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A Repetitive Rate Pulse System Used in Lifetime Evaluation of High Voltage Ceramic Capacitors

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The lifetime evaluation of High Voltage Ceramic Capacitors (HVCC), especially the ones working under repetitive pulses, is of great importance, which influences the overall stability of pulsed power system. However rare relevant studies were made under the conditions of repetitive rate pulse. In order to realize the accelerated lifetime testing for HVCC, a high voltage, high current repetitive pulsed power system was developed.

This system consists of a repetitive pulsed power supply and a short-circuit testing cavity, whose repetition frequency and output voltage can be regulated easily. The supply is based on high power pulse forming technology with the magnetic pulse compressor as the core. The supply is composed of a primary oscillator circuit, a two-stage magnetic pulse compression network and two HV pulse transformers. For its output, the rise time is ˜10μs and the amplitude is more than 70kV with the highest repetition frequency up to 50Hz. The elaborately designed short-circuit testing cavity is very compact in which SF6 gas can be charged more than 1.0MPa. A Rogowski coil is integrated into the cavity. The short circuit current is up to 20kA with the 2.5nF capacitive load. This repetitive microsecond pulsed power system is integrated and installed in a portable box which can realize the scale-up production.

With this system, the accelerated lifetime test for HVCC was conducted, and the lifetime characteristics at different voltage levels under 25 Hz repetitive rate pulse and two kinds of failure modes were studied. Based on the experimental results, several measures were taken to improve the performance of HVCC. The lifetime was extended greatly from thousands of times to more than a hundred thousand times. Furthermore, this system, with extensive applications, is also used to test the performance and lifetime of pseduospark switches and surface flashover properties of PEEK sheets.

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