DOI: 10.1017/S1431927605507621
Microsc Microanal 11(Suppl 2), 2005
Copyright 2005 Microscopy Society of America

Electron Transport Property Measurement of Metal Oxide Nanowire Based Nanodevices Using Nanomanipulators *In-Situ* FESEM

Weilie L. Zhou, Mo Zhu and Yuxi Chen

Advanced Materials Research Institute, University of New Orleans, LA 70148

A revolution has begun in science, engineering and technology, based on the ability to organize, characterize, and manipulate matter systematically at the nanoscale. Nanotechnology is the creation and utilization of functional materials, devices, and systems with novel properties and functions that are achieved through the control of matter, atom by atom, molecule by molecule or at the macromolecular level. Opportunities have opened as new tools enable fundamental discoveries and technological advances. In this paper, we present electron transport property measurement of metal oxide nanowire based nanodevices using nanomanipulators *in-situ* scanning electron microscope.

ZnO nanowires were fabricated through thermal vapor transportation method as shown in Fig.1. The nanowire grow along [10-10] direction with diameters ranging from 10-100 nm. As synthesized nanowires were assembled on SiO_2 coated Si substrate. The large electrodes were patterned using photolithography. The nanoelectrodes were patterned using e-beam nanolithography integrated with Carl Zeiss 1530VP Field Emission Scanning Electron Microscope (FESEM). The Kleindiek nanomanipulators were integrated with FESEM for *in-situ* electron transport measurement as shown in Fig.2 (a).

Fig.2(b) shows two nanoprobes directly contacting on a nanowire for the resistance measurement. Nanoelectrodes were patterned to connect nanowires. In this way, it is easier for the nanomanipulators to be positioned on nanowires for the measurement. Fig.2 (c) and (d) present two nanoprobes touching down on nanoelectrodes for I-V curve measurement of a nanowire. The linear I-V curve is shown in Fig. 3(a). A nanodiode was patterned as shown in Fig.2(e). The I-V measurement, as shown in Fig.3(b), shows that the nanodiode performs rectifying characteristic as applied forward bias. A field effect transistor was also shown in Fig.2(f). The detail performance will be discussed in the presentation.

References

[1] Y. Huang, X.F. Duan, Q.Q. Wei, and C.M. Lieber, Science 291, (2001) 630.
[2] X.F. Duang, Y. Huang, Y. Cui, J.F. Wang, and C.M. Lieber, Nature 409, (2003) 66.
[3] Y. Cui and C.M. Lieber, Science 291, (2001) 851.
[4] Y. Huang, X.F. Duang, Y. Cui, L.J. Lauhon, K.H. Kim, and C.M. Lieber, Science 294, (2001) 1313.
[4] We gratefully acknowledge the support of this work by the Advanced Materials Research Institute through the DARPA Grant No. MDA972-04-1-0029 and Louisiana Board of Regents Contract No. LEQSF (2003-06)-RD-B-13. We thank CAMD of Louisiana State University for the use of clean room and photolithography facility.

https://doi.org/10.1017/S1431927605507621 Published online by Cambridge University Press

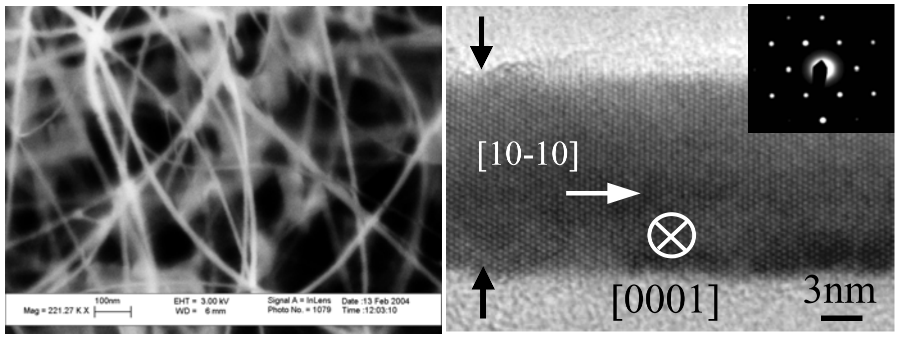

Figure 1 (a) ZnO nanowirs and (b) HREM image of [10-10] growth nanowire.

