Characterizing HVDC Accelerated Ageing in Artificially Defected Thermoplastic Materials

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TOPIC: degradation of **polymeric insulation** for **HVDC** cable application properties.

GOAL: investigate the **ageing** behavior of polypropylene-based insulation containing artificial **voids** under HVDC stress characterizing by the means of **Space Charge** and **Partial Discharge** measurements at different ageing stages.

1. Samples, ageing procedure & characterization

Fig. 1 - PP specimen with defect (void).

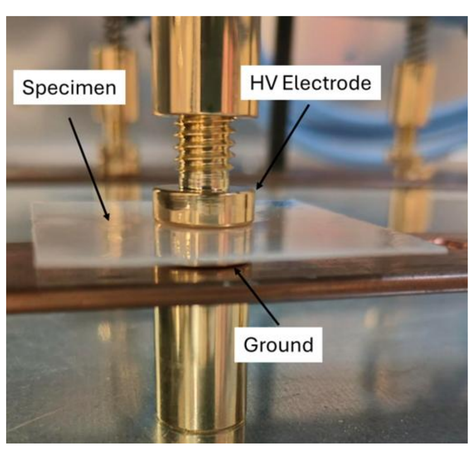

Fig. 2 - 0.5mm specimen electrical ageing layout.

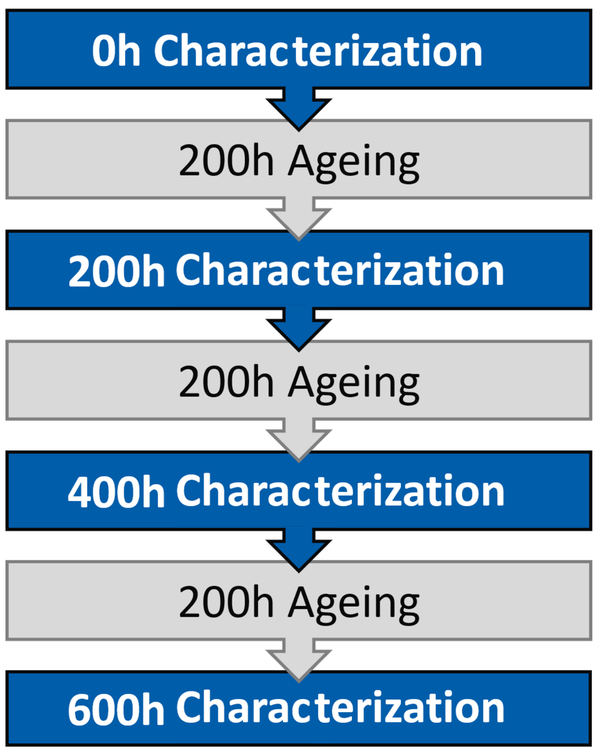

Fig. 3 - Experimental procedure.

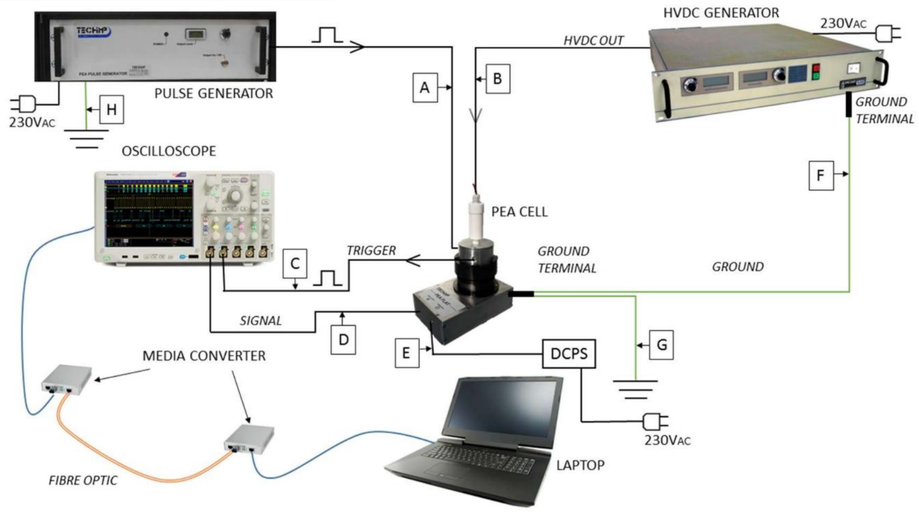

Fig. 4 - Schematization of the test setup for PEA testing.

