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The characteristics of repetitive frequency discharge of Plasma Synthetic Jet Actuators

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Characteristics of plasma synthetic jet (PSJ) actuators driven by repetitive pulsed discharge have drawn much attention. In this paper, the PSJ actuator is composed of a pair of tungsten electrodes and a boron nitride cavity without a cap. The cavity has a diameter of 8 mm and volume of 400 mm^3. The distance between two electrodes ranges from 1 mm to 4 mm. A homemade generator CMPC-40D is used to excite the PSJ actuator. It can provide a pulse with an amplitude of 30 kV, a rise time of 0.5 μs, a pulse width of 8 μs, and a repetition rate ranges from 0 to 5 kHz. Effects of pulse repetitive frequency (PRF) and air gap spacing on the discharge characteristic of a single actuator are investigated. Experimental results show that the breakdown voltage increases with the increase of the gap spacing, but decreases with the increase of the PRF. During the ignition time, the discharge voltage falls to zero in a few nanoseconds and the current discharge is damped sinusoidal oscillation. We observe that the energy dissipation oscillates in time, for total discharge energy of 2 to 10 mJ. The energy decreases with the increase of the PRF, but increases with the increase of the gap spacing. Furthermore, three actuators in series connection are studied. Experimental results show that synchronous discharge could be achieved for three actuators, the actuator closed to ground breakdown first, and then the middle one, and finally the actuator near the anode. The delay time is about 50 and 10 nanoseconds, respectively.

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