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Corona based air-flow using parallel discharge electrodes

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Highlights

- A novel ion wind generator with corona discharge from parallel pins.
- Ion wind was created with very few net charge.
- Effect of electrode tips were studied.
- Effect of electrode separations were studied.
- The ion wind speed has linear relationship with both square root of the discharge current and with discharge voltage.
- Three dimensional simulation in OpenFOAM has well agreement with experiment.

Abstract

A novel air-flow generator based on the effect of ion wind has been developed by the simultaneous generation of both positive and negative ions using two electrodes of opposite polarity placed in parallel. Unlike the conventional unipolar-generators, this bipolar configuration creates an ion wind, which moves away from both electrodes and yields a very low net charge on the device. The electro-hydrodynamic behaviour of air-flow has been experimentally and numerically studied. The velocity of ion wind reaches values up to 1.25 m/s using low discharge current 5 μA with the kinetic conversion efficiency of 0.65% and the released net charge of -30 fA, 8 orders of magnitude smaller compared with the discharge current. Due to easy scalability and low net charge, the present configuration is beneficial to applications with space constraints and/or where neutralized discharge process is required, such as inertial fluidic units, circulatory flow heat transfer, electrospun polymer nanofiber to overcome the intrinsically instability of the process, or the formation of low charged aerosol.

Keywords

Ion wind; Bipolar corona discharge; Neutralization; 3Dsimulation; OpenFOAM; Electrohydrodynamics

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