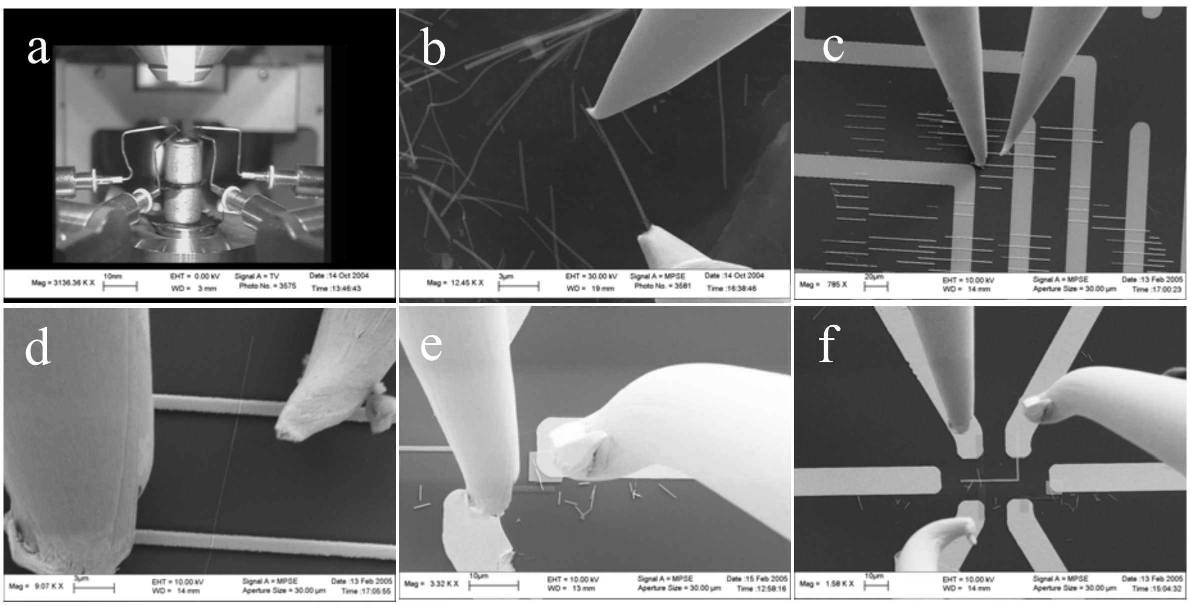

Figure 2 (a) configuration of four nanomanipulators, (b) nanoprobes on a nanowire directly for the resistance measurement, (c) and (d) nanoprobes positioned on nanoelectrodes for I-V curve measurement, (e) nanodiode measurement, and (f) transistor measurement.

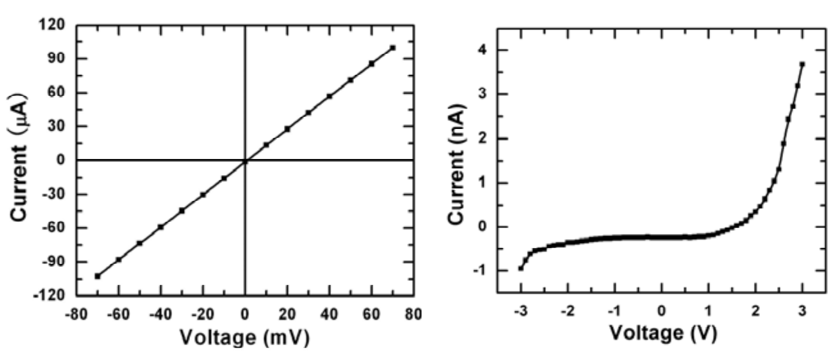

Figure 3 (a) I-V curve of ZnO nanowire and (b) nanodiode showing rectifying characteristic as applied forward bias.

https://doi.org/10.1017/S1431927605507621 Published online by Cambridge University Press