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A High Repetition-rate Bipolar Nanosecond Pulse Generator Based on Magnetic Pulse Compression System

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Magnetic compression system (MPC) is suitable for generating (Dielectric Barrier Discharges) DBD discharge due to its capability of producing high amplitude and short pulses voltage wave. Because of the frequency limit caused by magnetic core reset, and the high DBD discharge voltage, which is often up to several tens kV under the low-frequency unipolar voltage wave, this paper proposes a high-frequency bipolar magnetic compression system to study the discharge characteristics. First, the principle of bipolar MPC is explained, which is based on full bridge inverter circuit, pulse transformer, and magnetic switch. Besides, the system is designed by calculation. Then, a simulation based on PSPICE is implemented to testify the feasibility and study the impact factors of amplitude and rising time of the load voltage waveform. Finally, the measured waveforms are obtained from experiment device and the discharge phenomena under different conditions are compared. As a result, the nanosecond pulse generator produces a pulse on a resistor load, with an amplitude of 0–10 kV, a rise time of approximately 100ns, a repetition frequency of 0 to several kHz. Although the DBD discharge is influenced by multiple factors, the pulse repetition frequency and polarity impact greatly. The preliminary experimental data show the effects of the voltage amplitude, repetition frequency, and bipolar pulse. It confirms that the generator can provide a good performance on homogeneous discharge, compared with AC, and low discharge voltage, compared with unipolar pulse. The successful development of the system will facilitate deeply study on bipolar high frequency DBD discharge.

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