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Highly selective and sensitive biochemical detector for medical applications

We consider that novel biochemical sensor based on the charge transfer between detector's semiconductor nanostructures and analyte molecules that will be detected. It is an original concept that relies on the tunneling between an analyte molecule and the discrete energy levels of the detector's nanostructures. The energy levels in nanostructures, which depend on quantum confinement and external effects, are tailored to mimic the energy levels of the analyte to be detected. Charge tunneling between the detector's nanostructures and the analyte will occur only if the analyte has the energy levels matching the energy levels of the detector's nanostructures. This completely new concept for biochemical sensor, which leverages the unique properties of nanostructured materials and design and optimization of detector's nanostructure's, provides label free detection and identification of a wide range of analyses, with single molecule sensitivities. Such unique detection method allows for continuous, instantaneous real time, high selectivity, high sensitivity, miniature *in situ* characterization device that could be implemented for various medical applications. The sensor may be a standalone unit, or it can serve as a part of an instrument, enhancing selectivity and sensitivity of that device. Discussed will be modeling of the optoelectronic properties of nanoscale materials and QDs for realistic QD detector ensembles, including the study of collective effects on energy level spectra and charge transfer processes between nanostructures; its application for detection in fluids; and the production of the sensor components and the final prototype device in our nanotechnology laboratory.

Biography

Branislav Vlahovic is the Director of the National Science Foundation Computational Center of Research Excellence, NASA University Research Center for Aerospace Device and NSF Center Partnership for Research and Education in Materials at North Carolina Central University. In 2004, he was awarded by the Board of Governors of the University of North Carolina Oliver Max Gardner statewide award for his research and contribution to science. He has published more than 300 papers in peer reviewed journals on: Nanotechnology, Nanostructures, Tunneling and Charge Transfer between Nanostructures, Pulsed Laser Deposition, Nonlinear Optics, Detectors and Devices, Nano Photonics, Semiconductor Structures, Photovoltaic, and Genomics.

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