

#### **2016** Newsletter (1 issue per year)

#### Foreword from the HOD (Prof. Z.R. Tshentu)



The NMMU Chemistry Department offers chemistry for a diverse range of qualifications. The focus is in the teaching of fundamental principles of chemistry to BSc students as well as chemistry honours students. In addition, we offer a specialized Diploma in Analytical Chemistry including the BTech which will now be replaced by an Advanced

Diploma in Analytical Chemistry. The department also prides itself for being the only tertiary institution in South Africa that offers training in rubber, paint and plastics through its Diploma in Polymer Technology. We also offer service modules to Chemical Process Technology students as well as to the following departments; (i) Pharmacy, (ii) Medical Laboratory Sciences, (iii) Nursing Science, (iv) Environmental Health, (v) Dietetics, and (vi) Education.

Our first year BSc Chemistry numbers are in the range of 240 students (including education and dietetics students) and the number decreases to about 60 students in second year and 23 students in third year (2016 numbers). The honours class had 9 active students in 2016 with an additional 3 students who had one module to complete in 2016. The BSc attrition rate is a matter of concern and systematic approaches will be put in place to ensure growth in this area. The Diploma in Analytical Chemistry had about 60 first year students in 2016 and the BTech had 15 registered students. The Diploma Polymer Technology programme had 6 students which is contradictory with industry demands for qualified polymer technologists. We constantly have industry at our doorstep looking for

students who have qualified with skills that are being nurtured in this programme and we cannot meet the demand. However, more efforts were directed at marketing in the second half of 2016.

The Department has a wide range of equipment that it has available for teaching and research, including 400MHz NMR, GC-MS, GC-FID, EPR, AAS, SC-XRD and PXRD, HPLC, ATR-FTIR, TG-MS and DSC, UV-Vis and Fluorescence Spectrometers and a newly acquired TAMIII Calorimeter. We had about 70 registered M and D students across a range of qualifications in fundamental and applied chemistry between the department and associated institutes and centres. The department published more than 36 full articles in 2016 and 5 book/ chapters as well as many structure communications. We are also proud to be associated with InnoVenton, Centre for Rubber Science and Technology (CRST), uYilo, CSIR (PE) and a DST-NRF Research Chair in Microfluidic Biochemical Processing which is headed by Prof Paul Watts.

**NB**: For further information, please visit the department website (www.nmmu.ac.za/chem)

#### From the Editorial team



Dear student and staff of the department of chemistry, without your contributions a newsletter is not possible. The purpose of the newsletter is to serve as a platform to report on new developments and past year's events. As you can see, we received varied contributions, from staffs, students and researchers as well as from senior researchers and emeritus

professors. So, we have covered most of the entire academic spectrum with the content of these contributions. For this reason, I would like to invite everyone to send contributions to me in good time before the next newsletter. I wish you all a peaceful, happy, healthy, progressive and successful year in 2017.

Adeniyi S. Ogunlaja, Email: adeniyi.ogunlaja@nmmu.ac.za





#### 2016 Teaching

The Department started off 2016 with staffing challenges as several senior colleagues had reached retirement stage and there were resignations. However, we managed to pull through the first semester with the assistance of emeriti staff and postdoctoral and senior PhD students. The second half of the year was complicated by the #FMF protests. The department had several modules that were not completed when the protests started at the end of September. At least one module had just started at the BSc level and in Polymer Technology, respectively. The provision to convert some modules to continuous assessment allowed us to complete most of the Diploma in Analytical Chemistry Modules which had advanced in terms of teaching since they are all semester modules. We saw for the first time in our lives as chemists the teaching of chemistry at a church. We are grateful to the Summerstrand United Church for providing a venue for the teaching of organic chemistry 1, physical chemistry 3 and inorganic chemistry 3. The inorganic chemistry 3 practicals were also covered in a workshop type session at the NMB Stadium. Organic chemistry 2 as well as physical chemistry 2 and 3 also had lecture sessions at the stadium during this time and were later completed at North Campus. By the end of December 2016, we had a few modules that still needed to be completed during the January 2017 mini-semester including BSc Organic Chemistry (CHO1, CHOV102 and CHO1X1), BSc Physical Chemistry (CHP203), Polymer Raw Materials II Practical (CWP2002, WPP2132) and Polymer Raw Materials II (CWP2022; WPT2122). All the Chemistry Honours modules as well as the BTech modules were completed in December 2016.



Photo: The teaching of organic chemistry 1 at Summerstrand United Church during the November Academic recovery schedule. Thanks to Emeritus Prof Cedric McCleland (seen walking behind one of the white boards) for his effort to see the module through.



**Other interesting news:** 

Dr Gletwyn Rubidge who is the co-ordinator for Analytical Chemistry (A3) detailed the following: At the Diploma Analytical in Chemistry second-year level, we have had the best group of students I have experienced in many years. They were in general a pleasure to work with and even marking the practical was enjoyable. We

cannot complain about being left out wrt toys this year – a new FTIR with ATR, two auto titrators, and an HPLC was commissioned in 2016. The first semester went smoothly and a good pack of in-service trainees assisted in the practicals and with engagement work. SETA funding for the student assisted immensely.

A power failure during an A3 Analytical prac session saw the students switch to being exposed to a two-hour session of our engagement experiments. This was a welcome but educative distraction and we soon found second year students volunteering to assist with engagement work in and Science Discovery demonstrations Week. Spectroscopy practicals had another mini instrumental addition. Dr Patricia Forbes' low cost, lab made Specup spectrometer that uses LEDs as a radiation sources, a light dependant resistor as detector and multimeter readout featured in the spectroscopy practicals with surprisingly good results. We have five of them that were donated by Dr Forbes from UP.

Emanuelle Setlapelo, a BTech student, has adapted one to make it function as a fluorimeter and turbidimeter so at a cost of only a few hundred rands we can reintroduce analytical practicals involving quinine assay by fluorescence and nephelometric sulphate determination. The second semester was off to a delayed start with analytical practicals so students were give practical projects: Remediation of a chromate effluent and investigation of factors influencing the blue bottle reaction. They had to develop their own procedures and had to prove analytically if they were successful, or not. FMF disruptions prevented us from having presentations of the results but some solid reports were handed in. Practicals and classes were disrupted towards the end of the academic year but we managed to finish our analytical courses.







**Ms Anita Noah** who is the coordinator for Analytical Chemistry (A2) detailed the following: The completion plan for first year and second year Analytical Chemistry diploma modules began in earnest on the 3rd November on North campus. Despite an initial low student attendance in the first week, a direct

consequence of the lack of shuttle services to north campus. The second week was marked by a sharp rise in attendance, a reflection of the students willingness and dedication to completing the 2016 academic year amidst the many challenges they were facing. Students made alternative plans by forming lift clubs to and from lecture venues and taking public transport whenever and wherever necessary.

The first-year class representatives Mr Tsepo Kwinana and Mr Khumbulani Msweli together with the second-year class representative Mr Simphiwe Thabane showed great leadership in providing support for students and facilitating effective communication between first year coordinator and students by making use of various social media platforms. This enabled the completion of many modules through face to face lectures and extensive tutorial sessions to assist students to make up for time lost particularly for those modules that were adversely affected by the loss of contact time resulting from NMMU shutdown.

Notwithstanding, the above-mentioned challenges, the Chemistry Department would like to extend a warm and heartfelt thank you for the unwavering support received from our media services led by Mr Sipho Sam together with Ms Ronelle Plaatjies who went beyond the call of duty to ensure that all venue requirements and security measures were in place to ensure a successful completion plan.

As I take a few minutes to reflect on one important lesson learnt. "It is in our darkest hour, our most challenging moments in our lives, when we each must look inward and make a choice, to rise to the occasion, to choose to be our own hero and to combine our efforts, stand together and support each other, so that we may all succeed in meeting our common goal. Together, we stand a better chance of succeeding. Alone, we are guaranteed a tumultuous path with little hope of success."

# -A note from the Advanced Diploma (BTech), diploma IST programme coordinator, Prof Ernst Ferg.

2016 was indeed a year of challenges and changes in the chemistry department at the NMMU. As a wise man once said. "Trying to do the same thing over and



over and expecting different results is insane". So one has to believe that "change is good". Where the challenge was for us, was to understand what "good" is.

About 5 years ago, the NMMU embarked on the recurriculating of a number of its programmes in line with the



requirements of the Department of Higher Education (DoHE). This included the Diploma in Analytical Chemistry, which has been running successfully under the new programme outline for a number of years and the introduction of a new programme known as an Advanced Diploma in Analytical Chemistry. The directive given by the DoHE was to phase out the BTech related programmes and allow for the introduction of Advanced Diplomas in specialized fields. The different qualification types and their credits are summarized in the following table.

