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Effect of High Voltage Impulses on Change of Partial Discharge Characteristics in oil-Impregnated Paper for Online Diagnostics

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An important signature of degradation is usually linked to the onset of Partial Discharge (PD) activity within the insulation. The change in the PD pattern can concern the insulation degradation level. High voltage transients such as lightning and switching impulses are inevitable phenomena that happen in power systems. They can impose electrical stresses on the insulation system of power components such as power transformers and their bushings which may lead to their failure. In this paper, the effect of HV impulses on the change of surface and cavity discharges of oil-impregnated paper has been investigated. With resemblance to the real situation, superimposed impulse on the AC voltage has been applied to the samples. The probability of initiating partial discharges in oil-impregnated paper due to the impulses has been studied. The PD initiation depends on the status of the insulation, the impulse magnitude and the AC phase angle at which the impulse occurs. Behavior of the partial discharges before and after the impulse on the healthy samples has been compared to the samples with aging defects such as papers with moisture content or carbonization. The possible physical phenomenon behind each behavior has been discussed.
The results show the correlation of PD characteristics with the insulation degradation level and HV impulses. Recording the voltage signals with incident of high voltage transients can be used for assessing the insulation condition of power transformers and their bushings. These measurements can be done through test tap of the bushings to be used for the online diagnostics.

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