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Available Technologies

## Carbon Nanotube Nano-Electrode Arrays

### SUMMARY

Researchers at Pacific Northwest National Laboratory have developed a plasma-enhanced chemical vapor deposition method that allows the fabrication of low-site density-aligned carbon nanotubes (CNTs) with an interspacing of more than several micrometers. From these low-site density CNTs, the nanoelectrode arrays (NEAs) consisting of millions of nanoelectrodes per cm<sup>2</sup> with each electrode having less than 100 nm in diameter were successfully fabricated.

With the ability of CNTs to promote redox reactions of hydrogen peroxide and nicotinamide adenine dinucleotide (NADH), the CNT-NEAs could be used as amperometric biosensors associated with oxidase and dehydrogenase enzymes. The CNT-NEAs can also be used to detect aqueous-phase metal ions and drugs with high signal-to-noise ratio and low detection limits (in ppb), owing to the size reduction of each individual electrode and the increased total number of the electrodes.

The evaluations of the CNT-NEAs have been performed by cyclic voltammetry (CV) and square wave (SW) voltammetry techniques. The CV yielded excellent sigmoidal voltammogram for K<sub>3</sub>Fe(CN)<sub>6</sub> on the CNT-NEAs, which is a characteristic of microelectrodes having radial diffusion. The steady-state current arises because the rate of electrolysis approximates the rate of diffusion of analyte to the electrode surface. The scan rate-independent limiting current behavior of the nanoelectrode arrays indicates that there is no diffusion layer overlapping between the electrodes.

### Patents & Intellectual Property

- » Patent #: 7,452,452

### Technology Portfolio(s)

- » Materials Synthesis and Functionalization
- » Biosensors

### Potential Industry Applications

- » Chemicals
- » Computers & Electronics

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