As of 2017, the chemistry department will no longer be offering the BTech in Analytical Chemistry and instead has introduced the Advanced Diploma in Analytical Chemistry as a post graduate one year qualification at the NQF level 7. The aim will be to equip the learner to obtain training within a more advanced and specialized field of analytical chemistry that is related to instrumentation and laboratory organization. Training will focus on developing skills on certain key instruments that are commonly used in the chemistry related industry. The skills training will relate to equipping the potential analyst with the ability to plan, organize and execute complex analyses on specialized laboratory equipment. An important aspect of the programme will be to develop certain skills that will give the learner the ability to deal with large sets of





experimental data that will be accompanied by using applied knowledge in its interpretation.

NQF	Minimum credits per qualification	Qualification type
level	(and at exit level)	
10	360 (360)	Doctoral Degree
9	180 (120)	Master's Degree
8	120 (120)	Honours Degree
	120 (120)	Postgraduate Diploma
7	360/480+ (120)	Bachelor's Degree
	120 (120)	Advanced Diploma
6	360 (240)	Diploma
	120 (120)	Advanced Certificate
5	120 (120)	Higher Certificate

#### QUALIFICATIONS, LEVELS AND MINIMUM CREDITS

As part of the programme, students will be exposed to the use of Analytical Chemistry in the context of solid state and inorganic materials, polymers, organic compounds and its use in industrial control systems. Through the diverse range of applications, the students will be taught to evaluate critically the characteristics and abilities of various techniques in order to match them to the requirements of the problem at hand. This will also involve the ability to undertake first line maintenance and fault finding on equipment.

Career opportunities: The skills the student will acquire during the one (1) year programme will enable them to become more employable in modern analytical laboratories that often exist within the chemical production and process industries. Some of these industries are the petrochemical, mining, pharmaceutical, rubber/polymers, cement, catalysis, batteries and government departments. These can include forensics, water and sanitation, municipalities and within science councils and universities technical departments. Graduates can further develop their skills by becoming specialists of certain techniques that can then find employment within the large industrial sector of analytical instrument suppliers or agencies.

Admission requirements: Either a diploma in analytical chemistry or BSc majoring in Chemistry. In either case, the credit-weighted average mark for final year academic chemistry modules must be at least 60 %. If the demand for the programme exceeds the allowed capacity, then a competitive entry will be used, based on academic merit. Where the first preference will be given to students with the highest marks from their final year academic chemistry modules.

Mature students or those that do not qualify for the programme based on their initial lower entrance requirements can apply if they had worked in the related industry for at least one year after their undergraduate diploma or BSc qualification and would be considered for acceptance onto the programme by an interview process. The route of entry will be governed by the NMMU policy on RPL.

#### **Duration of Study: 1 year full time.**

#### Curriculum

Module Name	Module Code	When Presented	Credit Value
Material Chemistry Analysis	CMC401	Semester 1	20
Sample Handling	CSH401	Semester 1	10
Advanced Analytical Chemistry I	CAA401	Semester 1	20
Advanced Analytical Chemistry II	CAA402	Semester 2	20
Chemical Industrial Control	CCI402	Semester 2	10
Organic Chemistry Analysis & Data Analysis	COC402	Semester 2	20
Inorganic/Polymer Chemistry Analysis	CIP402	Semester 2	20

**Re-admission:** Students must complete the qualification within a maximum of four semesters (2 years). Students who do not pass all modules within the first two semesters of registration must have accumulated at least 60 credits in order to be considered for readmission for a third semester. Under special circumstances, the student can appeal in writing to complete outstanding modules in a  $3^{rd}$  year of study. The module names and their credit value are summarized in the following table. More detail of the





programme and module content can be obtained from the departmental secretary or programme coordinator.

In discussion and guidance given by the advisory board of the analytical chemistry diploma programme, the evaluation of the final in-service training (IST) year was undergoing change. 2016 saw the introduction of a number of assignments that the students have to complete in order to demonstrate their understanding of the related industry they are working in. Chemistry in a work place is not only the execution of a particular technique, but also relates to the entire value chain of the process from receiving of raw materials, the quality system, and the assurance that the final product is within manufactured specification. Many factors play a role in a work place and the life-skills learned by the student during their IST year are invaluable. We wish the students well that have successfully completed their training year and will be entering the employment market in 2017.

#### **GRADUATIONS 2016**

National Diploma (Analytical Chemistry) = 41

National Diploma (Polymer Technology) = 12

Diploma in Chemical Process Technology = 14

Bachelor of Technology (Chemistry) = 5

Bachelor of Science (with Chemistry as a major) = 8

Bachelor of Science Honours = 7

#### MASTER OF SCIENCE (RESEARCH)

#### MADANHIRE, Tatenda – Cum Laude

Titleofdissertation:SYNTHESISANDCHARACTERISATION OF LANTHANIDE COMPLEXESWITH NITROGEN- AND OXYGEN-DONOR LIGANDS

#### **MOYO, Cyprian Bertrand**

Title of dissertation: *DEVELOPMENT OF PALLADIUM* SELECTIVE REAGENTS AND MATERIALS

#### NCANYWA, Luphumlo Sympathy

Title of dissertation: EVALUATION OF P – MENTHANE – 3, 8 - DIOL CITRONELLAL ACETAL AS A SUITABLE BIO-PLASTICIZER FOR POLYVINYL CHLORIDE

#### NTSIMANGO, Songeziwe

**Title of dissertation:**THE DEVELOPMENT OFRHENIUM NANORADIOPHARMACEUTICALS

#### VON BERG, Stuart Raymond Colenzo

**Title of dissertation:** *THE CHARACTERIZATION OF AND FORMULATION DEVELOPMENT USING A NOVEL TYRE DEVULCANIZATE* 

# MASTER OF TECHNOLOGY: CHEMISTRY (COURSEWORK)

BUKULA, Nwabisa Asanda (Product and Process Development) Title of treatise: OPTIMISATION OF CLEARCOAT VISCOSITY

# MASTER OF TECHNOLOGY: CHEMISTRY (RESEARCH)

KOORTS, Waldo Pieter Ernst Title of dissertation: SCOPING OF A COMMERCIAL MICRO REFORMER FOR THE PRODUCTION OF HYDROGEN

COETZEE, Louis-Charl Cloete

Title of dissertation: A STUDY OF LANTHANIDE COMPLEXES WITH DI-2-PYRIDYL LIGANDS

#### DOCTORAL DEGREE CITATIONS

DEGREE OF DOCTOR OF PHILOSOPHY (CHEMISTRY)

#### 1. JANVIER MUKIZA Previous qualifications:

2011 BSc National University of Rwanda

2013 BSc Hons Nelson Mandela Metropolitan University 2014 MSc (*Cum Laude*) Nelson Mandela Metropolitan University

#### Thesis:

#### RHENIUM COMPLEXES WITH POTENTIALLY MULTIDENTATE LIGANDS CONTAINING THE AMINO, IMINO, HYDROXY AND THIOL GROUPS

This study focused on the co-ordination chemistry of the metal rhenium, which was shown to be the most versatile of all transition metals, for possible applications in catalysis, and as therapeutic agents in nuclear medicine.

One of the highlights of the study was the synthesis and characterization of a new class of metal compound never observed before in chemistry, containing triple bonds between metal atoms in the oxidation states of 3, 5 and 4,





with bridges by multidentate chelates. This result has opened a new research field in general co-ordination chemistry, which may find new applications in catalysis, cancer therapy and molecular switches, and has created widespread international interest after the publication of the results.

Another aspect of the project was a systematic study of rhenium complexes of orotic acid, which has been found to display anti-tumour activity. It was found that the bonding mode of orotate to rhenium is different to that of other similar metals, and can be fine-tuned by ancillary ligands, which may influence its activity.

This study also led to complexes of rhenium that catalyse the decarboxylation of organic acids, similar to the functioning of the enzyme OMP decarboxylase, which is of interest in the biosynthesis of nucleic acids in the body.

This thesis has produced high-quality results that have led to various publications in the international literature. It is ground-breaking research, which has opened many research avenues that should lead to many postgraduate MSc and PhD studies to follow.

#### 2. LUBABALO ROWAN MAFU

#### **Previous qualifications:**

2008 BSc (Chemistry and Computer Science) University of Fort Hare

2009 BScHons (Chemistry) University of Fort Hare 2012 MSc (Chemistry) Nelson Mandela Metropolitan University

#### Thesis:

#### DEVELOPMENT OF SMALL PRODUCTION PLATFORM FOR CITRONELLAL PROCESSING

In South Africa there is acceptance across government and industry that a key challenge to the future growth and sustainability of the chemical sector is to increase local manufacturing. Current manufacturing protocols have been the same for decades; and they are not competitive in a global market. NMMU is working to provide a step change in manufacturing technology that will increase the availability and affordability of a variety of chemical products, with a particular emphasis on South Africa's needs, in order to make the country more self-reliant.

