

NANO NEWS - SOUTH AFRICA

Volume 4, May 2010

Edited by Patience Iyuke

Co-edited by Neil Coville

Introduction

This month's newsletter contains important information on the DST launch of the Nanotechnology Research plan. This plan provides a framework for directions in Nano for the next ten years. While it has to be vague in specifics, it defines what the Government views as important directions, with implications for funding. Also included in the edition are articles on talks, forthcoming conferences and other articles on nano. Enjoy reading.

Neil Coville

Contents

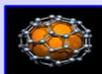
1. Introduction
2. Future of the Nano-Newsletter
3. DST 10 Year Plan for Nanoscience & Nanotechnology
4. Second Announcement: Nanoscience Young Researcher Symposium
5. Nanotechnology in Integrated Science and Engineering Education
6. Summary of the Invited Lecture on Nanohybrids at Wits
7. Application of Nanotechnology for Bioavailability Enhancement of Narrow Absorption Window Drugs
8. Forthcoming Nanoscience and Nanotechnology Events

Future of the Nano-Newsletter

The newsletter was initiated about two years ago, initially focused on Wits University news on nano and funded by Wits University and the DST/NRF Centre of Excellence in Strong Materials. Through the initiative of Patience Iyuke this was expanded to serve the larger SA community.

The newsletter at the moment is still funded by the DST/NRF Centre of Excellence in Strong Materials but SANi have now agreed to also partially fund the newsletter as part of their Outreach programme. This function will eventually be undertaken by SAASTA. Thus, in future this will have implications for the newsletter content. The idea is to expand the readership to those with less knowledge in nano (e.g. school learners) but with an interest in the topic. It is envisaged that the newsletter will be well indexed to allow for a readership that is more varied. In this way the nano message will reach a wider audience. More about these exciting developments in future issues.

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The DST 10 year Plan for Nanotechnology and Nanoscience

The DST 10 year Plan for Nanotechnology and Nanoscience was unveiled at a ceremony at the CSIR on Friday 9th April, 2010. Initially Dr Daniel Adams was to outline the Plan content. However, he was unable to attend and so JJ Molapisi, from the DST, who has driven much work on the Plan, gave the address. The event, held at the CSIR Knowledge Commons was attended by about 45 delegates from the local Universities, business, the CSIR and Mintek.

Many readers who have been following the development of the nanotechnology initiative in SA since its early days would have recognized the core strategies that were outlined in the 10 Year Plan that originated from many, many early discussions with the nano community. The Plan in essence summarized much of what is already on the ground and gave a sense of how this framework would be used in the future. A driver will still be human capital development – thought the creation of more NRF Chairs in Nano, stimulation of new international collaborative interactions, creation of possibly more Flagship Projects (if an audit reveals they have succeeded in their missions), more investment in the NNEP (and the NEP), support of a National TEM facility etc.

The research question of importance in the plan relate to water, energy, health in the social cluster and chemical/bio-processing, advanced manufacturing and mining minerals in the industrial cluster. On top of this will be issues of standards, ethics and communication.

For those who wish to get more details on the DST 10 year Plan – go to the DST webpage. The Plan will also be available on the SANi webpage in the months ahead.

Neil Coville

Second Announcement: Nanoscience Young Researcher Symposium

This is a call for participation in the 2nd symposium for young researchers (Masters and PhD students) currently undertaking research in the nanosciences.

The symposium will take place at the University of Johannesburg Doornfontein Campus on the 07th May 2010 from 09h30 – 15h00. All students from academic institutions based in Gauteng, North-west and Limpopo are invited.

There will be prizes for the best presentations and lunch will be served.

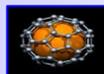
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Mr. Nsika Dlamini : 011 559 6754, dlaminijeanclaude@yahoo.com

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Submitted by Ntombi Mathe, Vice-Chair SANi Student Chapter.



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Nanotechnology in Integrated Science & Engineering Education

Prof. Sunny Iyuke from the School of Chemical & Metallurgical Engineering, Wits, delivered a lecture on the 21st of April, 2010 entitled 'Nanotechnology in Integrated Science and Engineering at the University of the Witwatersrand.

The lecture focused on the multi-disciplinary nature of nanotechnology, his teaching and research in nanotechnology as well as patents in nanotechnology.

