

Influence of Thermal Aged Paper on Space Charge Dynamics in Oil-paper Insulation System

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As the main insulation used in HVDC converter transformers, oil-paper insulation system should withstand not only AC voltage, lightning impulse and switching surge, but also DC stress and polarity reversal [1]. One of the major issues associated with HVDC is the easy accumulation of space charge. Therefore, it is important to investigate and understand the factors that affect the formation of space charge in the oil-paper insulation system [2]. In this study, the Kraft papers are dried and thermally aged at 150 °C for 0 day, 5 days and 15 days. Then, they are separately impregnated with fresh oil, and aged oil for comparison. The effects of thermally aged papers on space charge dynamics in the oil-paper insulation system are investigated by the pulsed electroacoustic (PEA) technique under different DC electric fields at room temperature. The properties of the fresh and aged oil are also characterised by the ultraviolet/visible (UV/Vis) spectrum. The results of space charge behaviour in the oil-paper insulation system indicate that the more deterioration of paper and the higher applied stress, the more homo-charges inject from the electrodes, and the more space charge accumulated in the dielectric bulk. However, compared with different oil properties, the impact of aged paper is generally not significant on charge accumulation. Remarkable negative charges are injected and accumulated in the sample with aged oil. And the results of decay tests indicate these negative charges are mainly fast charges due to the large conductivity of the aged oil.

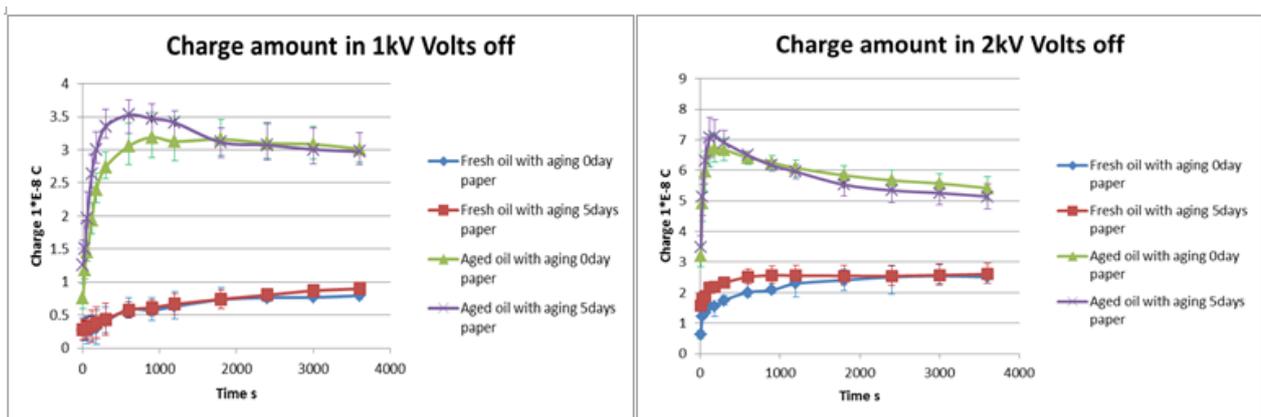


Figure 1 Total charge amount in 1kV (left) and 2kV (right) volts-off

- [1] A. Calson, "Specific requirements on HVDC converter transformers," , Ludvika, Sweden. www.abb.com
[2] J. Hao, G. Chen and R. Liao, "Effect of thermally aged oil on space charge dynamics in oil/paper insulation system," in Joint Colloquium on Transformers, Materials and Emerging Test Techniques, Kyoto, Japan, 2011.