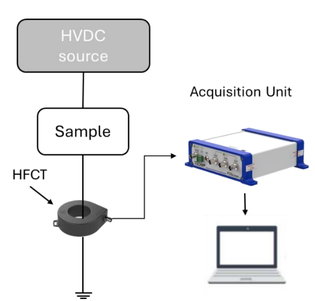

Fig. 5 - Schematization of the test setup for PD testing.

2. Space Charge & Partial Discharge results

Space Charge results show significant evolution of the charge distribution within the bulk of the specimens as a function of ageing time.

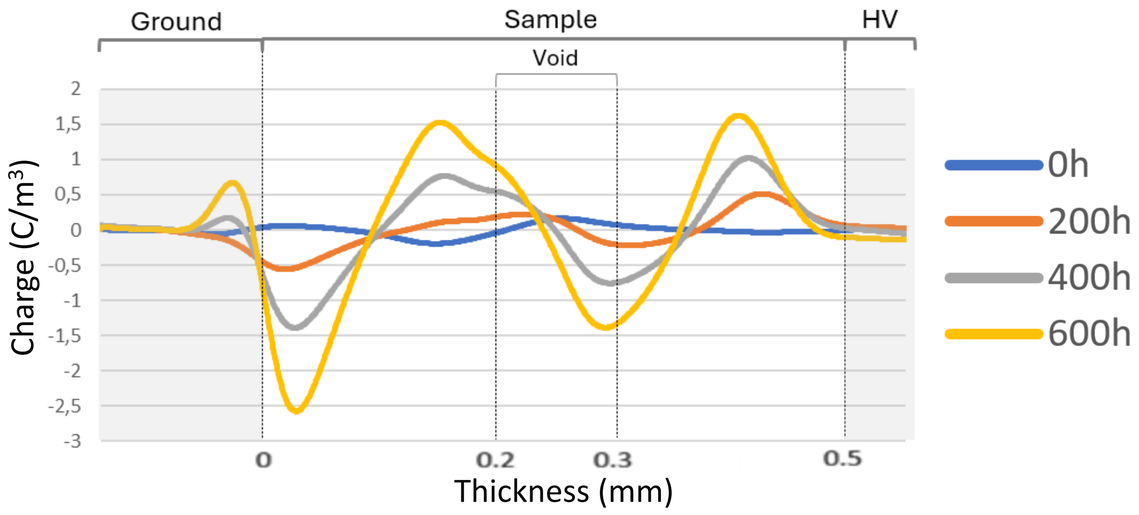

Fig. 6 - Volt-off SC profiles measured at 0h, 200h, 400h and 600h.