In his thesis, Lubabalo Mafu presents a substantive body of research into the development of continuous-flow reactor systems for a variety of chemical processes. He initially demonstrated that he could use natural citronellal oil, extracted from plants, and convert it into isopulegol and *para*-menthane-3,8-diol in high yield. These addedvalue materials were subsequently used as a feedstock for the microwave-assisted continuous flow synthesis of a variety of di-ester derivatives, which are potential plasticisers. This strategy allows one to have accurate control over the reaction temperature and substrate residence times. Moreover, it employs polymer-supported Scandium triflate as an environmentally friendly catalyst, resulting in green chemical methodology.

The candidate has presented his results at national conferences, as well as at the Flow Chemistry Congress, San Diego, USA. There is little doubt that the candidate has made a significant contribution in establishing continuous-flow technology in South Africa.

#### 3. GRATIEN HABARUREMA Previous qualifications:

2010 BSc (Applied Chemistry) Kigali Institute of Science and Technology

2013 BScHons Nelson Mandela Metropolitan University 2014 MSc (*Cum Laude*) Nelson Mandela Metropolitan University

#### Thesis:

#### RHENIUM COMPLEXES WITH MULTIDENTATE IMINE-, AMINE-, THIONE-, THIOL-, HYDROXY- AND CARBOXAMIDE CHELATES

This study was an extensive project on the synthesis and structural characterization of new compounds of the metal rhenium for applications in radiopharmacy, homogeneous catalysis, chemotherapy and chemosensing.

The interaction of rhenium in the oxidation states +I, +III and +V with a variety of biologically active organic molecules, like thiosemicarbazones, carboxamides, pyrazines, imidazoles, pyrimidines, carboxylic acids and diamines were investigated; and novel products were isolated and characterized. Several major contributions were made to extend the boundaries of knowledge of basic co-ordination chemistry. The first examples of the coordination of multidentate ligands as iminium-phenone zwitter-ions to a metal ion were presented; and a synthesis protocol was established for these compounds. Another was the importance of the donor-atom type and the backbone-chain length on the formation of bridges between rhenium(I) atoms, which would have an impact on the synthesis of other multinuclear transition-metal complexes. This study also presents the first example of a fifteen-membered chelate ring in the co-ordination sphere of any metal.





The major findings of this study were published in various publications in the international literature; and the impact is such that many postgraduate MSc and PhD studies will be initiated from these novel results.

## **DEGREE OF DOCTOR OF TECHNOLOGY** (CHEMISTRY)

#### 1. MTETELELI BETHWELL MTYOPO

**Previous qualifications:** 

2002 NDip (Analytical Chemistry) PE Technikon 2004 BTech (Chemistry) PE Technikon 2005 MTech (Chemistry) Nelson Mandela Metropolitan University

#### Thesis:

# THE DEVELOPMENT AND EVALUATION OF A NEW MANUFACTURING PROCESS FOR $\beta$ - SITOSTEROL - D - GLUCOSIDE

 $\beta$ -Sitosterol-D-Glucoside is a derivative of the plant sterol  $\beta$ -Sitosterol that is commonly used as an immune-system modulator in health supplements and certain food products. Isolation of  $\beta$ -Sitosterol from plant material results in complex mixtures of plant sterols, which require isolation and purification of the  $\beta$ -Sitosterol before it can be processed into the desired  $\beta$ -Sitosterol-D-Glucoside. Such purification procedures are not only very cumbersome, but also very expensive. The high costs associated with the production of  $\beta$ -Sitosterol-D-Glucoside limits the potential application of the product, especially in products that could be used for hunger relief and disaster relief.

In his thesis, Mtheza Mtyopo presents a study that attempts to produce the target  $\beta$ -Sitosterol-D-Glucoside product directly from the original plant sterol mixture, followed by separation only at the end of the synthetic step. The use of an alternative catalyst for the synthetic step allows some selectivity towards  $\beta$ -Sitosterol over other plant sterols, thereby reducing the demands, hence cost, on the purification step to some extent. As with any technological development project, the thesis elicits several questions that would need to be addressed before the proposed approach could become technically and economically viable.

#### AWARDS AND RECOGNITIONS

We would like to congratulate the following people for the award they received and for flying the NMMU Chemistry flag high in 2016.

#### STAFF

1. Dr Richard Betz received the following prestigious awards from NMMU in 2016:

(i) Faculty of Science - Emerging Excellent Teacher Award 2016.(ii) Faculty of Science - Emerging

Researcher of the Year 2016.



2. Prof. Zeni Tshentu was one of the recipients of the **IAAM Scientist Medal (2016)** from the International Association of Advanced Materials (IAAM) for notable and outstanding research in the Advanced Materials Science and Technology. He received the medal at the American Advanced Materials Congress (AAMC) which was held in Miami on the 4-9 December 2016. He presented on the topic "Functional nanofibers and their applications".



A picture of Prof. Tshentu receiving the medal from Prof. Hisatoshi Kobayashi who is the president of IAAM.

Prof. Zeni Tshentu also received a **Raikes Medal** 2016 from the South

African Chemical Institute (SACI) in 2016. The award is made to a person, under the age of 40 on the 31<sup>st</sup> March in the year of the award, whose original chemical research shows outstanding promise as judged by that person's publication record in reputable journals. It is further stipulated that the research shall have been performed in South Africa.

3. We would like to congratulate Prof TIA Gerber for the achievement - 5 most highly cited papers published in Polyhedron.

**Title of article:** Structural and DFT/TD-DFT investigation of tris(bidentate) complexes of rhenium(III) synthesized from the



cis-[ReO<sub>2</sub>]<sup>+</sup> core and benzenethiol derivatives. The article was published in 2013 and it's one of the most highly cited papers during 2014, 2015 and up until June 2016. https://www.journals.elsevier.com/polyhedron/most-cited-articles





4. We would also like to congratulate Prof P. Watts for the achievement- 5 most highly cited papers published in Nuclear Medicine and Biology.



**Title of article:** Microfluidics in radiopharmaceutical chemistry. The article was published in 2013, and it is one of the most highly cited papers during 2014 and 2015. https://www.journals.elsevier.com/nuclear-medicine-and-biology/most-cited-articles

#### **Research Associate**

1. Dr Maya John (a Research Associate in Chemistry Department) was the 1st runnerup in the DST Women in Science Awards for 2016. Congratulations to Dr Maya John.



YouTube Interview link-Dr Maya John:

https://www.youtube.com/watch?v=3-fqHS0qiQ4

#### **STUDENTS**

1. Mrs Xandri van Niekerk (previously Schoultz) received a prestigious award from L'Oréal-UNESCO For Women in Science.



2. Ms Aidan L. Battison received a prestigious **James Moir medal** from the South African Chemical Institute (SACI)

The James Moir medals are awarded to the best BSc Honours student in chemistry achieving a minimum aggregate final mark of 75% at each University, and the best BTech student with the same minimum aggregate in chemistry at each University of Technology. Only one is awarded per university.



3. Awards presented at the Annual Eastern province SACI Postgraduate Chemistry seminars

(i) Aidan Battison (1<sup>st</sup> Position, Junior category)



(ii) Cloudius Sagandira (Runner up in the senior category)







#### **DEPARTMENTAL RESEARCH OUTPUTS**

The following research articles, reviews and book chapters were published by staffs and postgraduates in 2016:

#### Full research articles

1. A Review of using Spray Pyrolysis through Solgel materials in the synthesis of cathode materials for lithium-ion batteries. C. D. Snyders, E. E. Ferg, J. Schuelein, H. Loewe. S. Afr. J. Chem., 2016, 69, 88–97.

2. Approximation-based integral versus differential isoconversional approaches to the evaluation of kinetic parameters from thermogravimetry: kinetic analysis of the dehydration of a pharmaceutical hydrate. R. Neglur, D. Grooff, E. Hosten, M. Aucamp, W. Liebenberg. *J. Therm. Anal. Calorim.*, 2016, 123, 2599-2610.

3. Congener profiles of polychlorinated biphenyls and the effect on marine mussels at an outfall site, Port Elizabeth, South Africa. E. Kampire, G. Rubidge, J.B. Adams, L Human. *Water SA*, 2016, 42 (3), 496-504.

4. Mine Air Analysis on the Reef in the Early 1900s – Observations From the Work of James Moir, Government Analyst. P. Loyson. *S. Afr. J. Chem.*, 2016, 69, 208-212.

5. Clathrates of novel ethylenediamine derivatives: thermal, X-ray crystallographic and conformational analysis of inclusion complexes of N,N'-bis(5-phenyl-5-dibenzo[a,d]cycloheptenyl)ethylenediamine and its 10,11-dihydro analogue. B. Barton, R. Betz, M. R. Caira, E. C. Hosten, C. W. McCleland, P. L. Pohl, B. Taljaard. *Tetrahedron*, 2016, 72, 7536-7551.

6. Discrimination between *o*-xylene, *m*-xylene, *p*-xylene and ethylbenzene by host compound (*R*,*R*)-(e)-2,3-dimethoxy-1,1,4,4-tetraphenylbutane-1,4-diol. B. Barton, E. C. Hosten, P. L. Pohl. *Tetrahedron*, 2016, 72, 8099-8105.

