Ultrasensitive electrical DNA identification with bio-bar-code DNA and nanoparticles in nanogap device

Chang T.-L., Liou D.-S., Lin H.-Y., Chang F.-Y., Chen P.-H.

Mechanical and Systems Research Laboratories, Industrial Technology Research Institute, Hsinchu 310, Taiwan; Department of Mechanical Engineering, National Taiwan University, Taipei 106, Taiwan

Abstract: An electrical detection method for an ultrasensitive approach to identify DNA strands with self-assembled multilayer gold nanoparticles (AuNPs) in nanogap device is presented. This approach provides high selectivity with sensitivity that can be comparable to nanogap sensing on-chip system without the need of polymerase chain reaction (PCR) amplification. The concentration of target DNA is amplified at least 100 folds utilizing bio-bar-code DNA approach which is a pseudo-homogeneous system with two nanoparticle-based solutions including magnetic/gold nanoparticles (MNPs/AuNPs). This study indicates that lower concentration of the probes can be used very efficiently to bind target DNA, thereby reducing time required for DNA sensing. The nanogap devices for DNA identification are fabricated by electron-beam lithography (EBL). The concept for electrical detection of biological molecular interaction herein will be an excellent dynamic range and ideally set up for multiplexing in the future. Based on bio-bar-code DNA amplification (BCA) detection technique, the target DNA can be detected the concentration even lower than femto-molar range.

Author Keywords: Bio-bar-code DNA; DNA biochip; Electrical detection; Gold nanoparticles; Magnetic nanoparticles; Nanogap; Self-assembled multilayer

Year: 2007
Source title: Tamkang Journal of Science and Engineering
Volume: 10
Issue: 2
Page : 133-136
Link: Scorpus Link
Document Type: Article
Source: Scopus

Authors with affiliations:

1. Chang, T.-L., Mechanical and Systems Research Laboratories, Industrial Technology Research Institute, Hsinchu 310, Taiwan
2. Liou, D.-S., Department of Mechanical Engineering, National Taiwan University, Taipei 106, Taiwan
3. Lin, H.-Y., Mechanical and Systems Research Laboratories, Industrial Technology Research Institute, Hsinchu 310, Taiwan
4. Chang, F.-Y., Mechanical and Systems Research Laboratories, Industrial Technology Research Institute, Hsinchu 310, Taiwan
5. Chen, P.-H., Department of Mechanical Engineering, National Taiwan University, Taipei 106, Taiwan