SIMULTANEOUS MEASUREMENT TECHNIQUE OF DISSOLVED OXYGEN CONCENTRATION AND VELOCITY FIELD USING OXYGEN SENSITIVE PARTICLE IN MICROCHANNEL

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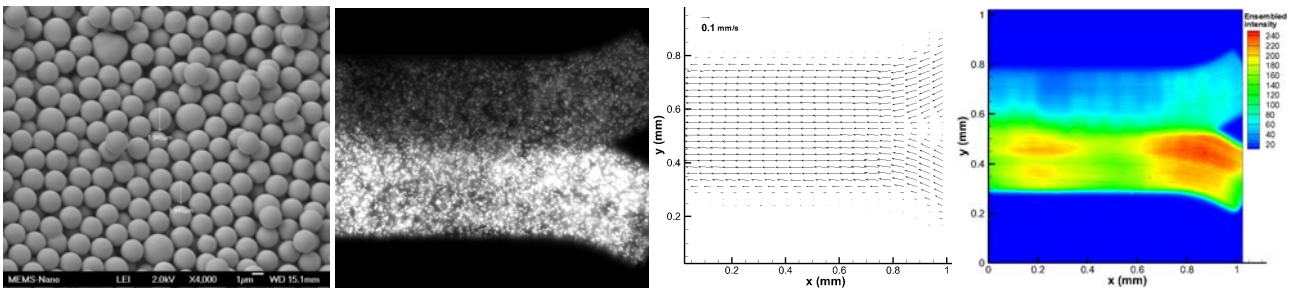
KEYWORDS:

Main subjects: simultaneous visualization of velocity and concentration field
Fluid: Microchannel flow, water
Visualization method(s): Laser Induced Fluorescence, Particle Image Velocimetry
Other keywords: oxygen sensitive particle, UV LED**,** dissolved oxygen concentration

ABSTRACT: This study introduces a simultaneous measurement technique of dissolved oxygen concentration and velocity field in a microchannel using oxygen sensitive functional particles. Oxygen sensitive particles (OSParticle) were fabricated by dispersion polymerization method for using the particles as oxygen sensors and PIV tracers. Diameter of OSParticle distributed in the range of 3 ~ 4 μm and could be controlled by adjusting the amount of Azoisobutyronitrile (AIBN) reagent. The oxygen concentration and flow velocity simultaneous measurement were carried out in the Y-shaped microchannel by injecting water samples with two different DO concentration using a double loading syringe pump. Water samples having DO values of 0% and 100% were prepared prior to the experiments. UV LED with wavelength of 385 nm was used as a light source and phosphorescence OSParticle images were stored using a CMOS high speed camera with an olympus BX51 microscope system. 20x objective lens and a 590nm long-pass optical filter were adopted to remove excitation light and image noises. With the Stern-Volmer equation of the luminescence of OSParticles with respect to the DO concentration obtained by the in-situ calibration, the DO concentration field over the whole channel area can be quantified. The velocity vector field inside of Y-shaped microchannel was extracted from the phosphorescence particle images using conventional two frame cross correlation algorithm.



(a) (b) (c) (d)

Fig. 1 SEM image of oxygen sensitive particle (a), phosphorescence image of oxygen sensitive particle in a microchannel (b), velocity field extracted from phosphorescence particle images (c), ensemble averaged phosphorescence intensity distribution (d)

References

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