

Title	Simultaneous measurement of internal and surrounding flows of a moving droplet using multicolour confocal micro-particle image velocimetry (micro-PIV)
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Abstract	<p>This paper presents a micro-multiphase flow measurement technique, 'multicolour confocal micro-particle image velocimetry (PIV), and its application to the internal and surrounding flow measurement of a droplet moving through a microchannel. The present system measures the dynamic interaction between flows in two different phases, such as solid–liquid or liquid–liquid, simultaneously and separately. Unlike conventional confocal micro-PIV, this system features a wavelength separation optical device. The optical components (e.g., filters and dichroic mirror) are designed to separate fluorescent lights of tracer particles and to eliminate unnecessary scattered light depending on the characteristic wavelengths. The system can record a sequence of images at up to 2000 frames per second. It also has an in-plane spatial resolution of 0.284µm/pixel in a field of 227.2µm × 170.4µm and a confocal depth of 3.43µm using Ø1.0µm particles and a 40× objective lens. This paper examines the performance of the present system, such as its ability to separate wavelengths. Furthermore, this system is applied to liquid–liquid two-phase flow, which consists of a water droplet and surrounding oil flow, in a microchannel. We succeeded in measuring each phase movement separately and simultaneously. As a result of the estimation of the out-of-plane velocity component, a three-dimensional flow structure is obtained and the interaction between each phase is investigated</p>
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