Nanotechnology according to Prof. Iyuke, refers to the "technology that dwells at the scale less than 1,000nm". He explained that the technology is multidisciplinary in nature and will require the broad understanding of basic Chemistry, Physics, Biology and Engineering, etc. He mentioned that nanotechnology makes it possible for scientists to have some basic knowledge of Engineering and vice-versa. For instance, he said, "when designing experiment and apparatus, scientists do engineering, similarly, when studying novel physical system, Engineers do science".

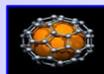
Prof Iyuke has been teaching nanotechnology course since 2005 to undergraduate and graduate Chemical Engineering and Biomedical Engineering students at the University of the Witwatersrand. He has also organised a series of short courses in the area of nanotechnology. In teaching nanotechnology, he urged that priority should be given to creative and critical thinking coupled with life-long learning.

In addition, Prof Iyuke spoke extensively on his research in nanotechnology, which include but not limited to, research in the use of carbon nanoparticles for applications of Production of electro catalytic electrodes for proton exchange membrane (PEM) fuel cell; Production of proton/ion exchange membrane reinforced with carbon nanoballs; immobilisation of yeast cells for bioethanol production (micro-beer brewery at Wits); Wastewater treatment; and Drug delivery. He also collaborates with various universities and industries in South Africa and Overseas, such as Vaal University of Technology, APV, National University of Malaysia, NASA, USA, Wits Schools of Chemistry, Pharmacy & Pharmacology and Molecular Cell & Biology.

In conclusion, he talked briefly on the status of his patent and possible commercialisation of his research in the following areas:

- a) Ion exchange membrane, for PEM Fuel Cell application (with Vaal University of Technology, South Africa, 2009).
- b) Yeast Cell immobilization, for Biofuel Production and Brewing (2009).
- c) A Process for Producing Carbon Nanotubes (Filed in USA, Europe and South Africa, 2008).

Patience Iyuke



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Summary of the Invited Lecture on Nanohybrids at Wits

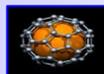
This invited lecture was presented by Dr Kenneth I. Ozoemena at the MPRI-CoESM, Wits University on the 25th of March 2010. Dr. Ozoemena is the Principal Researcher and Research Group Leader: Renewable Energy Technologies, Energy and Processes Unit, Materials Science and Manufacturing, CSIR) I

In his lecture titled “*Nanohybrids as Viable Platforms for Electrochemical Energy Storage and Delivery Systems*”, Dr Ozoemena first explained why nanohybrids have continued to attract much interest in the development of electrochemical energy storage and delivery systems (i.e., supercapacitors, fuel cells and lithium ion batteries) using local and international examples. One of the main reasons, according to him, is the urgent need to drastically ease the current global energy crisis and reduce man’s dependence on fossil fuels (crude oil). These electrochemical energy systems have been forecast to be the next generation of cost-effective, energy-efficient and environmental-friendly power sources for a variety of everyday applications such as hybrid electric vehicles, laptop computers, cell phone, etc). Recent examples of novel nanohybrids prepared, tested and published by the Ozoemena research group were also presented. Some of the examples include nanocarbons integrated with transition metallophthalocyanine complexes and/or metal nanoparticles. Also presented were charge transport dynamics of nanohybrid platforms.

Contributed by Dr. Kenneth Ozoemena, CSIR

Application of Nanotechnology for Bioavailability Enhancement of Narrow Absorption Window Drugs

Recent advances in nanotechnology have led to the development and application of nanostructures for diagnostics and therapeutic purposes. Materials such as biologics (e.g. monoclonal antibodies), polymers, silicon, carbon or metals have been employed for the fabrication of nanostructures, (Hughes, 2005; Lin and Chris-Wang, 2005; Sou et al, 2008; Yague et al, 2008). The preferred systems employed for drug delivery are polymer-based nanoparticles fabricated from both biodegradable and non-biodegradable polymers (Kaparissides et al, 2006). One of the benefits of biodegradable polymers is that they do not require retrieval or manipulation after introduction to the body, but rather are metabolized and eliminated from the body through normal metabolic pathways (Mainardes and Silva, 2004; Nimesh et al 2006). Polymeric nanoparticles are able to protect drug from degradation in the gastrointestinal tract (GIT), bypass the liver thereby preventing “first pass metabolism”, remain in the systemic circulation for longer periods, target the delivery of drugs to sites of action and deliver drugs via the oral route (Nimesh et al 2006; Soppimath et al, 2001; Italia et al, 2007).



