Electrostatics 2007 IOP Publishing
Journal of Physics: Conference Series **142** (2008) 012061 doi:10.1088/1742-6596/142/1/012061

Particle Image Velocimetry Measurements of Wire-non-parallel Plate Induction Fan Type Electrohydrodynamic Gas Pump

M. Kocik[1,2], J. Podliński[1], A. Niewulis[1], J. Mizeraczyk[1,3], H. Tsubone[2] J.-S. Chang[2]

[1]Centre for Plasma and Laser Engineering, The Szewalski Institute of Fluid Flow Machinery, Polish Academy of Sciences, Fiszera 14, 80-951 Gdańsk, Poland

[2]McIARS & Department of Engineering Physics, McMaster University, Hamilton, Ontario, L8S 4M1, Canada, **kocik@imp.gda.pl**

[3] Department of Marine Electronics, Gdynia Maritime University, Gdynia, Poland

Abstract. 2D and 3D PIV measurements were performed in wire-non-parallel plates type EHD gas pump. The velocity distribution of generated flow was measured for various discharge conditions. The flow rates of generated flow were calculated by integrating 3D velocity profiles. The results showed that the present EHD gas pump is capable to generate fl flow rates of several hundred cm^3/s.

1. Introduction

When a strong electric field is generated between a sharp object at high voltage and a grounded electrode in a gas medium, a corona is formed resulting in ionization of the gas molecules. An organized ion flux in an electric field initiates an ion-driven wind of neutral molecules (electrohydrodynamically induced gas flow) is generated. When the electrodes configuration results in unsymmetrical electric field distribution, the unidirectional gas flow can be generated i.e. EHD gas pumping Several electrodes geometries have been proposed for EHD gas pumps, such as needle-to-mesh, needle-to-ring, wire-to-rod, wire-non-parallel plate etc. In this paper the particle image velocimetry (PIV) technique was used to measure the flow velocity generated by the wire-non-parallel plate type EHD gas pump. It was already demonstrated that the PIV is able to measure flow velocity fields in similar discharge conditions [1].

2. Experimental set-up

The EHD gas pump was made of transparent acrylic sheet of thickness of 1 cm. The internal dimensions 120x35x50 mm. Two engraved slits with 3° conversion angle were made in two sidewalls. Two plates supporting grounded electrodes could slide-in and off in the engraved slits. When the supporting electrodes were placed in the EHD gas pump body, the cross sections of pump exit and inlet were of 35x24 mm and 35x12 mm, respectively. The grounded electrodes (75x35 mm) were made off aluminum tape of thickness of 50 μm and placed onto the supporting plates in the desired position. The wire electrode was stainless-steel wire of diameter of 0.23 mm and width of 35 mm placed in between the plate electrodes. Changing the electrodes geometry (both, wire and grounded electrodes) affects the pump performance, even can change direction of generated flow [2]. In this paper the one position of corona wire electrode (21 mm from pump inlet) and one position of grounded electrodes (36 mm from pump inlet) are investigated. The EHD gas pump was placed