7. Crystal structures, antibacterial, antioxidant and nucleic acid interactions of mononuclear and tetranuclear palladium(II) complexes containing Schiff base ligands. S.B. Moosun, M.G. Bhowon, E.C. Hosten, S. Jhaumeer-Laulloo. *J. Coord. Chem.*, 2016, 69 (18), 2736-2753.

8. 2-Mercapto-orotic acid as a bridging chelate in a Re(III)Re(IV) dimer with a metal-metal bond. J. Mukiza, T.I.A. Gerber, E. Hosten. *Inorg. Chem. Comm.*, 2016, 67, 64-66.

9. Electrospun poly(vinylbenzyl chloride) nanofibres functionalised with tris-(2,2'-pyridylimidazole)iron(III): A test strip for detection of ascorbic acid and dopamine. B. Mudabuka, A.S. Ogunlaja, Z.R. Tshentu, N. Torto. *Sens. Actuators, B*, 2016, 222, 598-604. 10. Functional nanofibers for separation of rhodium(III) and iridium(IV) chlorido species. Avela Majavu, Adeniyi S. Ogunlaja, Eric C. Hosten, Zenixole R. Tshentu. *Miner. Eng.*, 2016, 87, 32-44.

11. Selective removal of isoquinoline and quinolone from simulated fuel using 1,1'-binaphthyl-2,2'-diol (BINOL): crystal structure and evaluation of the adduct electronic properties. A.S. Ogunlaja, E. Hosten, R. Betz, Z.R. Tshentu. *RSC Adv.*, 2016, 6, 39024-39038.

12. A colorimetric probe for the detection of  $Ni^{2+}$  in water based on Ag-Cu alloy nanoparticles hosted in electrospun nanofibres. D.A. Ondigo, B. Mudabuka, B. Pule, Z.R. Tshentu, N. Torto. *Water SA*, 42, 408-414.

13. Metal Complexes of New Bioactive Pyrazolone Phenylhydrazones; Crystal Structure of 4-Acetyl-3-methyl-1-phenyl-2-pyrazoline-5-one phenylhydrazone Ampp-Ph. O.G. Idemudia, A.P. Sadimenko, E.C. Hosten. *Int. J. Mol. Sci.*, 2016, 17, 687.

14. Reactivity of a benzothiazole-thiourea derivative with the oxorhenium(V) core: Isolation of rhenium(III) and (V) complexes. S. Sathdeo, X. Schoultz, T.I.A. Gerber, R. Betz, E. C. Hosten. *Polyhedron*, 2016, 112, 1-5.

15. Rhenium(I) complexes with benzothiazole-thiourea derivatives. X. Schoultz, T.I.A. Gerber, E.C. Hosten. *Polyhedron*, 2016, 113, 55-60.

16. Rhenium(III), (IV) and (V) complexes with 6-hydroxypicolinic acid. J. Mukiza, E.C. Hosten, T.I.A. Gerber. *Polyhedron*, 2016, 110, 106-113.

17. Syntheses, characterization, and antimicrobial properties of nickel(II) dithiocarbamate complexes containing NiS<sub>4</sub> and NiS<sub>2</sub>PN moieties. D.C. Onwudiwe, A.C. Ekennia, E. Hosten. *J. Coord. Chem.*, 2016, 69(16), 2454-2468.

18. Synthesis and properties of ZnS nanoparticles by solvothermal and pyrolysis routes using the Zn dithiocarbamate complex as novel single source precursor. M. Hrubaru, D. C. Onwudiwe, E. Hosten. *J. Sulfur Chem.*, 2016, 37 (1), 37-47.

19. Synthesis, characterization and antimicrobial properties of some mixed ligand complexes of Zn(II) dithiocarbamate with different N-donor ligands. D.C. Onwudiwe, Y.B. Nthwane, A.C. Ekennia, E. Hosten. *Inorg. Chim. Acta*, 2016, 447, 134-141.

20. Synthesis, crystal structure, thermal and theoretical studies of bis(N-ethyl-N-phenyldithiocarbamato) Ni(II) and (N-ethyl-N-phenyldithiocarbamato) (isothiocyanato) (triphenylphosphine) Ni(II). D.C. Onwudiwe, M.M. Kabanda, E. E Ebenso, E. Hosten. *J. Chem. Sci.*, 2016, 128 (7), 1081-1093.





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#### **Books/Book chapters**

1. T.I.A. Gerber, X. Schoultz, Rhenium: Coordination Chemistry and Radiopharmacy, in *Crystallizing Ideas –The Role of Chemistry*, Chapter 3, 2016, pp 47-56, Eds: P. Ramasami, M. Gupta Bhowon, S. Jhaumeer Laulloo, H. Li Kam Wah; Springer. Web address: http://www.springer.com/gp/book/9783319317588

2. A.S. Ogunlaja and Z.R. Tshentu, Molecularly imprinted polymer nanofibers for adsorptive desulfurization. In *Applying Nanotechnology to the Desulfurization Process in Petroleum Engineering*, Editor: Tawfik A. Saleh, 281-336 (2016), ISBN: 9781466695450, Web address: <u>http://www.igi-global.com/book/applying-nanotechnol-</u> <u>ogy-desulfurization-process-petroleum/134808</u>

3. A. S. Ogunlaja, P.E. Kleyi, R.S. Walmsley and Z.R. Tshentu, Nanofiber-supported metal-based catalysts, in *Catalysis* for the book series *Specialist Periodical Reports*, Royal Society of Chemistry (RSC), Catalysis, 2016, 28, 144–174. ISBN: 978-1-78262-427-1, Web address: http://pubs.rsc.org/en/content/chapter/bk9781782624271-00144/978-1-78262-427-1#!divabstract

4. P. Watts, The synthesis and use of unstable reagents and intermediates in flow reactors, in 'Sustainable Flow Chemistry - Methods and Applications' ed L. Vaccaro, Wiley-VCH, 2016, 193-218. ISBN: 978-3-527-33852-8, Web address: http://eu.wiley.com/WileyCDA/WileyTitle/productCd-

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5. P. Watts, Organometallic catalyzed gas-liquid reactions in flow, in 'Organometallic Flow Chemistry' ed T. Noel, Springer, 2016, 77-95. Web address: .http://link.springer.com/chap-

ter/10.1007%2F3418 2015 159

6. Peter Loyson, Early Pharmacy Teaching in Port Elizabeth: The story of the diploma in Pharmacy; self-published, place Port Elizabeth, 2016, pages 173, ISBN 978-1-920508-75-3.





## CONFERENCES ATTENDED AND PAPERS PRE-SENTED BY STAFF AND STUDENTS Student conferences

#### Keith Nare

(i) Polymer modified bitumen a response surface methodology approach at the 6th SASOR Rheology Conference, CSIR International Conference Centre, Lynnwood Ridge, Pretoria, 19-21 September 2016.

(ii) Polymer modified bitumen a response surface methodology approach, 31<sup>st</sup> Road Pavements Forum in Addo, Eastern Cape on the 5th of May 2016.

#### Tendai O. Dembaremba

Vanadium(IV)/(V) for the catalytic oxidation of refractory organosulfur compounds. The South African Spectroscopic Society's Young Spectroscopist Symposium, South Event, 8th of November 2016, Stellenbosch University.

#### Mondeli Mngoma

Chemical Analysis of the tree bark of Strychnos henningsii of the Eastern Cape. Frank Warren, 4 - 8 December 2016, Rhodes University, Eastern Cape, South Africa.

#### Nehemiah Latolla

Investigating the Phytochemistry and Bioactivity of Some Compounds Found in, Eastern Cape Medicinal Plant, Cissampelos Capensis L.f. (Menispermaceae), Frank Warren, 4 - 8 December 2016, Rhodes University, Eastern Cape, South Africa.

#### Lungelwa Mahanjana

Isolation and characterization of active compounds with anti-HIV activity from methanolic extracts of Bulbine species, Eastern Cape, Frank Warren, 4 - 8 December 2016, Rhodes University, Eastern Cape, South Africa.

#### Staff conferences

#### Dr Buyiswa Hlangothi

(i) Characterization of synergistic activity of plant extracts from Strychnos henningsii medicinal plant of the Eastern Cape, South Africa, 17th Tetrahedron Symposium, 28 June - 01 July 2016, Sitges, Spain.

(ii) Phytochemistry and bioactivity of selected Eastern Cape medicinal plants, Frank Warren, 4 - 8 December 2016, Rhodes University, Eastern Cape, South Africa

#### Dr Adeniyi S. Ogunlaja

(i) Towards oxidative denitrogenation of fuel oils: vanadium-catalysed oxidation of quinoline and adsorptive

removal of quinoline-*N*-oxide using functional nanofibers, CATSA conference, 6th – 9th November 2016, Champagne Sports Resort, Central Drakensburg, South Africa.

