Development of Micro Optical Diffusion Sensor Using Novel Interference Excitation Method

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This research reports the feasibility study of novel interference excitation method for the point-of-care testing (POCT) device using micro optical diffusion sensor (MODS). The diffusion coefficient is important parameter for the analysis of the conformation changes of the biological samples such as protein. Miniaturized one-chip sensing device which achieves a high-speed and high-sensitivity measurement of the diffusion coefficient would be applied to medical, drug development and biochemical field. In order to gain the signal-to-noise ratio drastically and detect the diffusion phenomena optically, it is important to create the high-contrast lattice-shaped concentration distribution of the small biological sample that experiences weak dielectrophoretic (DEP) force. We have newly proposed a fringe spacing control technique so as to concentrate the sample. By narrowing the fringe pattern of excitation laser in micrometer order continuously, the small sample is trapped and concentrated by dielectrophoretic force, and thick concentration distribution is induced. Consequently, we can gain a sufficient diffraction efficiency of the concentration grating. In this study, the preliminary measurement for the concentration method has been conducted. We have newly built a bench top apparatus which can change the width of interference fringes in micrometer order at the same sample area. The apparatus is composed of the mirror mounted on the automatic *x*-axis stage which controls the optical path and the lens which can control incidence angle of the excitation laser. The signal intensity excited by the concentration technique was successfully improved because the thick concentration distribution was generated. As a result, the validity of our proposed interference excitation method has been experimentally confirmed.