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Application of the EHD Flow to a Pump

Tetsuhiro Tsukiji, Taisei Tajima, Rei Suzuki
Sophia University
7-1 Kioi-cho, Chiyoda-ku, Tokyo, Japan
t-tukiji@sophia.ac.jp

Extended Abstract

EHD (Electro hydro dynamics) phenomenon is known as the induced flow of an EHD fluid in the presence of an electric field. One of the application of the flow is the pump for EHD fluids. Although EHD pumps have been studied in recent years, simplifying their structure to improve their efficiency and compactness remains an important challenge.

On the other hand, the design of the electrode to apply the voltage to the EHD fluid for the pump is very important to develop the characteristics of the pump. Many electrode shapes were designed in various research organizations and have been tested.

Thus far, we have been researching EHD pumps based on cylindrical electrodes developed by our previous study[1][2]. For such a geometry, the total circumference length of the edge of the holes in the electrode that generates the rotational flow is small, resulting in a small one-directional flow velocity. Therefor the multi-holes electrodes were developed to increase the circumference length [3][4]. However, it has not been lead to practical use yet.

In the present study, our aim is to investigate the shape of the electrode on the flow velocity under application of the electric field using simple flow channel for flow visualization, and on the pressure-flow rate characteristics of the pump. Our pumps are structurally simple, easy to fabricate, and the flow direction can be reversed by simply swapping the positive and negative electrodes.

The main conclusions of this study are as follows:

1. For a given applied voltage, increasing the number of the electrode pair and the non-symmetric configuration of the electrodes are very useful to increase the velocity of the EHD fluids.

2. Using HFE-7100 as the EHD fluid in the pump using the hole electrode, an approximately linear relationship was found between the pressure and flow rate.

3. The maximum flow rate of the pump can be increased by increasing the area of the hole of the electrode at the constant length of circumference of the hole.

4. To increase the maximum pressure of the pump, increasing length of circumference of the hole of the electrode at the constant area of the holes of the electrodes is very effective.

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