Polymer-Nanostructure Composition For Selective Molecular Recognition
Technology #19817

Applications

This technology is a carbon nanotube-polymer conjugate that allows molecular recognition by binding and detecting specific molecules. This technology has potential applications in biological, environmental, or industrial sensing.

Problem Addressed

Specific molecular binding and recognition is important in biological, environmental, and industrial sensing. Molecular recognition is a common property of biomolecules such as proteins and antibodies, and scientists often use engineered antibodies as molecular recognition tools. However, antibodies are expensive to produce, are very fragile, and cannot recognize many types of molecules such as toxins and small molecules. Additionally, measuring antibody binding can be challenging since the only way to recognize a binding event is to add further functionalization, such as including a fluorophore. These inventors have developed a molecular recognition platform that binds to specific molecules and simultaneously provides a simple photoluminescent readout. Importantly, this technology can be altered to tune analyte binding affinity or to recognize different analyte compounds.

Technology

This technology uses polymer adsorbed to single walled carbon nanotubes as molecular recognition molecules. Single walled carbon nanotubes (SWNTs) are composed of single layers of graphene rolled into nanometer-scale cylinders. SWNTs have well defined optical properties, including non-photobleachable near IR fluorescence. When polymer is adsorbed onto the surface of the SWNTs, a complex 3D structure is formed that allows specific binding of different molecules. Changing the identity of the polymer allows different molecular binding specificity and slight modifications to the polymer tunes the binding affinity to the molecule. When molecules bind to the polymer-SWNT complex the photoluminescent properties of the complex change, which allows detection of bound molecule. The polymer-SWNT complex therefore provides a new way of detecting molecular analytes by binding specifically to the analyte molecule and simultaneously producing an optical readout of analyte presence. The inventors performed three proof of principle experiments and showed that different polymers were able to facilitate binding and detection of riboflavin, L-thyroxine, and nitric oxide.

Advantages

- Customizable system for detecting molecular analytes
- Tunable analyte specificity and binding affinity through modification of polymer
- Potential to detect molecules untargetable using antibodies or other methods
Categories For This Invention:
Materials
Micro & Nanotech
Biotechnology
Industrial/Energy
Environment
Research Tools

Intellectual Property:
Polymer-nanostructure composition for selective molecular recognition
US Patent Pending
2017-0328890

Inventors:
Michael Strano
Jong Kim
Paul Barone
Daniel Heller
Jingqing Zhang

Publications:
Molecular recognition using corona phase complexes made of synthetic polymers adsorbed on carbon nanotubes
Nature Nanotechnology
2013

External Links:
Strano Group
http://srg.mit.edu/