

# Ageing Assessment of Liquid-Solid Insulation Systems Used in Power Transformers

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Over the past century, the combination of mineral oil and Kraft paper insulation materials has been widely used as the main insulation system in power transformers. In the last decades, ester liquids have gradually become one of the alternative insulating liquids used in transformer insulation systems due to their better fire resistance behaviour and biodegradability [1]. In addition, Gas-to-Liquid (GTL) and biodegradable hydrocarbon liquids have also emerged in the market and gradually gain popularity [2]. In terms of solid insulation, there is variety of thermally upgraded Kraft papers due to the different nitrogen contents. Adoption of new insulation materials in transformers requires understanding the long-term ageing performance of the liquid-solid insulation systems [3].

This PhD work focuses on ageing assessment of transformer liquid-solid insulation systems including experimental methodology, material characterisation and identification of new ageing markers. Both non-thermally and thermally upgraded Kraft papers (with different nitrogen contents) are considered. Four types of insulating liquids, including mineral and biodegradable hydrocarbon oils, natural and synthetic esters, are used. In the first set of experiment, cyclic ageing of mineral and biodegradable hydrocarbon oils are conducted at 150 °C. After each cycle of 7-day ageing, the closed vessels are taken out of the oven to cool down for 47 h then open to air environment for 1 h. This is done deliberately to accelerate the ageing process. Parameters including DP, tensile strength, moisture and acidity are measured during the ageing process. The ageing experiments are stopped when the degree of polymerisation reaches about 250.

## REFERENCES

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