APPLICATION NOTE

Manipulation and Positioning of Single ZnO Nanowires for Photoconductive Characterization

Semiconductivity and photoconductivity have, among other properties of Zinc Oxide nanowires, potential applications in the next generation of electronic and photonic devices such as transistors, solar cells, LEDs and detectors. In order to be able one day to utilize these unique properties, further characterization of single nanowires is still needed.

The first steps required to measure photoconductive gain on a ZnO single nanowire with high accuracy are described in [1]. This application note reports on the use of Imina Technologies miBot manipulators to carry out the delicate step that consists in positioning the nanowires grown by metalorganic chemical vapour deposition (MOCVD) at specific locations on the substrate.

With diameters of 100 - 200 nm and lengths of about 10 µm, the manipulation of these nanowires was expected to pose significant challenges. It however happened to be relatively easy to achieve with the miBots. In fact, with using two of them equipped with 10 µm diameter probe tips, and by taking advantage of the nanometer-scale positioning resolutions over four degrees of freedom, one was able to select and move individual nanowires around on the substrate. Figure 1 illustrates the result by showing seven nanowires aligned to spell the UTT logo.

In order to characterize the photoconductive properties, good ohmic contact between the semiconducting nanowires and metallic electrical connections is required. This was realized by selecting and positioning ZnO nanowires at precisely pre-determined locations on the substrate defined by an indentation map, then depositing metallic fingers over either end of the nanowire using an electron beam lithography (EBL) process [Figure 2].

[1] Geng, W., Kostcheev, S., Sartel, C., Sallet, V., Molinari, M., Simonetti, O., Lérondel, G., Giraudet, L. and Couteau, C. (2013), Ohmic contact on single ZnO nanowires grown by MOCVD. Phys. Status Solidi C, 10: 1292–1296. doi: 10.1002/pssc.201200984

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Imina Technologies products in use:
- miBotTM BT-11 micromanipulators
- miBase BS-41 stage
- syDrive SD-10 piezoelectric controller

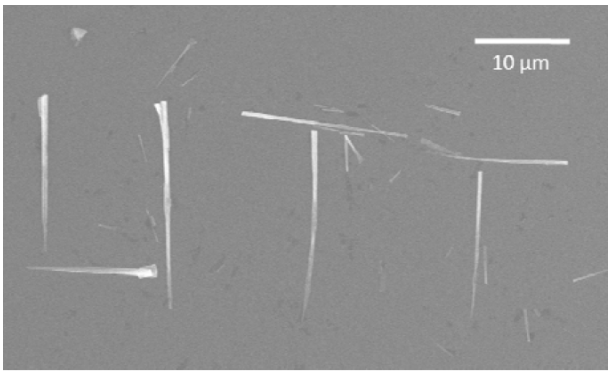

Figure 1. Manipulation of single ZnO nanowires into an arrangement that spells the abbreviated university name (UTT). (Source: [1])

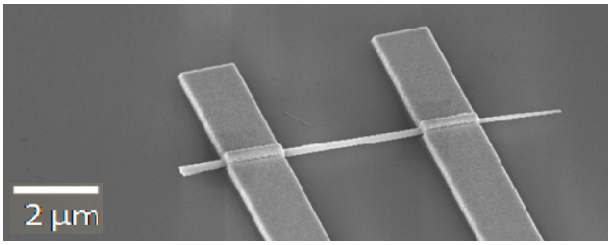

Figure 2. Metallic contacts deposited by EBL on a ZnO nanowire pre-positioned by the micromanipulators. (Source: [1])

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