

Press release

2 July 2020

Ageing of electrotechnical papers in power transformers

On June 19, 2020, Axelle Barnet defended her doctoral thesis of the Université Grenoble Alpes, prepared under the supervision of Professor Gérard Mortha, and the co-supervision of Nathalie Marlin, Associate Professor HDR (Grenoble INP-Pagora / LGP2), and of Lucie Boiron, Research Engineer (Ahlstrom-Munksjö).

She presented the results of her research work entitled *Understanding of the ageing phenomena occurring in electrotechnical papers in power transformers and research of industrial solutions*.

Power transformers are expensive devices and the degradation of the cellulosic insulation paper contributes to limiting the transformer life expectancy. This work studies the kinetic degradation of two electrotechnical papers during accelerated ageing trials in mineral oil: one standard paper and one Thermally Upgraded paper (TU) containing an additive.

The degradation of the standard paper, measured via the cellulose viscometric degree of polymerisation (DPv), follows a first order kinetic model and the calculated activation energy is close to activation energy reported for the acid hydrolysis of cellulose in the literature. The TU paper behaves differently since the additive slows the paper degradation, and none of the tested kinetics models succeed to model experimental data. A deeper study of the additive reaction mechanism confirms and completes the hypotheses presented in the literature.

Moreover, some mechanical characterizations of aged papers highlight a correlation between the cellulose DPv and the double fold resistance of the paper. Thereafter, it has been discussed if the presence of lignin in paper presents a protective effect on cellulose and it has been shown that it leads to the production of methanol (used as a marker of paper degradation to monitor power transformers).

Finally, a new protective solution on the paper surface, gave encouraging results, particularly in terms of paper mechanical strength properties preservation.

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