#### Dr Shanganyane P. Hlangothi

(i) Green Natural Fibre Reinforced Reclaimed Rubber Composites, Recycled Rubber Products Conference held from  $14 - 16^{th}$  September 2016 in Las Vegas, USA.

#### **Prof Zenixole Tshentu**

(i) Invited lecture (medal lecture): Polymer nanofibers for desulfurization of fuels, American Advanced Materials Congress 04 – 09 December 2016 MIAMI, USA.

 Polymer nanofibers for desulfurization of fuels, 7<sup>th</sup> World nano-conference, June 20-21, 2016, Cape Town, South Africa.

(iii) Keynote Address: From complexity to simplicity in natural systems - a call to drive towards sustainability, delivered at the opening of the National Science Week at the Nelson Mandela Bay Science and Technology Centre, Uitenhage, South Africa, 10 August 2016.

#### **Prof Paul Watts**

(i) Keynote Lecture, 'The Use of Continuous Manufacturing to Facilitate Sustainable Synthesis in Emerging Markets', Flow chemistry India 2015, Mumbai, India, January 21-22 2016.

(ii) Invited Lecture, 'The use of multi-step continuous manufacturing to enable sustainable synthesis in emerging markets', CPAC Rome Workshop 2016: Utilization of Cascade Concepts and MVA for Next Generation Process Optimization, Rome, Italy, March 21-23, 2016.

(iii) Keynote Lecture, 'State of the Science of Pharmaceutical Provision in Africa', UBRICA ONE, Texas A&M University, April 25-28, 2016.

(iv) Invited Lecture, 'Continuous Manufacturing to Enable Sustainable Synthesis', CPAC Summer Institute 2016: Next Generation Process Development Approaches Which Will Enable Truly Sustainable Chemical and Biomass Processing', University of Washington, Seattle, July 19-21 2016.

(v) Keynote Lecture, 'Pharmaceutical Provision in Africa: A possible Solution', UBRICA SUMMIT, Nairobi, 12-16 October 2016.

(vi) Keynote Lecture, 'The Use of Continuous Flow to Facilitate Sustainable Fine Chemical and API Manufacturing in Africa'. Flow chemistry congress 2016, Miami, November 2-3, 2016.





#### **Prof Thomas I.A. Gerber**

(i) Invited Lecture - The reaction of Re(V) precursors and orotic acid: Re(IV)-Re(IV) dimers, Re(III)/Re(V) monomers and decarboxylation; ICCC 2016; Brest, France – July 3-8, 2016.

(ii) Decarboxylation of aminocarboxylic acids by rhenium(V) complexes; 17th Tetrahedron Conference, Sitges, Spain – June 26-July 1, 2016.

#### **Prof Peter Loyson**

(i) Invited lectures: Ancient Roman Engineering, Physics Dept, NMMU, 8 April 2016.

(ii) Invited public lecture: Italian Genius through the Ages, Italian Culture Club, Italian Club in Port Elizabeth, 20 Sept 2016.

(iii) Invited public lecture: First Woman graduates in the world, Italy leading the way, Italian Culture Club, Italian Club in Port Elizabeth, 15 November 2016.

#### WORKSHOPS AND SEMINARS

(i) Mr Jacques E. Thomas, Mr Samuel Bosman and Mr Francois Olivier attended a safety workshop titled: Safety Solutions for a Modern-Day Laboratory, on the 29<sup>th</sup> July 2016 at Pickering Park in Port Elizabeth. The workshop was organised by LASEC and ASECOS.

(ii) Staff and students attended the annual Eastern Province SACI Postgraduate Students Chemistry Seminars at Rhodes University in October 2016.



Pictured here are Drs Mama and Ogunlaja with Chemistry and InnoVenton Postgraduate and Postdoctoral Students.

#### TRAINING

(i) Mr Lukanyo Bolo attended the Microscopy Training & Tool Demonstration at Karlsruhe, Germany, 10-16 July, 2016.

#### COMMUNITY ENGAGEMENT

At NMMU we pride ourselves in the values; ubuntu, respect for diversity, excellence, respect for the natural environment, integrity and taking responsibility. By taking these into account and integrating it into our day to day interactions within the chemistry department we can apply and incorporate these values into engagement and outreach activities. The engagement activities aim to promote chemistry to the non-academic members of the community such as school going learners and educators which may be considering too further or pursue a career in the chemistry field. In addition, outreach events promote the chemistry department and inform educators, learners and different members of the community from all walks of life about the career opportunities, different aspects of chemistry have to offer and how it forms part of your day to day life. Below are the chemistry outreach events done so far in 2016:

Open Day Chemistry Stall (06 – 07 May 2016)



A group of high school learners wanting to pursue a career in chemistry, and loving what the interactive stall had to offer (left). N. Dip. Analytical Chemistry students (Mzukisi Mdingi and Monicia Damons) volunteering at the hands-on and interactive stall to tell the public about chemistry and the opportunities it has to offer (right).





National Science Week Nelson Mandela Bay Science and Technology Centre (8 – 13 August 2016)



On the left the combustion of gun cotton (nitrocellulose) is in a controlled manner. The theme for this year was: 'Science for sustainable development and women empowerment'. A series of presentations were done during the week based on the theme and the guest lecturer for the opening event was Prof. Tshentu.

Eskom Junior Scientists at the NMMU indoor sport centre (23 August 2016)



An opening demonstration for an audience of primary school learners before their science projects were reviewed. On the left Dr Rubidge holds fire without being burnt and the children stand with outstretched hands for the experiment to "work". Physics in Action NMMU South Campus (September 2016)



The physics and maths in action host the top learners from the province and have them spend some time in each science department for about half an hour. Above the learners were shown a method of water purification and a neutralisation reaction by exhaling into a slightly alkaline solution. Dr Rubidge and myself hosted the chemistry section for the morning.

Chapman High School (20 October 2016)



An interactive demonstration was done by having the grade 10 Physical Science learners make a large circle around the activity being done, then break off into smaller groups to do smaller experiments. The event was arranged by Dr. Rubidge, Asif Muhammed and the Physical Science Educator Ms Erasmus. The Analytical Chemistry students which assisted that day was Cecile Witbooi and Monicia Damons.





## Nickelodeon Genius - Cape Town and Uitenhage (October and November 2016)



The Nickelodeon Genius competition is where leaners from both high and primary school in their respective categories battle it out against each other with a science quiz to stand a chance to win R100 000 and a trip to the Kennedy Space Centre in Florida, USA. A day before their quiz the learners had a hands-on chemistry workshop and a short motivational and illustrative talk on chemistry and other science related topics. The students which helped to assist during the workshop was Amanda, Cecile Witbooi, Masego Loeto, Monicia Damons and Simbablwe Simlota. The day at the NMB Science centre was ended off with demonstrations and chemistry talk by Dr. Rubidge.

#### RESEARCH CENTRES AND CHAIR The uYilo e-Mobility Technology Innovation Programme (EMTIP)



Prof Ernst Ferg (Director of uYilo, NMMU)

The uYilo e-Mobility Technology Innovation Programme (EMTIP) was launched on the 13<sup>th</sup> March 2013 as an initiative by



government's Technology Innovation Agency (TIA) to fast track the development and commercialization of key technologies in support of the electric vehicle (EV) industry and related electric mobility (eMobility) as a whole. The programme aims to identify niche technologies within this field that will help the South African industry to develop and add value to its use in local application that can range from full sized battery driven electric vehicles to e-bikes.

The uYilo programme is currently in the process of submitting a new Business Plan that looks at expanding the national facility for the next 5 years.





As part of a pilot project that is looking at introducing an e-mobility platform on universities' campus, uYilo in partnership with NMMU have started an e-bike

sharing scheme between the various campuses in Summerstrand. The students and staff are able to register through an on-line system to make use of the bikes as alternative means of moving between the north and south campus. The bikes availability and location can be found on the NMMU staff and student portal's web page.

The offices of uYilo and its laboratories are located within the eNtsa engineering facilities near the new engineering building on north campus of the NMMU Summerstrand campus. A staff compliment of about 10 people with a variety of engineering and science skills work with the eNtsa team to provide solutions in the field of eMobility. This includes the annual administration of government funding through a scheme known as "kick-start" funding that allows small businesses to apply in order to help them fast track key technologies to commercialization. More information on the programme can be found on the web page: **uyilo**.org.za/



You might ask "Where does chemistry fit into the field of electric mobility?" One of the most important components of the electric vehicle is its battery. By weight it is about 20-25% of the car and contributes to more than half the price of the vehicle's cost. It is also that component of the vehicle that has a limited life span. As with all modern portable electronic commodities that makes use of portable power, the battery is one of those things that have a significant influence on the use of a product. Be it a portable power tool, cell phone, starting of a motor vehicle





engine or an electric vehicle. In essence, the battery stores chemical energy and its use in application depends very much on its material characteristics and physical composition. By understanding the chemistry and electrochemical behavior of the material, slight changes in their composition can have a large effect on the ability extend the battery's life, to optimize its use in various environmental applications and improve, above all, the safety in the consumer product. Recently this had become evident in the case of the unmanaged thermal charging cycles of certain smart phone devices. All these tie into the careful understanding of the physical properties of materials, thermodynamics and basic electrochemistry.

