Electrohydrodynamic Gas Pump in a Square Channel with Two-Stage Corona Wind Generator

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***Abstract*—In this paper, the fluid flow within a square channel by a two-stage electrohydrodynamic (EHD) gas pump are examined using numerical simulation to seek the relation between the pump performance and number of stages. Using the finite difference and finite volume method respectively, the three-dimensional governing equations for the electric and flow fields are solved. EHD-induced (i.e. Corona-driven) flow in a square channel is calculated first, and its results are compared with the collected experimental data to validate the computational code. This study is implemented for a two-stage EHD gas pump, each stage with three emitting electrode configurations: 4, 12, and 28 respectively with 0.5-inch wide grounded electrode for a wide range of operating voltages starting from the corona threshold voltage up to 24 kV for further improvement in its performance over a single-stage one. Both corona current and corona wind velocity inside the channel are obtained for operations using positive corona discharges. The numerical results enable vivid flow visualizations inside the channel, providing a great understanding of the development of the induced flow. The performance of the EHD gas pump is then evaluated against that of conventional fans used in personal computers. The results of the numerical study show that EHD technique has a great potential for many engineering applications.**