In-situ characterization of well-arranged biomolecules on smart surfaces fabricated by scanning probe lithography

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The surface immobilization of bio-macromolecules, such as proteins and cells, has long been a goal in biosensing, biomaterials, and tissue-engineering research and for use as detection systems, or as simplified model systems to study biointeractions. Patterning biomolecules at the nanometer scale gives a significant potential for studying how biological systems function at the macromolecular length scale. Herein, we combined the scanning probe lithography (SPL) with self-assembly method and/or wet etching method for the fabrication of positive and/or negative 3D micro/nano-structures. These prepared smart surfaces via SPL were then used to achieve site-selective arrays of biomolecules. In this study, we arrayed bio-molecules on the pre-fabricated silicon structures, even a single molecular level. In addition, direct observations of immobilized biomaterials were performed by real-time AFM imaging and tip-induced force-distance curve measuring. These studies provide understanding on characteristics and behaviors of biomolecules through visualization and manipulation at the single molecular level.