

## A strategy of surface design for detection sensitivity of CNT-FET biosensor

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In order to enhance the sensitivity of CNT-FET biosensor, we devised the surface of carbon nanotube which were modified with linker and spacer. The carbon nanotube surfaces were constructed from various mixtures of different molar ratios of 1-pyrenebutanoic acid, succinimidyl ester (Linker) to 1-pyrenebutanol. As a result, the CNT-FET biosensor in which the CNT surface was modified with 1:3 surface ratio of linker to space could detect 1 pg/mL (about 7 fM level), without labeling the target proteins. The advantage of surface design is the increase of immobilization efficiency because steric hindrance was reduced by surface modification. The detection scheme presented here, combined with the sensitivity of nanotube electronic devices, enables the production of a label-free ultrasensitive electronic biosensor for detecting clinically important biomarkers in disease diagnosis.