**OP8B-1**

Aptabodies immobilized on carbon nanotubes - new artificial receptors for detection of proteins

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**Introduction:** DNA/RNA aptamers are in vitro synthesized single stranded nucleic acids with high affinity to proteins or to other low and macromolecular compounds, which is comparable with affinity of antibodies. So far used aptamers were based on single stranded DNA, thus had only one binding site for the ligand. Here we report simple method of molecular engineering based on well known properties of DNA to hybridize in solution with complementary strand. We designed so-called aptabodies, that in contrast with traditional aptamers contains two binding sites.

**Methods:** We used novel thickness shear mode acoustic methods (TSM) for characterization of the properties of the aptamers at the surface. The electrochemical quartz crystal microbalance (EQCM) was used for preparation of carbon nanotube layers (MWNTs) by electro-polymerisation and for detection thrombin – aptamer interactions. We prepared also neutravidin layers chemisorbed at gold for immobilisation of biotinylated aptamers. We used known aptamer that bind thrombin in its fibrinogen binding site: 5'- GGT TGG TGT GGT TGG TTT TTT TTT TTT TTT 3'-BIOTIN. Hybridization of this aptamer with complementary supporting part: 3'- GGT TGG TGT GGT TGG AAA AAA AAA AAA AAA 5' resulted in formation of aptabody.

**Results:** The layers with immobilized aptabody were thicker due to different conformation of single and double stranded aptamers. This suggests that aptabodies are oriented normally to the surface while single stranded aptamers had no preferred orientation. Addition of thrombin resulted in decrease of resonance frequency which saturated at larger thrombin concentrations (100 nM). These changes were higher for aptabody in comparison with single stranded aptamer. Using Hill plot we determined the binding constant for aptabody: (2.76 ± 0.38) x 10^4 M^-1, which suggest stronger binding of thrombin to aptabodies. The limit of detection (LOD) for thrombin for aptabody was 0.3 nM, while 0.9 nM for single stranded aptamer. The LOD for aptamers immobilized on neutravidin layer was much higher: 4 nM.

**Conclusion:** The nanofabricated sensor based on aptabody and MWNTs allowed us to detect thrombin with detection limit three times better in comparison with conventional single stranded aptamer. The results obtained by TSM method confirmed assumption on different configuration of single stranded aptamer and aptabody at the surface.

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**OP8B-2**

Targeted self assembly of quantum-dot nano-emitters using genetically engineered inorganic binding peptides

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**Introduction:** Genetically engineered peptides for inorganics (GEPI) are solid-binding peptides selected using combinatorial biology techniques, using both cell surface and phage display libraries. These peptides with short amino acid sequences (7-15) offer unique opportunities in synthesis and formation of nanomaterials, and, in particular, targeted assembly on multi-material patterned surfaces. Material components in the microchips utilized in optoelectronic and photonic devices are generally composed of at least three different materials: a semiconductor (e.g., GaN), a conductor (Au), and a non-conducting material (SiO2). The efficacy of micro- and nano-fabrication of such systems is directly related to the ability for the specific assembly of nanomaterials on spatially desired locations during device fabrication.

**Results:** Utilizing biotinylated silica-binding dodecapeptides, we directed assembled streptavidin coated quantum dots on micro-fabricated LED chips for controlled chromaticity. Our results showed that quantum dots were self assembled specifically only on silica regions and neither on the metal electrode nor the semiconductor, resulting in no adsorption from neither Au nor GaN on LED.

**Conclusion:** One of the everlasting challenges in building nanostructures is the ability to control and self-assemble nano-components on patterned substrates. Traditionally available chemical surface modification methods and the use of chemical linkers are not selective enough for assembling nano-components on multi-material surfaces. A novel silica binding peptide, a member of newly developed GEPIs, as demonstrated here, serve as molecular linker and enable the targeted assembly of the nanomaterials on desired surfaces with a high degree of affinity and specificity leading to device functions.