The battery used in a passenger EV is significantly larger and has to comply with very stringent safety regulations. The battery and materials research facility in uYilo and the chemistry department was established not only to do research into battery related chemistry, but also to find engineering solutions for new and novel energy storage applications.

Within the diploma and BTech graduate training programme, over the last number of years the group had successfully equipped graduates during their in-service training (IST) year and related BTech project in the field battery and materials chemistry. Avukonke Jona (diploma student) worked on a project that looked at the measuring thickness of successfully electroplating nickel onto stainless steel. Madlavuza Nwabisa (BTech student) looked at the chemical process of recycling Li-ion batteries and the ability to measure Li concentrations in various solutions that included sea water.

In 2016 Charmelle Snyders completed her doctoral study in chemistry with the title "An



investigation of the morphological and electrochemical properties of spinel cathode oxide materials used in Li-ion batteries". From her work, she successfully published two papers with one more article being currently in the process of completion. These were "A Review of using Spray Pyrolysis through Sol-gel Materials in the Synthesis of Cathode Materials for Lithium-ion Batteries; C.D. Snyders, E.E. Ferg, J. Schuelein and H. Loewe; *S. Afr. J. Chem*; 69 (2016) 88-97, and "An investigation into the temperature phase transitions of synthesized materials with Al and Mg doped lithium manganese oxide spinels

by in-situ powder x-ray diffraction; C.D. Snyders, E.E. Ferg and D. Billing; *Powder Diffraction*. DOI: https://doi.org/10.1017/S088571561600066X. Besides the value of the work in the form of articles and post graduate qualifications, the results of the study gave the group some insight into how the materials that are used in Li-ion batteries undergo various phase transitions during their production process. This allows for possible improvements and the reduction of costs in making the materials in a large-scale manufacturing process.

In 2016, we had an interesting project that was done in collaboration with eNtsa at the mechanical engineering facility. By combining their tribometer that measures the



wear properties of metal surfaces and an electrochemical potentiostat from the chemistry department, Brandon Davoren completed his master's level study by combining the two techniques to look at the tribocorrosion properties of surfaces of friction welded and laser welded titanium alloys. He completed his study in one year and his findings were novel enough that were also written-up and submitted to a peer-reviewed journal for publication in 2017.



The battery group in uYilo has an accredited battery testing facility with a large number of battery equipment. The accreditation (SANAS 17025) is specific for

analytical testing facilities that allows the local battery industry to send through batteries that can undergo





validation testing according to national or international specifications such as SABS, IEC or even Original Equipment Manufacturers (OEM) like VW or Nissan. These specification testing are usually lengthy and can take up to 6 months to complete one batch of batteries. A range of battery testing equipment is available at the facility that can test from coin-cell size batteries right up to 12V lead-acid batteries at a 1000A discharge.

The materials/electrochemistry chemistry group located in



the physical/polymer laboratories on the ground floor of the chemistry building have access to a wide range of instrumentation that are used on a regular basis

to do materials characterization, quality control and in particular to solve problems for the local battery and materials related industry. These include, amongst others, phase composition of powders by x-ray powder

diffraction, particle size distribution by laser diffraction, BET surface area of battery electrode material, the melt flow index (MFI) of plastics and elemental analysis by x-ray fluorescence.



#### Centre for Rubber Science and Technology (CRST)



From the Director: Dr Shanganyane P. Hlangothi

The Centre for Rubber Science and Technology (CRST) draws on Nelson Mandela Metropolitan University's historic experience in chemical rubber science and technology. Its activities include the advancement of rubber related

research and development programs across various disciplines such as Chemistry, Environmental Science and Computer Science; training for the needs of the rubber and tyre manufacturing industries within South Africa; and providing analytical and technical services to the South African rubber and tyre manufacturing and recycling industries. Staff: The centre has a total of 7 staffs (research associates and technician). Staff information could be found on <a href="http://crst.nmmu.ac.za/Staff-and-Associates">http://crst.nmmu.ac.za/Staff-and-Associates</a>

Instruments available: The centre has the following instruments...

- mDSC Q100
- SDT Q600
- ARES G2 Rheometer
- MonTech's Dynamic Rubber Process Analyzer (D-RPA-3000)
- Moving Die Rheometer (MDR-3000 basic)
- Dynamic Mechanical Analysis (DMA Q800),
- Differential Scanning Calorimetry (DSC Discovery series)
- Thermogravimetry coupled with Mass Spectrometry (TG-MS Discovery series).

Recently, a new Thermo Scietific Haake Polylab (modular torque rheometer platform) mixer was installed and commissioned.

#### **Bursaries**:

CRST offered 10 undergraduate bursaries worth R32000 each to academically deserving students studying chemistry at NMMU.

The centre also offer scholarships to postgrads (MSc and PhD's); funds are also available for post-doctoral researchers.

Some past and current REDISA Funded Projects are presented below:

Project topic	Year
	started
The devulcanization of model compounds by variety of	2014
diphenyldisulfides.	
Extraction of diallyl sulphides and other similar	2016
compounds from Tulbaghia violacea, a South African	
plant, for potential use as devulcanising agent.	
Diol-derived Antimony(V) Chelate Compounds as	2016
potential devulcanization agents.	
The study of the interaction between rubber crumbs and	2015
Bitumen.	



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An Investigation into the effects of interaction between	2016
crumb rubber and bitumen in the dry mixing process of	
asphalt mixtures.	
Use of rubber tyres in low-cost RDP housing.	2016
'Green' Natural Fibre Reinforced Natural Rubber/	2015
Reclaimed Rubber Composites.	
Binary and ternary blends of polypropylene, waste	2015
rubber crumb & wood flour.	
The Synthesis of Functionalized Carbon Nanomaterials	2016
from Waste Rubber Sourced Carbon for Chemosensing	
during Water Purification Processes.	
Effect of Tuball Rubber on the curing properties of	2016
recycled/virgin rubber blend formulations.	
Waste rubber derived nanomaterials for potential	2016
applications in Li batteries or conveyer belting (tbc).	
Fuel production from tyre derived oil and the	2016
development of chemical degradation method for waste	
tyres.	
Study of EPM/crumb rubber mixture as a	2016
compatibilizer and/or a processing aid in the processing	
of recycled plastics.	
REDISA Tyre Volume Estimator.	2016

Other interesting news from the centre:

- Keith Nare (CRST research associate) was invited to present his research at the launch of the Bitumen Laboratory (NMMU-North campus) on the 21st of April 2016.
- Keith Nare (CRST research associate) was invited by Society of Asphalt Technology to give a presentation on his research on the 5th of July 2016 in Port Elizabeth.
- Pumza Mente and Phuti Tsipa (CRST postgrads) presented at the South African leg of the IOM3 annual Young Persons' World Lecture Competition which took place on the 13th June 2016 at Wits University.
- Dr Percy Hlangothi exhibited CRST and Polymer Technology activities (representing the Faculty of Science) at a SAASTA SOD Turning ceremony held in Cofimvaba on the 18<sup>th</sup> June. This event was officiated by the Minister of Science & Technology.

- Please see page 72 in the following link: <u>https://issuu.com/tohara/docs/sa\_plastics\_dec\_201</u> <u>6 - jan\_2017</u>
- Please see page 27 in the following link:

http://www.fleetwatch.co.za/e-mag/fw/issue42/issue44-11-year-old-buys-first-truck/index.html

For further information, please visit CRST website: <u>http://crst.nmmu.ac.za/</u>

### INNOVENTON



Prof Ben Zeelie Director of InnoVenton

**InnoVenton: Institute for Chemical Technology** is a formally registered Research Institute at the Nelson Mandela Metropolitan University; whose principle research focus is in Product and Process Development. The Institute strives to be self-sustaining through income generated from services to industry, income from technology transfer projects and royalties from patents. InnoVenton offers a range of services to our clients, customers and students.

Formal Training, Short courses, Analytical Services and Technology support form the foundation of our interaction. The Microalgae to Energy project, sponsored by the DST is one of InnoVenton flagship activities.

**Coalgae® Technical Demonstration:** The start of 2016 saw the completion of the construction of the Coalgae® technical demonstration facility at a cost of some R2.4 million. The main purpose of the facility was to produce 5-6 tonnes Coalgae® product in a dedicated campaign in

which all the unit operations of the Coalgae® technology was integrated. Independent external testing of the product from potential users of the technology or product was solicited.



Some 5.2 tonnes of coal was processed through the facility. Some 200 kg of the product was processed by means of pyrolytic topping into a bio-crude pyrolysis oil (~25 kg) and which were sent for a crude oil assay by Intertek (UK). Other tests conducted on the product include mechanical resistance and weather resistance testing, and fixed-bed combustion testing (John





Thompsons). Pulverised combustion testing is still to be conducted by Eskom.

