

# SiC $du/dt$ High Voltage Generator for Electrical Ageing of Winding Insulation

## Motivation

- The switching of converters results in high frequency electrical traveling waves, which can superimpose and result in high overvoltages and deteriorate the insulation by partial discharges (PDs).
- For low voltage machines electrical ageing by PDs is not considered directly and must be avoided by the manufacturer according to international standards.
- Different standard safety factors lead to high test voltages, which are not practicable for high switching rise times (cp. Table 1).

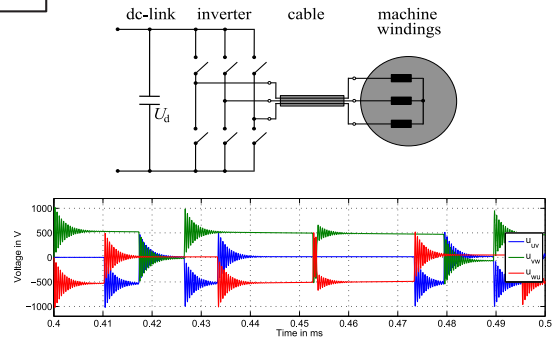


TABLE I. STRESS CATEGORIES FOR INSULATION SYSTEMS [7].

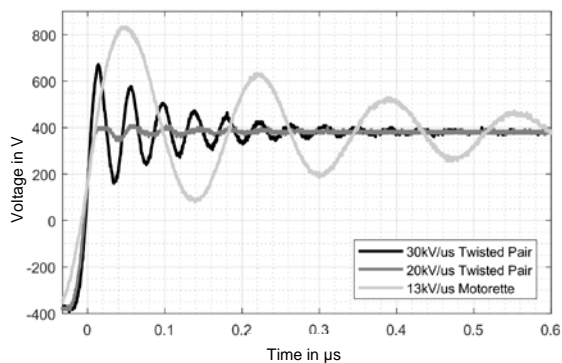
Stress category	Overshoot factor (p.u. $u_{pk}/u_{dc}$ )	Impulse rise time $t_r$ in $\mu s$
A-Benign	$OF \leq 1.1$	$1 < t_r$
B-Moderate	$1.1 < OF \leq 1.5$	$0.3 \leq t_r < 1$
C-Severe	$1.5 < OF \leq 2.0$	$0.1 \leq t_r < 0.3$
D-Extreme	$2.0 < OF \leq 2.5$	$0.03 \leq t_r < 0.1$

## Technical Data

- SiC  $du/dt$  High Voltage Generator:

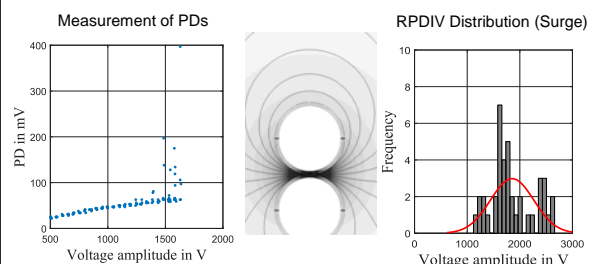
Transistor technology	IGBT / SiC
Reverse voltage	1200 V
Max. dc-link voltage	1000 V
Max. switching frequency	95/150 kHz
Max. rise time	35/80 kV/ $\mu s$

### Measured voltages with different rise times



## Current application/ Opportunities

- For the interturn insulation twisted pairs of enameled copper wires are used to incorporate the requirements of standards (20 °C (68 °F), 50 % r. H.).
- A quantitatively relationship between simulated electrical fields and the probability of partial discharges cannot be found using different manufacturing forces of enameled wires with different nominal diameters.
- The voltage shape has an extensive influence on the probabilistic parameters of partial discharges and has to be considered.



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