Name: **Ivan LAVRINOVICH**
Email: ivan.lavrinovich@univ-pau.fr
Supervisors: Anton GUSEV
Partners/Funding: E2S UPPA/Imperial College London

Status: PostDoc started on the 03/2021

Impact-ionization semiconductor switches for pulsed power applications

Abstract

Triggering of high-voltage thyristors in impact-ionization wave mode is a promising method that significantly improves their commutation characteristics such as switching time and maximum current rise rate. This triggering technique requires applying the high-voltage (5-20 kV) high rise rate (> 1 kV/ns) pulse to the thyristor's main electrodes – anode and cathode. The main barrier to developing this approach is the trigger generator, which meets these strict requirements.

Main Results

A spiral generator (Fig. 1) designed by the Imperial College London was optimized for triggering of standard thyristors in the impact-ionization wave mode. This generator is used to run a 2 kV standard thyristor in impact-ionization mode. This allows switching a high current (1.2 kA) with a high rise rate (12 kA/µs) by the single thyristor. A two-thyristor stack with a blocking voltage of 4 kV was triggered as well. The current amplitude and rise rate have been increased to 2.6 kA and 25 kA/µs correspondingly (Fig. 2). The obtained value of the current rise rate is more than 30 times higher than the datasheet parameter of the tested thyristor.

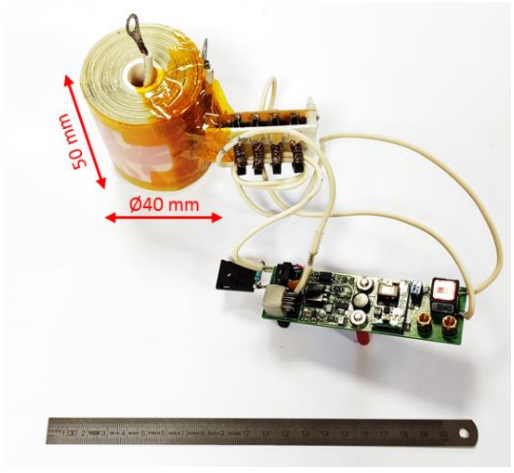

Figure 1 Appearance of the spiral generator.

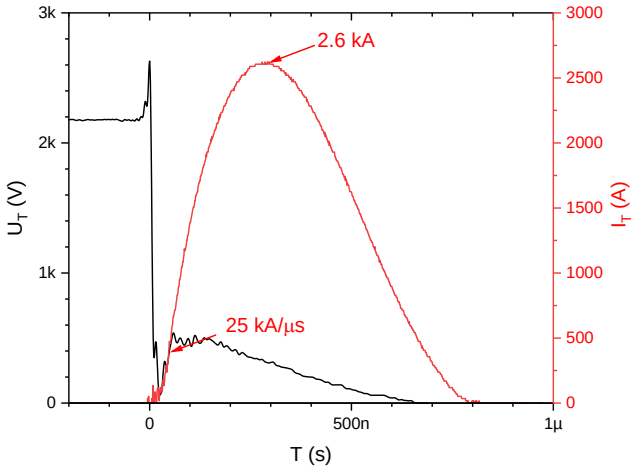

Figure 2 The voltage (black) and current (red) waveforms of the single thyristor in the 4 kV two-thyristor stack.