#### New appointments at InnoVenton

✓ Dr Shaka Shabangu, a former post-doctoral fellow and research associate at Cornell University was appointed as Renewable Energy Theme leader in the Microalgae Technologies Project.

✓ Mr Brian Tait, previously Business Development Manager, Sasol Technology, has been appointed as Inno-Venton's first Strategy and Operations Executive.

 $\checkmark$  Dr Carla Kampman, a former post-doctoral fellow at the center has been appointed as theme leader for Microalgae Cultivation Systems in the Microalgae Technologies project.

 $\checkmark$  Mr Derek Hislop has been appointed as instrument technician in InnoVenton to take responsibility for the repair and maintenance of Inno-Venton's significant investments into equipment and instrumentation.

#### **Two TIA Seed Fund Projects Approved**

Two additional Seed Fund proposals were approved for InnoVenton in October 2016. These proposals were:

**1.** Low Smoke Fuel for Low Income Households: The proposed project involves the development of a lowemission solid fuel, primarily aimed at developing a replacement fuel for the household use of coal and biomass (wood).

2. Biological fertilisers and soil conditioners: The proposed project involves the development of three related product offerings using microalgae as the critical basic input. These product offerings are:

 $\checkmark$  Biological fertilizer produced by either blending animal manure with microalgae and optionally pelletizing said blends into a solid fertilizer,

 $\checkmark$  A low cost, low technology for growing microalgae in a wet bed of animal manure or other organic residue, and using said mixture directly as biological fertilizer; and

 $\checkmark$  A soil conditioner containing microalgae, bacteria, and humic acid substances.

The information above was extracted from InnoVenton 2017 Newsletter,

http://innoventondcts.nmmu.ac.za/News/InnoVenton-Times-Newsletter-2016

For further information, please go to: <u>http://innoventondcts.nmmu.ac.za/</u>

#### **RESEARCH CHAIR: MICROFLUIDIC BIO-CHEMICAL PROCESSING**

#### **Prof Paul Watts (Research chair)**

Professor Watts research aim to develop a continuous flow methodology to investigate how small production platforms can enhance chemical manufacture within the South African economy. In addition, research



will be undertaken to investigate the integration of synthesis and purification within continuous flow systems.

Research interests include:

Micro reactor and continuous flow synthesis;

• Green chemistry;

• Process intensification and process analytical technology;

• Pharmaceutical manufacture;

• Catalysis (and biocatalysis) in continuous flow reactors;

- Drug formulation;
- Nanochemistry.

For further information, please go to: <u>http://research.nmmu.ac.za/Research-Chairs/Chair-in-Micro-fluidic-Bio-Chemical-Processing</u>

#### WELCOME ON BOARD!

1. Mr Aldritt McLean joined the Chemistry Department in the capacity of Laboratory Technician responsible for the First-Year Laboratory. He holds a Master's Degree in Technology (MTech) Chemistry. He started his career as a Laboratory Technician and later a



Research Chemist at Aspen Pharmacare before He joined the former Vista University as a Junior Lecturer in the Department of Chemistry. During his time at NMMU, He was involved with the Extended Programme of the Science Faculty at Missionvale Campus.





2. А former NMMU's Chemistry Department postdoctoral fellow, Dr Adeniyi S. Ogunlaja was appointed to a lecturing position. Dr Ogunlaja, a former National research foundation (NRF) Green Economy post-doctoral Fellow



and a recipient of the SASOL Post-Graduate Medal (2013) awarded by the South African Chemical Institute (SACI) for original and innovative research holds a Bachelor (Hons) and Masters (MSc) degree in Industrial Chemistry from the University of Ilorin, Nigeria, while He obtained his PhD degree in Chemistry from Rhodes University. He is a member of (1) South African chemical institute (SACI) and (2) Catalysis Society of South Africa (CATSA). His research focus is in (i) the development of smart materials (nanofibers and MOFs) capable of selectively removing and sensing sulfur- and nitrogencontaining compounds in hydro-treated fuels *via* molecular recognition and (ii) the synthesis of mixed platinum group metal-base metal nanocatalysts for hydrodesulfurization of fuels.

#### FAREWELL

The department would like to wish the following retired staff members; (1) Ms Lee-Anne Ingram, (2) Ms Margaret Nobe (Lab Assistant), (3) Ms Myriam Ghenne (Lecturer) and (4) Mrs Magda Vooslo a happy retirement filled with joy and happiness.

Photos of some retired staff members as well as pictures collected at the farewell gathering organised for Mrs Magda Vooslo (North campus Secretary) on the 25/11/2016 are presented below.



Ms Lee-Anne Ingram (lab Technician)



Ms Margaret Nobe (Lab Assistant)

#### ALUMNI

#### Mr Masixole Swartbooi

He works at Aspen Pharmacare as a laboratory analyst and recently won the Aspen recognition community award. He was recognized for teaching young pupils in the location Mathematics and Physical Sciences particularly at junior phases (Grade 8, 9 and 10).







Mrs Magda Vooslo (Departmental Secretary, North Campus)





#### **2016 END OF YEAR PHOTOS**

After an interesting academic year, it was time to relax and celebrate. The end of year dinner party was held at Chapman Hotel on the 15<sup>th</sup> of December, 2016. Staff members in attendance are depicted in the photos below.



#### 2016 POSTDOCTORAL RESEARCH FELLOWS

Name: Dr Motshabi A. Sibeko Area of Research: Polymer Science Host: Dr Shanganyane P. Hlangothi



**Centre OR unit:** Centre for Rubber Science and Technology

Name: Dr Felix Odame Area of Research: Bioinorganic Chemistry, medicinal chemistry, and computational chemistry Host: Prof Zenixole R. Tshentu Centre OR unit: Inorganic research group



Name: Dr Mohau Justice Phiri Area of Research: Polymer Chemistry and Rubber Technology Host: Dr Shanganyane P. Hlangothi Centre OR unit: Centre for Rubber Science & Technology



Name: Dr. Devender Mandala Area of Research: Organic Synthesis Host: Prof. Paul Watts Centre OR unit: Continuous Flow Chemistry

Name: Dr Lubabalo Ruvan Mafu Area of Research: Organic Synthesis Host: Prof. Paul Watts Centre OR unit: Continuous Flow Chemistry









## MEET THE CHEMISTRY DEPARTMENT STAFF

#### ACADEMIC STAFF

1. Prof. Zenixole Tshentu Position: Associate Professor (Chemistry) Department: Chemistry Room: 13 01 03 Location: Summerstrand Campus (South) Phone: 041 504 2074



Email: zenixole.tshentu@nmmu.ac.za

Research Areas: Beneficiation of earth and secondary resources.

Current research projects: (i) recovery of precious metals, (ii) metals in medicine, and (ii) metal-based catalysis towards fuel applications (denitrogenation and desulfurization).

2. Dr Abubak'r Abrahams

Position: Lecturer: Inorganic Chemistry Department: Chemistry Room: 130202



Location: Summerstrand Campus (South) Phone: 041 504 1203

Email: abubakr.abrahams@nmmu.ac.za

Research Areas: Inorganic Chemistry focusing on Lanthanide Coordination Chemistry; Catalysis.

Current research projects: (i) Lanthanide complexes with Schiff bases of varying denticity; (ii) Applications of the aforementioned in hydrophosphonylation reactions; (iii) The syntheses and computer modelling of air-sensitive lanthanide compounds; (iv) The syntheses and characterisation of lanthanide-thiosemicarbazone complexes and their biological applications.

#### 3. Dr Benita Barton

Position: Senior lecturer- Organic Chemistry

Department: Chemistry Location: Summerstrand Campus (South) Phone: 041 504 4859

Email: <u>benita.barton@nmmu.ac.za</u>

Research Area: Organic Chemistry

Current project: Host-guest chemistry and the application thereof for isomer separations.

4. Dr Richard Betz

Position: Lecturer: Inorganic Chemistry Department: Chemistry Location: Summerstrand Campus (South) Phone: 041 504 2103 Email: richard.betz@nmmu.ac.za



**Research Areas:** Inorganic chemistry

Current research projects: Sugar-acid supported coordination compounds. These cover a vast range of elements, both from the main groups (for example, arsenic, selenium and antimony) as well as the transition metals. Some applications are directed at artificial photosynthesis.

5. Prof Ernst Ferg Position: Associate Professor Physical Chemistry Department: Chemistry Room: Building 13003 Location: Summerstrand Campus (South) Phone: 041 504 3160 Email: ernst.ferg@nmmu.ac.za



Research Areas: Research in battery electrochemistry and powder X-ray diffraction.

