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Research on Influence of Mechanical Stress on Insulation Characteristics of Oil-immersed Pressboard

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Oil-immersed pressboard are used in transformer to separate high voltage winding and low voltage winding, as well as providing structural support. Thus during normal operation of a transformer, oil-immersed pressboard will be subjected to the action of mechanical stress and constantly aging. Moreover, when the transformer suffers a sudden short-circuit, huge axial force will act on the pressboard near winding ends, affecting insulation properties of the pressboard, leading to failure of the transformer. Therefore, it is necessary to study the evolution of insulation properties of oil-impregnated paperboard under different mechanical stress. In this paper, normal mechanical stress experiments on oil-immersed pressboard were performed, and partial discharge tests of insulation pressboard after pressed were carried out in order to obtain its partial discharge inception voltage, breakdown voltage and partial discharge characteristics. Material testing machine is used to apply mechanical stress between 0 and 100 MPa to the pressboard and the strain curve is recorded as well. Insulation characteristics of pressed oil-immersed pressboard were obtained by performing both short-term and long-term partial discharge tests under point-plane electrodes. Experimental results indicates that mechanical stress on pressboard will reduce its insulation ability. As the applied mechanical stress increases, the breakdown voltage and withstand voltage time of pressboard will continue to decrease. Partial discharge inception voltage stays substantially when the mechanical stress is relatively low, but decreases rapidly when the mechanical stress is higher than 60MPa. When the mechanical stress is higher, the maximum discharge magnitude and average discharge magnitude will be higher, but the distribution phase of discharges has little to do with the mechanical stress. Confocal microscopy observations on pressed pressboard indicate that damage on fiber inside pressboard caused by mechanical stress may be the cause of reducing insulation ability.

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