N1-P015

Work function variation of doped ZnO nanorods by Kelvin probe force microscopy

Chu Van Ben[1], Min Chi Hong[2], and Woochul Yang[1,2]

[1]Academy of Nano and Information technology, Dongguk University,
[2]Department of Physics, Dongguk niversity

One dimensional (1-D) structures of ZnO nanorods are promising elements for future optoelectronic devices. However there are still many obstacles in fabricating high-quality p-type ZnO up to now. In addition, it is limited to measure the degree of the doping concentration and carrier transport of the doped 1-D ZnO with conventional methods such as Hall measurement. Here we demonstrate the measurement of the electronic properties of p- and n-doped ZnO nanorods by the Kelvin probe force microscopy (KPFM). Vertically aligned ZnO nanorods with intrinsic n-doped, As-doped p-type, and p-n junction were grown by vapor phase epitaxy (VPE). Individual nanowires were then transferred onto Au films deposited on Si substrates. The morphology and surface potentials were measured simultaneously by the KPFM. The work function of the individual nanorods was estimated by comparing with that of gold film as a reference, and the doping concentration of each ZnO nanorods was deduced. Our KPFM results show that the average work function difference between the p-type and n-type regions of p-n junction ZnO nanorod is about ~85meV. This value is in good agreement with the difference in the work function between As-doped p- and n-type ZnO nanorods (96meV) measured with the same conditions. This value is smaller than the expected values estimated from the energy band diagram. However it is explained in terms of surface state and surface band bending.

Keywords: ZnO, nanorod, KPFM