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Nanosecond repetitive pulsed discharges under turbulent flow in atmospheric air flow

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The research of nanosecond repetitive pulsed discharges has received extensive attention [1-2]. It is valuable to study on gas discharges under the airflow, as well as flow control, discharge mode, etc. In this paper, we are focus on the discharges under motion law of charged particle of nanosecond pulsed discharges in the vortex flow, applied voltages and repetitive frequencies.

FIG. 1. Schematic of experimental setup.
This experimental setup is schematically shown in Fig. 1, which consists of DBD (dielectric barrier discharge) configuration, detour flow configuration and airflow system.
The turbulence intensity and pressure of flow field under detour flow configuration obtained from the fluent model are visualized in Figure 2（b）and Figure 2（c）.The intensity and pressure of flow field have a periodic change and the simulation results are common to Karman Vortex Street. The discharge photographs are captured by a high speed camera with 1/1000 s exposure time in Figure 2（c）.

（a）（b）（c）
Fig.2 Experimental and Simulation Results
（a）The simulation of turbulence intensity（b）The simulation of pressure
（c）The patterns of discharge
For the voltage amplitude of 20 kV and frequency of 1000 Hz, top view images of DBDs like simple-harmonic wave that has periodic change good agreement with the simulation results. When the discharge is generated in detour flow, it presents as a bunch of parallel filaments distributed in the discharge gap. The spatial distribution of microdischarge is significantly influenced by detour flow effect. Therefore, nanosecond repetitive pulses of the discharge can be affected by detour flow under the condition of a certain voltage amplitude and frequency.
[1] De-Zheng Yang . APL 102, 194102.
[2]M. S. Bak. APL 98, 011502.

Authors: TANG, Miao (Harbin Institute of Technology); Mr YU, Daren (Harbin institute of Technology); Mr ZHANG, Chaohai (Harbin institute of Technology)

Co-author: Mr TANG, Jingfeng (Harbin institute of Technology)

Presenter: TANG, Miao (Harbin Institute of Technology)

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