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Experimental Study of Dielectric Insulator Behaviour under High Voltage Pulse

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Nowadays, in pulsed power applications, during the design of a modulator, it is necessary to take into account all problems linked to insulators and their capability to withstand a dielectric strength. Indeed, many of these modulators integrate transformers, allowing a significant increase of voltage. So, the first objective is to provide an adequate insulation to maintain compact size.
This paper deals with the conception of a multi-primary pulse transformer, allowing a voltage increase of 40kV to 600kV with durations of 1µs. The constraints related to the size of the insulation have a direct impact on the value of the stray elements (leakage inductance and primary/secondary stray capacitance) which is directly related to the pulse waveform. It is therefore important to define a sufficient insulation without over-dimensioning it.
An important criterion concerning the choice of the material is its dielectric strength but generally, the latter is characterized according to the IEC standard 60243-1 which defines this behaviour under DC and AC conditions. The data is not provided in pulsed mode. The problematic is then to choose a dielectric material without knowing this data.
The aim of this paper is to carry out a comparative study of the dielectric properties of materials commonly used in pulsed power modulators in order to compare their behaviour in pulsed mode in relation to AC/DC mode.

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