

Materials science and manufacturing

CSIR nano facility marks new era

Barely out of its baby shoes and only recently officially launched by the Minister of Science and Technology, Mr Mosibudi Mangena, at the CSIR; the National Centre for Nano-structured Materials affirms the establishment of this exciting research field at the CSIR.



Showing its mettle with technical outputs of the highest calibre, research group leader Dr Suprakas Sinha Ray and eight handpicked researchers distinguished themselves last year already with eight internationally peer-reviewed articles. Two articles were published in international conference proceedings, one book chapter contributed, nine keynote and plenary lectures were given. Four articles are awaiting publishing and two patents are pending. Added to these impressive statistics is the honour for Ray to have no fewer than three feature articles on journal cover pages. These are titled 'Morphology and Electrical Conductivity of Poly(N-vinylcarbazole)/Carbon Nanotubes Nanocomposite Synthesised by Solid State Polymerisation' in the *Macromolecular Rapid Communications Journal*, the 'Effect of Organoclay on the Orientation and Thermal Properties of Liquid-Crystalline Polymers' in *Macromolecular Chemistry and Physics* and the 'Effect of Organoclay on the Morphology and Properties of Poly(propylene)/Poly[(butylene succinate)-co-adipate] Blends' in *Macromolecular Materials and Engineering*.

A key component of the strategy of the CSIR is to improve the level of research and development (R&D) outputs and outcomes. This is of particular importance in the exciting and diverse area of nanotechnology, which is considered pivotal for future research. It comprises the study and manipulation of tiny material structures with at least one dimension roughly between 1 and 100 nanometres.

The focus of the CSIR-hosted centre is on the design, modelling, synthesis, characterisation and fabrication of new and novel nano-structured materials with specific functional properties and various possible applications.

One of the key strategies of the centre is to act as a national resource for MSc and PhD students to perform innovative research under the supervision of experienced researchers. The staffing strategy of the centre involves establishing a relatively small core of permanent staff of researchers and equipment technicians, complemented by a larger number of temporary staff comprising postdoctoral fellows and MSc and PhD students.

The Centre is located on the CSIR Pretoria site. The building has been renovated and includes modern laboratories, space for wet and dry laboratory work, nano-synthesis facilities and the required space and controlled environment for characterisation

equipment. The centre consists of eight laboratory areas, 14 offices and space for visiting researchers and students. It compares favourably with top international nanotechnology centres and is a landmark on the local research landscape.

The cutting-edge facility has extensive synthesis and characterisation techniques available. Equipment (Click down)

Equipment

- Hot-wire chemical vapour deposition (HWCVD) equipment for the synthesis of highly purified single-walled carbon nanotubes
- Hot-wire chemical vapour deposition (HWCVD) equipment for the fabrication of silicon and other nano-particles
- Laser ablation equipment for the synthesis of highly-aligned carbon nanotubes (Spectra Physics Nd: YAG Laser Pro-290E-30 Series)
- PolyLab rheomixer for polymer nanocomposites preparation
- Arc-discharge equipment of the production of carbon nanotubes
- Compression moulder
- Spin coater
- Various centrifuges and sonicators
- Precisely temperature controlled hot-press
- Vacuum oven
- Four probe electrical property measurement facility
- Pyrometer (nano-contact temperature sensor) microgram scale
- Atomic force microscope (AFM)
- Scanning tunneling microscope (STM)
- NanoLog™ spectrofluorometer
- Raman spectrometer
- Time-of-flight secondary ion mass spectroscopy (TOF-SIMS)
- Temperature modulated differential scanning calorimeter
- Ultra-high resolution thermogravimetric analyser (TGA)
- Dynamic mechanical analyser
- Complete set of rheometer equipment
- Small-angle X-ray scattering (SAXS) with wide angle attachment
- Ellipsometer
- FT-IR spectrometer with infrared imaging
- UV/VIS spectroscopy

A dual-beam high-resolution field-emission scanning electron microscope with EDX and STEM facilities will be commissioned by June 2008 and high-resolution field-emission transmission electron microscopy will be available from June 2009.

The NCNSM will offer access to characterisation equipment and facilities.