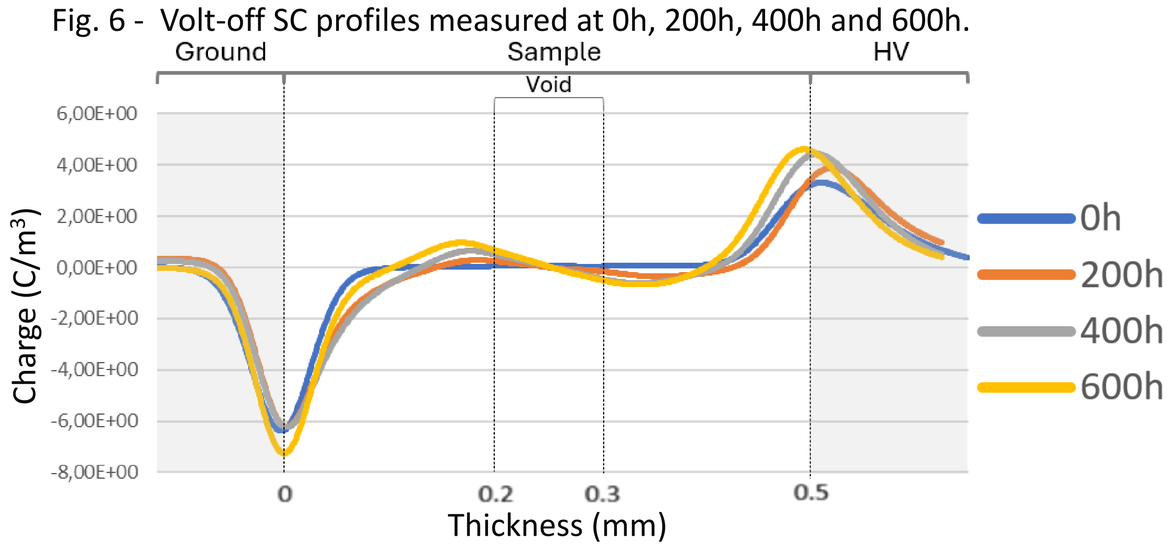

Fig. 7 - Volt-on SC profiles measured at 0h, 200h, 400h and 600h

Partial Discharge results voltage did not reveal a clear evolution of PD activity as a function of ageing time. In most cases, the average PD amplitude slightly increased with increasing applied voltage.

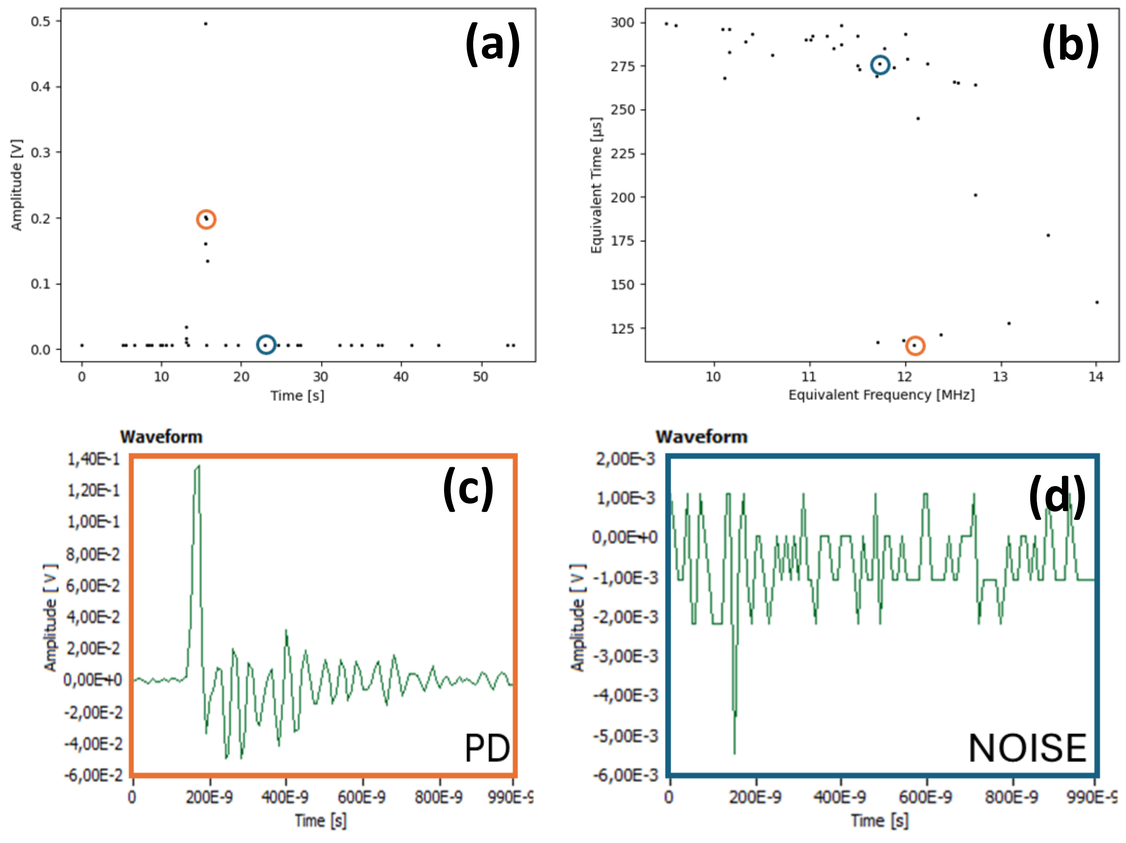

Fig. 8 - Representation of PD amplitudes versus time of occurrence as Time Resolved Partial Discharge pattern (a), Time–Frequency map (b) and sampled waveforms for partial discharge (c) and noise(d).

CONCLUSIONS: 20kV/mm ageing does not show significant changes in the partial discharge phenomena at different ageing time levels while space charge evolution may be affected by uncertain behavior due to the void presence.

NEXT STEPS: longer ageing durations and higher applied DC stress levels will be considered.

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