditional AC transformers cannot meet the needs of converter transformer any longer, and more attention should be paid on space charge effect during design and manufacture of converter transformers.

Keywords: breakdown;converter transformer;creeping flashover;oil-paper insulation;space charge

收稿日期 2009-05-21 修回日期 2009-07-21 网络版发布日期 2009-08-13

DOI:

基金项目:

基金项目: 国家自然科学基金资助项目(50438070); 教育部新世纪优秀人才支持计划项目(NCET-04-0095); 教育部博士点基金项目(200800030040)。

通讯作者: 周远翔

作者简介:

作者Email:

参考文献:

[1] Hammer F, Kuchler A. Insulating systems for HVDC power apparatus[J]. IEEE Transactions on

扩展功能

本文信息

Supporting info

PDF(549KB)

[HTML全文]

参考文献[PDF]

参考文献

服务与反馈

把本文推荐给朋友

加入我的书架

加入引用管理器

引用本文

Email Alert

文章反馈

浏览反馈信息

本文关键词相关文章

体击穿;换流变压器;沿面闪络;油纸绝缘;空间电荷

本文作者相关文章

PubMed

Electrical Insulation, 1992, 27(3): 601-609. [2] 韩晓东, 翟亚东. 高压直流输电用换流变压器[J]. 高压电器, 2002, 38(3): 5-6. Han Xiaodong, Zhai Yadong. Converter transformer used for HVDC transmission[J]. High Voltage Apparatus, 2002, 38(3): 5-6 (in Chinese). [3] 王烜, 曹晓珑. 特高压换流站输电设备概述[J]. 电气技术, 2006(5): 9-14. Wang Xuan, Cao Xiaolong. Summarize of UHVDC station transmit electricity equipments[J]. Electrical Engineering, 2006(5): 9-14 (in Chinese). [4] 吕晓德, 陈世坤, 孙定华, 等. 各向异性非线性直流电场数值算法研究[J]. 电工技术学报, 1998, 13(4): 60-64. Lu Xiaode, Chen Shikun, Sun Dinghua, et al. The study on numerical method for anisotropic nonlinear DC electric field[J]. Transactions of China Electrotechnical Society, 1998, 13(4): 60-64 (in Chinese). [5] Li Ying, Takada T. Progress in space charge measurement of solid insulating materials in Japan[J]. IEEE Electrical Insulation Magazine, 1994, 10(5): 16-28. [6] 王春玲, 李建华. 换流变压器阀侧绕组极性反转试验端部电场的计算与分析[J]. 变压器, 2005, 42(2): 11-14. Wang ChunLing, Li Jianhua. Calculation and analysis of end electrical field in valve winding polarity reverser test for converter transformer [J]. Transformer, 2005, 42(2): 11-14 (in Chinese). [7] 全国绝缘材料标准化技术委员会. GB/T 1408. 2-2006. 绝缘材料电气强度试验方法第2部分: 对应用直流电压试验的附加要求[S]. 北京: 中国标准出版社, 2006. National Technical Committee 51 on Insulating Materials of Standardization Administration of China. GB/T 1408. 2-2006, Electrical strength of insulating materials-Test methods-Part 2: Additional requirements for tests using direct voltage[S]. Beijing: Standards Press of China, 2006 (in Chinese). [8] Zhou Yuanxiang, Wang Yunshan, Li Guangfan, et al. Space charge phenomena in oil-paper insulation materials under high voltage direct current[J]. Journal of Electrostatics, 2009, 67(2-3): 417-421.

本刊中的类似文章