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Scanning probe microscopy in material science and biology

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Abstract content
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Today, a wide range of analytical techniques can be used for materials research. The most commonly used high-resolution analysis techniques are Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM) and Scanning Probe Microscopy (SPM). Although each technique can resolve surface (SEM and SPM) structure down to the nanometer scale, the different image formation mechanisms result in different types of information about the structure of the surface, making these techniques complementary. SPM is the enabling tool for nano(bio)technology, which has opened new understandings in many interdisciplinary research areas. In addition, SPM can image surface structures with atomic (height) resolution without the necessity of damaging the sample. Moreover, a SPM operates without vacuum, in contrast with electron microscopes. It can also measure different physical properties, such as electric (using Kelvin Probe Force Microscopy (KPM / KPFM)) or magnetic properties (Magnetic Force Microscopy, MFM). As a result, associated with the developments in SPM instrumentation and techniques, new and previously un-thought-of opportunities in understanding the physics and chemistry of molecular and biomolecular processes on the nanoscale level are appearing. In this presentation SPM nanoprobng of surface morphologies of different semiconducting nanostructures (like InSb, GaSb, ZnO, NiO, MgO) and phase separation in diblock copolymer films are presented and discussed. In addition, in-situ electrochemical deposition of lead (Pb) from lead sulfate solutions, for battery applications, is demonstrated. The application of SPM in understanding structural properties of biological materials (e.g. live cells or cell membranes) is also presented and discussed in detail. In addition KPFM of different semiconductor heterojunctions is presented and discussed.

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Main supervisor (name and email) and his / her institution

JR Botha, Department of Physics, Nelson Mandela Metropolitan University, P.O. Box 77000, Port Elizabeth 6031

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Primary author: Dr URGESSA, Zelalem N. (NMMU)

Co-authors: Mr AHIA, Chinedu Christian (NMMU); Prof. FERG, E.E. (Department of Chemistry, NMMU, P.O. Box 77000, Port Elizabeth 6031, South Africa); Dr DEALTRY, Gill (Department of Biochemistry and Microbiology, Box 77000, Port Elizabeth 6031, South Africa); Prof. BOTHA, Johannes Reinhardt (NMMU); Mr BOLO, Lukanyo (Department of Chemistry, NMMU, P.O. Box 77000, Port Elizabeth 6031, South Africa); Mr TILE, Ngcali (NMMU); Mr DOBSON, Stephen (NMMU); Mr TANKIO DJIOKAP, Stive Roussel (Nelson Mandela Metropolitan University); Dr HELEN MORRISON, maria (Department of Biochemistry and Microbiology)

Presenter: Dr URGESSA, Zelalem N. (NMMU)

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