Directed Assembly of Nanoparticles for Biosensing Applications

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Abstract

There is a need for multifunctional nanosystems for the simultaneous monitoring of a variety of biomarkers in biological fluids to assess the progress of disease, toxicity, stress, etc. Further, the use of such devices for multidrug release in real time disease treatment is an important goal. The detection of biomarkers in combination with controlled drug release represents an exciting long term application of multifunctional nanosystems. Northeastern University's NSF Nanoscale Science and Engineering Center for High-rate Nanomanufacturing (CHN) has developed a new process for selective assembly of nanoparticles into designated nanotrenches to yield structures for such multipurpose devices. The Center (CHN) is developing tools and processes that will enable high-rate/high-volume bottom-up, precise, parallel assembly of nanoelements (such as carbon nanotubes, nanoparticles, etc.) and polymer nanostructures. The center has developed and fabricated templates with nanostructures and used them to direct the assembly of nanoparticles (down to 10 nm) into nanoscale trenches (down to 30 nm) in a short time (30-90 seconds) and over a large area (> 2.25 cm^2). The nanoscale chips allow nanoparticles of a specific size to be locked in designated nanotrenches of a given dimension. Nanoparticles of the correct size in each trench can be coated with specific antibody such that the whole chip can represent a multifunctional biosensor. The feasibility of this new design for biomarker monitoring will be tested in vitro and in vivo (as part of an intravenous catheter) to determine detection limits, bio-fouling protection and effectiveness. .