

Research and Development of Circular Pipe Pump using EHD Fluid

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ABSTRACT

Three different methods of EHD (Electro-hydro-dynamics) pumping such as ion-drag, induction and conduction are known. The ion-drag pumps show the higher flow rates compared with other two types of pumping. From the merit of the ion-drag pump the researches about EHD ion-drag micro-pump have been performed [1], [2].

In the present study the circular pipe EHD pump with circular pipe electrodes unlike a pump shape developed in the past is proposed for the applications such as in small scale liquid cooling systems. This small scale technology can be thought to be applied for microscale system. Our pumps are structurally simple, easy to fabricate, and the flow direction can be reversed by simply swapping the positive and negative electrodes.

At the first, the induced flow between electrodes is explained under application of the electric fields. The distributions of the velocity, the electric force and the charge density, which are obtained by the numerical method near the electrodes are shown and the numerical results are confirmed by the experimental flow visualization. From the results, it is found that the one directional flow can be generated in some range of the electrode configuration.

In the next, the small pump based on cylindrical electrodes developed to utilize previous research and to induce one directional flow is explained [3]. Finally, we produced the pumps in which the electrode contains multiple holes to increase one-directional flow velocity and the load pressure [4]. We measured the pressure-flow rate characteristics of multi-holes electrode pair pumps and compared their performances.

As a result, the mechanism to induce one directional EHD flow near the electrodes under application of the voltage is understood clearly and the influence of the electrode shapes and the configuration, on the pressure-flow rate characteristics of the present pump is shown.

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