Diamond biosensor for specific sequence of DNA with ultra-high sensitivity

Showing the potential application in detecting a variety of diseases and biomolecules

The Diamond Research Center has developed a method to fabricate vertically aligned diamond nanowires with 10 nm lateral spacing on conductive diamond surfaces and succeeded in high sensitivity detection of DNA (2 pM) with the electrochemical sensor based on the nanostructured diamond electrodes. Sensitivity two or three orders of magnitude higher in comparison with conventional sensors using gold or glassy carbon has been achieved. Probe DNAs (23 mer) were grafted on the apex of diamond nanowires. When target DNAs are complementarily hybridized with the probe DNAs to make double strand chains, redox current measured on the electrode is decreased since the surface area opened for electrolyte decreases. This is the mechanism to detect specific sequence of DNAs on this electrochemical sensor. Several sequence of DNA can be detected by changing arrangements of probe DNA. Furthermore, this technology is beneficial for detection/measurement for variety of diseases and biomolecules.

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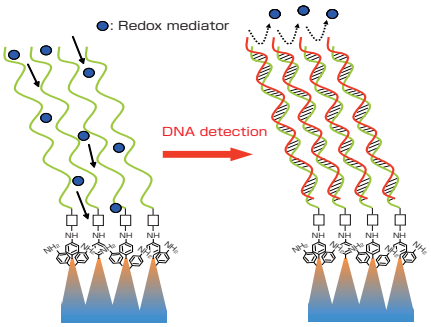

Conformation of linker molecules and DNAs fixed on diamond nanowire electrode and detection principal of DNA.

Lightweight hollow carbon fine particles produced from biomass

Elastic hollow fine particles resembling paper balloons

We have developed a new method for producing various lightweight hollow carbon fine particles (diameters ranging from several nanometers to several tens of micrometers) from lignin, which is a byproduct obtained in large quantities during the manufacture of paper or bio-ethanol, and inorganic salts. Global warming and depletion of oil reserves are issues of global concern; hence, it is desirable to use biological resources in place of fossil resources such as oil. In this method, lignin and inorganic salts are dissolved in water, and the solution is spray-dried to form fine composite particles; the particles are then pyrolyzed at 600 - 800 °C, washed, and finally dried to yield various lightweight hollow carbon fine particles. The forms of the hollow carbon particles depend largely on the kind of added inorganic compounds. The extremely lightweight hollow carbon particles of 200-ml in capacity weigh less than 3 g. Rubber or plastics can be reinforced by these lightweight materials instead of conventional carbon black.

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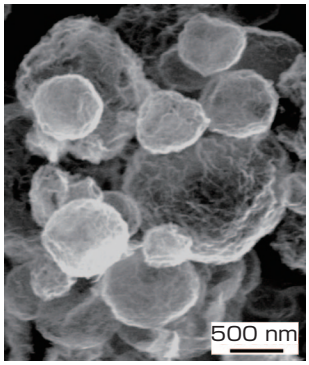

SEM image of ultra-lightweight hollow carbon fine particles