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On exotic nanostructure for bio-FET

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To use biosensor in conjunction with today's electronics, the signal sensed by biosensor must be readable at least as charge transportation; which is component of electric current. To aim this, Field Effect Transistor (FET)-type biosensor (bio-FET) is regarded as a promising solution. Koike et al demonstrated the detection of human immunoglobulin G (IgG) using a transparent ZnOFET. They prepared in-doped ZnO layer on glass substrate and hence fabricated Ta_2O_2 gate dielectric layer with IgGaptamers above ZnO layer. Charge that human IgG will carry to the surface of Ta_2O_2 in a solvent leads to induced charge on the surface of ZnO layer across Ta_2O_2. We can detect this induced surface charge as threshold voltage (Vt) shift of bio-FET by using peripheral sense circuit composed of standard CMOS architecture. Note here that visible Vt shift corresponds to at least 1012 cm^2 per electron on the surface. If the gate area of bio-FET is 100um x 100um, then human IgG must carry at least 108 electrons to the surface of Ta_2O_2 in a solvent for predetermined examination time. To make healthcare chip popular, it is demanded to shorten the examination time. If we append an exotic nanostructure to bio-FET, then the number of electrons that must be carried to surface in a solvent is reduced to several thousounds on 100um x 100um gate area.

Biography

Hiroshi Watanabe received the PhD degree from University of Tsukuba, Ibaraki, Japan in theoretical physics. After that, he joined the Corporate Res. & Dev. Center, Toshiba Corporation from 1994 to 2010. His current position is a tenure-track Faculty Full Professor, Dept. of Electrical and Computer Engineering in National Chiao Tung University, Hsinchu, Taiwan, since February, 2010. He has studied quantum-statistical mechanics, electron device physics, semiconductor device modeling, semiconductor memories, and some cutting edge devices. He holds more than 170 patents all over the world (106 issued & 67 waiting). He is a Senior Member of IEEE.

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