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Multiple Voids Insulation System Response by Partial Discharge Analysis

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The purpose of the present work is to evaluate the dielectric response, in presence of multiple voids, analysing Partial Discharge measurements and simulations. Air voids are simulated inside specimens, one or two vacuoles have been taken into account in different positions and with different diameters, and partial discharges patterns have been traced. The approach combines the known circuit model of three capacitors with a model used to describe the behavior of the ionized channel inside of the inclusion during the discharge phenomenon, short-circuiting the capacity that represents the void.
The approach is based on time-variable conductance of the void, subjected to multistress conditions: voltage, temperature and pressure. Before the discharge, the electric field distribution inside the void is be evaluated solving the Laplace equation.
During the ionization phase the prevalent conductance is given by the ionized channel, as the ionized channel expires the remaining conductance is given by the surface conductivity of the resin. In the evaluation of the total electric field inside the cavity, the charge deposited on the polar area has to be taken into account. In order to consider the statistical aspect of PD, the Weibull probability function has been used. The implementation of the model is done in Simulink environment. In the first simulation are considered two voids of the same radius and the same distance from the electrodes. In the second simulation a void is moved upwards and the other downwards. In the third simulation it is doubled the radius of the first void. Finally, partial discharge measurements have been carried out in order to validate the dielectric's behavior.

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[2] Di Silvestre M. L, R. Miceli, Romano P., Viola F., "Simplified Hybrid PD model in voids: pattern validation" , 4th International Conference on Power Engineering, Energy and Electrical Drives –Powereng, 13-17 may, 2013, Istanbul ,Turkey.

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