Current Nanoscience, vol. 9(2), 2013, pages 283-287

DNA hybridization detection using 5-nm polysilicon nanogap structure

Abstract

This report described a polysilicon nanogap biosensor for the detection of target DNA hybridization which is a key step in biodiagnostics, gene expression profiling, environmental monitoring and forensic investigation. The detection was performed with a low cost dielectric analyzer which measured the changes in capacitance, conductance and permittivity of the nanogap electrodes upon target DNA hybridization. A conventional lithography coupled with thermal oxidation-based size reduction technique was used to fabricate the polysilicon nanogap electrodes. A layer of self-assembled amine functionalities coupled with non-covalently adsorbed gold nanoparticles was added onto the nanogap surface to create a binding chemistry for the thiol-modified probe DNA and to enhance the detection signal. The hybridization detection discrimination among the complementary, noncomplementary and single mismatch targets was reflected through the differences in capacitance, conductance and permittivity profiles of the biosensor. The detection limit of the polysilicon nanogap biosensor was 5 nmol/L of target DNA.

Keywords

Capacitance; Conductivity; DNA detection discrimination; Nanogap biosensor; Permittivity