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Effect of hydrostatic pressure on the impulse breakdown characteristics of transformer oil

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The aim of this study was to clarify the hydrostatic pressure effect on the initiation and propagation process of oil streamers under the application of pulsed voltage with different polarities. The statistical characteristics of the impulse breakdown voltage and time lag in transformer oil were studied over a wide range of hydrostatic pressure, and the statistical discharge time lag and the discharge formation time lag were calculated by the Laue's pattern. The breakdown voltage distribution can be well fitted by 3 parameter Weibull distribution. The results show that the breakdown voltage increases with the hydrostatic pressure for both positive and negative polarity. However, the increase trend is different, linear for the positive polarity and saturated for the negative polarity. At a fixed voltage, when the pressure is increased, the breakdown time lag increases slightly for the negative polarity, but remarkably for the positive polarity. The statistical time lag for negative polarity is much larger than positive polarity, and the hydrostatic pressure has greater influence for negative polarity. The characteristics of formation time lag are quite different: for negative polarity it decreases very slightly with the hydrostatic pressure, but increases remarkably for positive polarity. These differences are due to different initiation and propagation mechanisms, which are also discussed in the paper.

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