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Hydrothermally Synthesized Ultrathin Zinc Oxide Nanowires Based Field-Effect Transistors

Guan-Hung Shen[1], Andrew Ronaldi Tandio[1], Franklin Chau-Nan Hong[1,2,3,4*]

[1] Department of Chemical Engineering, National Cheng Kung University, No.1, Daxue Rd., East Dist., Tainan 70101, Taiwan
[2] Advanced Optoelectronic Technology Center, National Cheng Kung University, Tainan 70101, Taiwan
[3] Center for Micro/Nano Science and Technology, National Cheng Kung University, Tainan 70101, Taiwan
[4] NCKU Research Center for Energy Technology and Strategy, National Cheng Kung University, Tainan 70101, Taiwan
*Corresponding author's Tel.: +886-6-2757575-62662. E-mail address: hong@mail.ncku.edu.tw

ABSTRACT

In this experiment, ultrathin zinc oxide (ZnO) nanowires-based field-effect transistors (FETs) were fabricated. The ZnO seed layer was deposited using RF sputtering on top of a silicon dioxide dielectric layer. After the deposition of Ti and Pt films on the ZnO seed layer, ZnO nanowires were laterally grown from the ZnO seed layer by hydrothermal method. We have shown that the ultrathin single crystal ZnO nanowires could connect the source and the drain electrodes under an appropriate precursor concentration. Besides these nanowires grew along the surface of the dielectric with good attachment. ZnO nanowire-based FET thus fabricated have a threshold voltage of around -2.04 V, a field-effect mobility of ~ 64.28 $cm^2 V^{-1} s^{-1}$, a sub-threshold swing of 4.006 V/dec, and a current on/off ratio as high as 1.01×10^4. Compared to the common ZnO nanowire-based FET, the close attachment of these nanowires to the gate dielectric decreases the distance between the gate electrode and the nanowire channels, thus enhancing the switching control of the fabricated FET.

Keywords: zinc oxide, nanowires, transistors