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Two-color μ-PIV for Measurement of Electrokinetic Flow Phenomena in Microchannels

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Electroosmotic flow (EOF) is applied to various microfluidic devices as an effective method of transporting liquids and molecular species. There are difficulties in the measurement of EOF using micro particle image velocimetry (μ-PIV) itself, since the flow of particles are affected by both electroosmosis and electrophoresis. Although Devasenathipathy and Santiago(1) demonstrated measurement of EOF by the use of data taken from μ-PIV and the numerically obtained electrophoretic flow, the validity was not confirmed due to the lack in the experimental data of electric field and electrophoretic flow.

In this paper, we present a novel two-color μ-PIV for the measurement of electric field and electrophoretic flow. Two kinds of particles which have different mobility are used as seed particles to visualize the flow. The electric field is successfully obtained from the velocity difference between them. The demonstration of experimental prediction is conducted in a T-shaped microchannel, which consists of two rectangular channels of 50 μm$\times$100 μm in cross section and 5 mm in length as shown in Fig. 1. Electric voltages are applied to be 5.0 V. Figure 2 shows the comparison of electric potential distribution between the numerical and experimental predictions. Left half of Fig.2 shows the experimental prediction obtained by the proposed method and right half is numerical one. The experimental prediction quantitatively agrees with the numerical result. This suggests that the proposed method is applicable to measure the local electric field in microchannels.

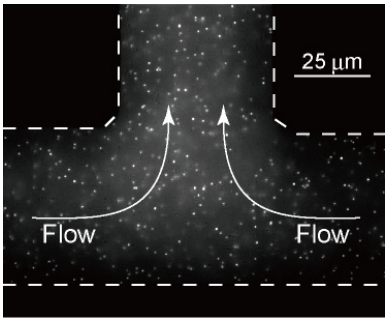

Figure 1: Photograph of fluorescent micro particles at junction of T-shaped microchannel

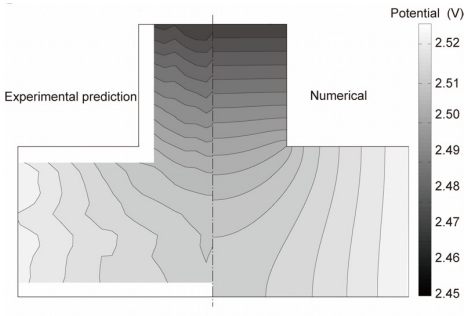

Figure 2: Comparison of electric potential between experimental and numerical result

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References

1. Devasenathipathy, S.; Santiago, J.G. (2002): "Particle Tracking Techniques for Electrokinetic Microchannel Flows", *Analytical Chemistry*, Vol. 74, pp. 3704-3713.