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Behavior of Epoxy Insulator with Surface Defect under HVDC Stress

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Abstract : HVDC technology is becoming increasingly popular due to its simplicity in topology and less power loss over long distance of power transmission, in comparison with HVAC technology. However, the dielectric behavior of insulators in the long term under HVDC stress is completely different from that under HVAC stress as a result of charge accumulation in a constant electric field. Insulators used in practical systems are never perfect in their structural conditions. Over time shallow cracks may develop on their surface. The presence of defects can lead to drastic change in their dielectric behaviour and thus increase the probability of surface flashover. In this contribution, experimental investigations have been carried out on the charge accumulation phenomenon on the surface of a rod insulator made of epoxy that is placed between two disk shaped electrodes at different voltage levels and in different gases (SF6, CO2 and N2). Many results obtained, such as, the two-dimensional electrostatic potential distribution along the insulator surface after the removal of the power source following a pre-defined period of application. The probe has been carefully calibrated before each test. Results show that surface charge distribution near the two disk shaped electrodes is not uniform in the circumferential direction, possibly due to the imperfect electrical connections between the embeded conductor in the insulator and the disk shaped electrodes. The axial length of this non-uniform region is experimentally determined, which provides useful information for shielding design. A charge transport model is also used to explain the formation of the long term electrostatic potential distribution under a constant applied voltage.

Keywords : HVDC, power systems, dielectric behavior, insulation, charge accumulation
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