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Biomacromolecule immobilization and self-assembled monolayer chemistry on atomic layer deposited metal oxide materials

MAGNUS BERGKVIST, College of Nanoscale Science and Engineering, University at Albany - SUNY

Many biotechnology applications involve interfacing proteins, DNA and other macromolecules to non-biological material surfaces acting as supports. Support materials employed for this purpose span the periodic table and range from polymeric membranes/hydrogels to metals and ceramics, for example gold and hydroxyapatite. Lab-on-a-chip and other sensing/detection applications based on lithography and semiconductor technology typically rely on alkanethiol and organosilane chemistry to immobilize biological material to gold and silica. While successful in many instances, organosilane chemistry offers limited options for orthogonal chemistry and often results in multilayer film buildup. Self-assembly on gold is straight forward but gold is often undesirable from a device perspective. Recent developments in atomic layer deposition (ALD) allow fabrication of high quality thin films of alumina and high-k oxide materials that are compatible with clean room operations and are interesting emerging materials for integrated optical, electronic and biological applications. Here we will show alternative self-assembly chemistries on ALD materials for biological immobilization than those used on gold/silica and also demonstrate direct biological interfacing to high-K materials for potential use in bioscreening and detection.