359g Individually Addressable Conducting Polymer Nanowires for Fet Based Label-Free Sensing

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Most of the ligand-receptor binding assays require arduous process of labeling either the sensor or the analyte. On the other hand, sensors employing electrical signal for sensing purpose offer direct, real-time, rapid and label-free sensing. The electrical properties of such sensors can be further controlled using Field Effect Transistor (FET) configurations. Using an extra electrode as a Gate, the properties of the transducer material can be tuned for better sensitivity. As against conventional thin film based sensors, in case of one-dimensional nano-structures like nanowires, charge depletion/addition area covers almost the entire cross-sectional are of the nano-structure. Thus the signal and hence the sensitivity of the sensor can be improved.

The interest in identifying multitude of chemical compounds with high sensitivity and selectivity requires high-density nano electronic sensor with fabrication controllability and addressability of individual nano-structure. Recently we have developed a facile technique of fabricating and bio-functionalising individually addressable nanowires in one single step of electropolymerization. Using this technique, growth and confinement of individual conducting polymer nanowires between gold electrodes has been achieved using micro fabricated electrodes on Silicon wafers in individual and array configurations. By simple addition of biomolecules in the monomer solution, bio-functionalization of conducting polymer nanowires was also demonstrated. For biotin-avidin binding reaction, a simple resistance measurement- based sensor have shown response down to 1 nM concentration.

The sensitivity, dynamic range and detection limit is expected to be modulated with FET configuration. Fine-tuning the properties of gate potential-dependent conducting polymer, can lead to improved performance of the sensor. Further investigations are required for biomolecule functionalization and use as a FET sensor and integration of microfluidics with the sensor for better control of analyte dispensing mechanism.

Reference:

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