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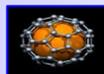
The oral route still remains the route of choice for most patients; however, while some drugs have good absorption throughout the GIT, others possess limited sites of absorption (narrow absorption window drugs). The latter do not produce good clinical response when presented as conventional dosage forms. Therefore, this necessitates the exploration of nanotechnology to improve bioavailability of narrow absorption window drugs.

In our study, the nano-matrix has been explored to improve the oral bioavailability of narrow absorption window drugs which is envisaged to lead to superior therapeutic effects. Biodegradable and biocompatible polymers were employed to fabricate the polymeric nanoparticles using novel polymeric combinations and methodologies. A delivery system into which the nanoparticles are ultimately incorporated has also been developed to further modulate the release of the drug from the nanoparticles. The delivery system is also designed such that it is retained in the gastric region over a prolonged period making the drug available at the site of absorption for an extended period.

It is anticipated that the nano-enabled drug delivery system will be an improvement on some of the currently available dosage forms for narrow absorption window drugs (e.g. levodopa, ciprofloxacin).

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Contributed by: Ndidi Ngwuluka, a PhD student in drug delivery under the supervision of Prof. Viness Pillay at School of Pharmacy and Pharmacology, Faculty of Health Sciences, University of Witwatersrand, Johannesburg.

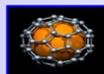
Forthcoming Nanoscience and Nanotechnology Events

Local Events:

- i. The Second Symposium for Young Research (Masters and PhD students) currently undertaking research in the nanosciences, University of Johannesburg, Doornfontein Campus, 7th May 2010 from 09h30-15h00.

International Events

- i) African School on Nanoscience for Solar Energy Convergence, Addis Ababa, Ethiopia, 3rd-7th May 2010: <http://portal.ictp.it/energynet/african-school-on-nanoscience-for-solar-energy-conversion>
- ii) First Online Nano-Globe Conference & Exhibition, Internet, 5th May at 6 am to 8th May at 7 pm: <http://www.nano-globe.com/> or <http://www.nanopaprika.eu/events/first-online-nanoglobe>
- iii) Bridging the Gaps: 2010 SME Annual Conference, Sheraton Music City Nashville TN USA, 6th-8th June 2010
<http://www.goingtomeet.com/conventions/details/55058> or
<http://www.sme.org/cgi-bin/get-event.pl?--001889-000007-home--> **SME-**



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- iv) Intensive Course on Nanomaterials, Bad Gastein, Austria, 8th-10th June 2010: <http://www.nanoconsulting.de/englisch/annoucement-2010.pdf>
- v) The 2nd Annual ICPC NanoNet Workshop, Beijing, China, 14th-15th June 2010: <http://www.icpc-nanonet.org/>
- vi) 5th Annual Greener Nanoscience Conference & Program Review, Portland, Oregon, 16th-18th June 2010: <http://oregonstate.edu/conferences/greenernano/> or <http://www.nanopaprika.eu/profiles/blogs/greener-nano-2010-reducing>
- vii) Nanotech Conference & Expo 2010, Anaheim Convention Centre, Anaheim, California, USA, 21st-25th June, 2010 <http://www.techconnectworld.com/Nanotech2010/>
- viii) 2010 Villa Conference on Interaction Among Nanostructures (VCIAN-2010), Santorini, Greece, 21st-25th June 2010: <http://www.oanano.org/vcian> or http://www.nanopaprika.eu/events/events/show?id=161234%3AEvents%3A56407&xq_source=msg_invite_event
- ix) Nanotechnology for Sustainable Energy, ESF Research Conference, Austria, 4th-9th July 2010. <http://www.esf.org/activities/esf-conferences/details/2010/confdetail315.html>
- x) 18th International Conference on Composites/Nano Engineering (ICCE-18), Anchorage, AK (USA), 4th-10th July 2010 http://myweb.polyu.edu.hk/~mmktau/ICCE/ICCE_Main.htm
- xi) Nanosafe 2010, Minatec, Grenoble (France) 15th -19th November 2010. More information: <http://www.nanosafe.org/>
- xii) The 2010 International Chemical Congress of Pacific Basin Societies (Pacifichem), Honolulu, Hawaii, USA, 15th-20th December 2010. <http://www.pacifichem.org/>