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2P68 - Design of a Dielectric Compression Bushing for Compact, High-Voltage Applications

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High voltage insulation methods that can easily be assembled and disassembled are of use on compact pulsed power systems. High voltage isolation systems are a key element for reliable pulsed power operation. Verus Research's Dense Plasma Focus (DPF) system, under development as a radiation test source for the U.S. Army, requires an electrical-mechanical interface that can withstand a minimum of 100 kV peak voltage in air, during nominal operation over a small distance. A solid dielectric compression washer was used to make a critical seal providing high voltage isolation. A layered design constructed of thin Kapton film was fabricated to provide a long tracking path and sufficient dielectric strength with minimal inductance to prevent failure of the bulk material and transfer electrical stress upon the high voltage compression region. A test apparatus was designed and fabricated to test the failure point, and to identify the failure mechanisms. Multiple materials, such as silicone and urethane, as well as different compression concepts were tested to failure using the test apparatus and a 1 stage MARX to generate a high voltage pulse up to 200 kV for the test. Results from electrostatic modeling and empirical testing of the high voltage designs are presented here, as well as findings for the leading breakdown failure mechanism.

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