

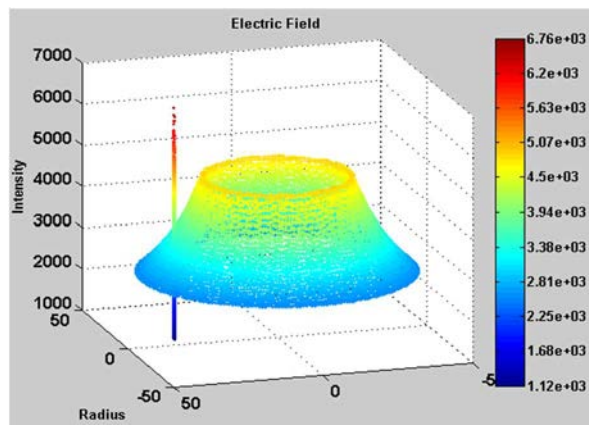
Effect of impurities on electric field distribution in HV XLPE insulation

Omar **MONAJJED** (1)

1 Liban Cables – Nexans, Beirut, Lebanon, omar.monajjed@nexans.com

Nowadays, the majority of underground HV/EHV cables are XLPE insulated. When dealing with XLPE, special care should be taken to insure an impurity-free product since these contaminations will cause localized stresses that will deteriorate the insulation leading to failure.

In this paper, we will be able to accurately identify and simulate, using image processing and FEM, the exact values of the localized stresses which will give you a strong base for further analysis of their effect.



The electric field distribution within insulation in the absence of any contaminant is well known and dependent on the voltage level, diameter over conductor shield, diameter over insulation and distance of the desired point from conductor shield. We get maximum electric stress when the distance is equal to the conductor shield diameter i.e. nearest insulation point to the conductor. The electric stress level is the same on each equipotential line inside the insulation.

In the presence of any void, impurity or contamination, electric stress distribution in insulation is disturbed especially around and inside the contamination. These disturbances and variations in stress level depend on the material, shape, and size of impurity. In theory and literature, large sizes containing sharp edges are the most dangerous. But none of them have specified this risky stress level that is reached in a specific real case measured in V/mm.

Many papers have simulated using FEM the electric stress disturbance due to a circular shape contamination inside XLPE, which does not reflect the actual situation since in real life, we won't get a 100% circular shape void or impurity. Thus, these simulations are irrelevant for the objective of knowing exactly what's happening in the surrounding and inside the impurity.

To be able to precisely simulate the real life case, a microscopic picture of the impurity shall be taken, and then image processing of this picture shall be performed to detect the boundaries, followed by an electrostatics simulation using FEM to compute electric stresses.

Key words

XLPE, impurity, contamination, void, localized stress, HV/EHV, Gmsh, GetDP, Matlab