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Quantitative Analysis of Protein-Ligand Interactions on Poly(amidoamine) Dendrimer Monolayers by ToF-SIMS

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Quantitative analysis of biomolecules on surfaces is essential for various applications of biosensor and biomaterial engineering. In particular, it is necessary to quantitatively study protein-ligand interactions in various environmental conditions. Recently, static time-of-flight secondary ion mass spectrometry (ToF-SIMS) has been an increasingly popular way of investigating adsorbed proteins due to its chemical specificity and surface sensitivity. However, there are few systematic quantification studies of protein-ligand interactions due to the complex matrix effect and low molecular secondary ion efficiency from biomaterials. For the present work, we will show that it is possible to produce a quantitative study of the protein-ligand interaction using ToF-SIMS. As a model system, the interaction of the streptavidin and biotin-functionalized surface is studied as a function of streptavidin concentration. The biotin-functionalized surface is made by a covalent bond formation between the biotin and amine group of G3 PAMAM dendrimer, which is also covalently bonded to a carboxy group of MUA SAM on a gold surface. Instead of SAM amine surface, the G3 PAMAM dendrimer is used due to its property of elevated binding interaction for biomolecules. To show the usefulness of the ToF-SIMS technique, the results of the ToF-SIMS measurements are compared to those of surface plasmon resonance (SPR) measurements.