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Fabrication and characterization of Au and ZnO nanowires on silicon substrate spin coated with poly(methylmethacrylate) resist.

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One of the goals of nanoscience and nanotechnology is to synthesize and manufacture nanodevices that are multifunctional, exceptionally small and sensitive with low power consumption. In the past five decades, numerous investigations resulted in novel nanodevices with applications such as resonators, biosensors, logic devices, transistors, optoelectronics and even in situ biomedical monitoring and detection. Real-time energy harvesting from the environment to power these nanosystems and devices is an essential requirement. As such solar-energy harvesting technologies for nanoscale devices have been an emerging field of research. For example, a singular silicon nanowire has been demonstrated to fabricate a photovoltaic cell that is effective to drive a nanowire-based logic gate or even pH sensor. As an added incentive, these technologies may further be scaled up to deliver more efficient green energy sources, by manipulating the current solar-energy harvesting technologies on the nanoscale to increase their efficiencies. In this study it is shown that metal (Au) and semiconductor (ZnO) nanowires can be fabricated by a combination of pulsed laser deposition (PLD) and electron beam lithography (EBL). EBL was conducted using the electron beam from the auger electron spectroscopy (AES) system to produce grooves trenched on poly (methyl methacrylate) (PMMA). This polymer was spin coated on oxidized silicon (110) substrates. PMMA thickness for each specimen was then measured using atomic force microscopy (AFM) and x-ray photoelectron spectroscopy (XPS) and the relationship of the thickness to spin speed and PMMA composition was established. The morphology of the fabricated nanowires was examined by utilization of scanning electron microscope (SEM). The changes in optical and electrical properties with respect to nanowires dimensions were investigated through characterization by photoluminescence (PL), UV absorption and solar simulation techniques.

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Dr. Richard Harris
University of the Free State

HarrisRA@ufs.ac.za

Primary authors: Dr HARRIS, Richard (University of the Free State); Mr LARA, Sekhants'o (University of the Free State, Department of Physics)

Presenter: Mr LARA, Sekhants'o (University of the Free State, Department of Physics)

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