Diffusion Coefficient Measurement of a Liposome using a Micro Optical Diffusion Sensor

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Recently the aggregation properties of nanoscale particles are gathering attention. For example, antibody drugs are the systems where such properties are important. Antibody pharmaceuticals are medicines that utilize reactions with strong binding properties called “antigen-antibody reactions” specific to proteins. This type of medicine has a higher therapeutic effect and a smaller side effect than a chemical one, and it is expected to be effective against diseases that have been difficult to treat. However, nanoscale particles such as proteins are characterized as being very easy to agglutinate, and this aggregation is considered to adversely affect the drug efficacy and safety. The surface state of the particles is a dominant factor for the particle aggregation, but the mechanisms of the aggregation are still unknown. The western blotting or ELISA are well known methods to evaluate the surface conditions, however, these methods take a long time. The diffusion coefficient is a parameter reflecting the surface condition of nanoscale particles. Therefore, a Micro Optical Diffusion Sensor (MODS) has been developed to measure the diffusion coefficient of nanoscale particles. By combining MEMS technology and laser-induced dielectrophoresis (LIDEP), MODS can measure the diffusion coefficient at high speed, with a small sample volume and without pre-treatment. In this study, liposomes are selected as measurement samples. A liposome is a particle consisting of a lipid bilayer membrane, which is the same component as the cell membrane. It can enclose various substances inside and is regarded as a substance close to a biological particle that can be handled easily. Our research aims to investigate the aggregation characteristics by measuring the diffusion coefficient of the liposomes under the conditions of various surface compositions with differences of the intermolecular interaction or electrical interaction by using our state-of-the-art sensor.