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高电压技术

±500 kV气体绝缘金属封闭输电线路绝缘尺寸设计

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摘要：

随着高压输变电设备如气体绝缘金属封闭输电线路(gas insulated transmission line，GIL)的大规模应用，内部支撑绝缘子的介电强度成为设备安全稳定运行的重要因素。限制GIL在直流输电中应用的2个重要因素分别是绝缘子表面电荷积聚和自由导电微粒的影响。在考虑这2种影响因素的情况下，借助有限元分析软件，设计 ±500 kV直流GIL的绝缘尺寸，包括GIL的内外径，内、外屏蔽电极和屏蔽坑，含氧化铝的环氧树脂盆式绝缘子的结构设计。此外，还提出直流GIL盆式绝缘子外形结构设计的3项原则，设计中考虑了表面电荷积聚和金属微粒对GIL绝缘水平的影响因素。设计结果达到预期目标，绝缘子和电极系统的等位线分布比较均匀，但是其耐电性能还有待实验的进一步检验。

关键词： 雷电冲击耐受电压 内屏蔽电极 外屏蔽电极 自由导电微粒 表面电荷积聚 气体绝缘金属封闭输电线路

Design of Insulation Dimension for ±500 kV DC Gas Insulated Transmission Line

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Abstract:

Along with large-scale application of high-voltage power transmission and transformation equipment such as gas insulated transmission line (GIL), the dielectric strength of inner supporting insulators becomes important factor influencing secure and stable operation of the equipment. Two key influencing factors restricting the application of GIL in HVDC power transmission are charge accumulation along insulator surface and free conductive particles. Considering the two factors and by use of finite element analysis software, the insulation dimensions for ±500 kV DC GIL, including insulation dimensions of inner and outer diameters of GIL, inner and outer shielding electrodes and shield pits as well as the structural design of alumina-filled epoxy resin disc-type insulator, are designed. Besides, three principles for the structural design of outer form of disc-type insulator for DC GIL are proposed and in the design the influences of surface charge accumulation and metal particles on insulation level of GIL are considered. Designed results achieve anticipated targets; the distribution of equipotential lines is uniform, however, the insulation performance of designed results is to be further verified by experiments.

Keywords: lightning impulse withstand voltage inner shield electrode outer shield electrode free conductive particle surface charge accumulation gas insulated transmission line (GIL)

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