Current activities are the investigation of the solid-state phase transitions of synthesizing cathode and anode battery related materials and their electrochemical properties. Work also includes the development of and integration of storage cells into suitable battery systems for a variety of applications. http://www.nmmu.ac.za/ErnstFerg/

#### Mr Fanus Gerber 6.

Position: Senior Lecturer: Polymer Chemistry Department: Chemistry Location: Summerstrand Campus (South) Phone: 041 504 3460 Email: fanus.gerber@nmmu.ac.za **Research Areas:** Polymer Technology







7. Prof Thomas Gerber Position: Professor in Inorganic Chemistry Department: Chemistry Room: 130208 Location: Summerstrand Campus (South) Phone: 041 504 4285 Email: thomas.gerber@nmmu.ac.za



**Research Areas**: Inorganic Chemistry.

Current research projects: (i) development of rhenium metal complexes for the diagnosis of Alzheimer's disease and (ii) metal-metal bonded rhenium complexes as deamination and decarboxylation catalysts.

8. Dr Driekus Grooff

Position: Lecturer: Physical & Analytical Chemistry Department: Chemistry Location: Summerstrand Campus (South) Phone: 041 504 1219 Email: driekus.grooff@nmmu.ac.za



Research Areas: Physical/ Analytical chemistry Solid-state properties of active pharmaceutical ingredients Application of thermal analysis to the investigation of solid-state reaction processes.

9. Dr Buyiswa Hlangothi Position: Lecturer: Chemistry Department: Chemistry Room: 0305 Location: Summerstrand Campus (South) Phone: 041 504 3270



Email: buyiswa.hlangothi2@nmmu.ac.za

**Research Areas:** Natural Product and Medicinal Plant Chemistry. Isolation and characterization of secondary metabolites followed by their bioactivity screening.

10. Dr Shanganyane Hlangothi Position: Lecturer in Physical & Polymer Chemistry and Director of the Centre for Rubber Science & Technology Department: Chemistry Room: 0005 Location: Summerstrand Campus (South) Phone: 041 504 2437 Email: percy.hlangothi@nmmu.ac.za

Research Areas: Polymer modification of bitumen, devulcanization of rubber, Polymer blends, polymer composites and polymer nanoscience.

For current research projects, please go to the CRST website: http://crst.nmmu.ac.za/

11. Dr Neliswa Mama Position: Senior Lecturer Department: Chemistry Location: Summerstrand Campus (South) Phone: 041 504 2368 Email: neliswa.mama@nmmu.ac.za Research Areas: Synthesis and applica-



tions of fluorescent polymers.

12. Ms Anita Noah Position: Lecturer: Analytical Chemistry Department: Chemistry Room: A101 Location: Summerstrand Campus (North) Phone: 041 504 3093 Email: anita.noah@nmmu.ac.za



Research Areas: Analytical Chemistry and Catalytic Oxidations

13. Dr Adeniyi S. Ogunlaja Position: Lecturer: General & Analytical Chemistry Department: Chemistry Room: A102 Location: Summerstrand Campus (North) Phone: 041 504 9061



Email: adeniyi.ogunlaja@nmmu.ac.za

Research Areas: Analytical Chemistry, Materials Chemistry & Catalysis

Current research projects: (i) the development of smart materials (nanofibers and MOFs) capable of selectively removing and sensing sulfur- and nitrogen-containing compounds in hydro-treated fuels via molecular recognition and (ii) the synthesis of mixed platinum group metalbase metal nanocatalysts for hydrodesulfurization of fuels.

14. Dr Gletwyn Rubidge Position: Lecturer in Analytical Chemistry Department: Chemistry Location: Summerstrand Campus (North) Phone: 041 504 3176 Email: gletwyn.rubidge@nmmu.ac.za







**Research Areas:** Research Areas: Analytical Chemistry, Chemistry Engagement.

**Current research projects:** (i) Heavy metal contamination in the vicinity of shipwrecks and (ii) Development and optimisation of procedures for enhancing science in community.

15. Dr Colin Southway
Position: Lecturer
Department: Chemistry
Location: Summerstrand Campus (South)
Email: colin.southway@nmmu.ac.za
Research Areas: Analytical Chemistry
(especially environmental applications)



Prof Paul Watts
Position: Research Chair in Microfluidic
Bio/Chemical Processing
Department: InnoVenton and The Downstream Chemicals Technology Station
Room: A201A
Location: Summerstrand Campus (North)
Phone: 041 504 3694
Email: paul.watts@nmmu.ac.za

For research areas and current research projects, please go to <u>http://research.nmmu.ac.za/Research-Chairs/Chair-in-Micro-fluidic-Bio-Chemical-Processing</u>

#### **Polymer Technology Contract Staff**

1. Name: Dr James Carson Position: Project Manager CRST and Polymer Technology Lecturer (Rubber) Department: Chemistry Room: 016 Location: Summerstrand Campus (North) Email: James.Carson@nmmu.ac.za Research Areas: Tyre recycling Current project: Product testing Institute, Coega



Ms Rekha Neglur
 Position: Paint technology lecturer
 Department: Chemistry
 Room: 13008
 Location: Summerstrand Campus (South)
 Phone: 041 504 2275



Email: <u>rekha.neglur@nmmu.ac.za</u> **Research Area:** Paint technology

Current project: Polymorphs, Thermal Analysis

3. Mr Bryan Drake Position: Lecturer in Polymer Technology (Plastics) Department: Chemistry Location: Summerstrand Campus (South) Phone: 0732176601 Email: <u>bryan.drake@nmmu.ac.za</u> andrake6@gmail.com

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#### EMERITI

Prof Hans Rohwer
 Department: Chemistry
 Location: Summerstrand Campus (South)
 Phone: 041 504 2274
 Email: <u>hans.rohwer@nmmu.ac.za</u>



2. Prof Peter LoysonDepartment: ChemistryLocation: Summerstrand Campus (South)Phone: 041 504 2147

Email: <u>peter.loyson@nmmu.ac.za</u>

**Current research interests** are (i) History of Chemistry, (ii) Chemical Education, and (iii) Education in general, Ancient technologies



3. Prof Cedric McCleland
Department: Chemistry
Location: Summerstrand Campus (South)
Phone: 041 504 2607
Email: cedric.mccleland@nmmu.ac.za
Research Areas: Organic Chemistry &

Computational Chemistry

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**Current research interests** are in the chemistry of reactive intermediates (specifically radicals and radical-cations), and host-guest complexes.

The general thrust is to apply computational approaches to elucidate the reaction mechanisms and properties of reactive intermediates on one hand, and host-guest complexes on the other, in order to better understand various selectivity phenomena manifested in their chemistry.





#### **RESEARCH ASSOCIATES**

1.Dr Kathy GardePhone:041 504 2437Email:katherine.garde@nmmu.ac.zaResearch interest:Polymers



2. Dr Bennie Van Brecht
Phone: 041 504 2276
Email: <u>bernardus.vanbrecht@nmmu.ac.za</u> **Research interest:** Coordination chemistry of transition metals



3. Dr Maya John
Phone: 041 508 3292
Email: mjohn@csir.co.za
Research interests: Bio-based composites and their applications



4. Prof Chris Woolard
Email: <u>chris.woolard@uct.ac.za</u> **Research interests:** Polymer science and technology. Fuel research.



#### **RESEARCH OFFICERS**

Dr Eric C. Hosten
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Lukhanyo Bolo
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#### **TECHNICAL STAFF**

1. Mr Samuel Bosman

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2. Pumza Fibi Department: Centre for Rubber Science and Technology (CRST) Location: Summerstrand Campus (South) Phone: 041 504 2380 Email: pumza.fibi@nmmu.ac.za



3. Mr Aldritt Maclean
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4. Mrs Kina Muller
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5. Ms Rekha Neglur
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6. Mr Francois Olivier
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7. Mr Henk Schalekamp
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8. Mr Jacques Thomas
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6. Ms Cynthia Balintulo Position: Laboratory Assistant

5.

Position: Laboratory Assistant Department: Chemistry Location: Summerstrand Campus (South) Email: <u>cynthia.balintulo@nmmu.ac.za</u>

Miss Phelekwa Nkonzo

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#### LABORATORY ASSISTANTS

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2. Mr Phindile Gaika
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3. Ms Bukelwa Mletshe
Position: Lab Assistant
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4. Mr Joseph Ndimeni
Position: Laboratory Assistant
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#### ADMINISTRATIVE STAFF

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 Department: Chemistry
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Mrs Magda Vosloo
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 Phone: 041 504 3993
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#### **ACADEMIC CALENDAR: 2017**

#### LECTURE BLOCKS

• **First teaching block:** Monday 6 February – Friday 24 March (34 days)

• Second teaching block: Monday 27 March – Friday 26 May (36 days)

• Third teaching block: Monday 17 July – Friday 1 September (34 days)

• Fourth teaching block: Monday 4 September – Friday 27 October (35 days)

#### NORMAL EXAMINATION PERIODS

• **First Semester:** Wednesday 31 May – Tuesday 20 June (16 days)

• Second Semester: Thursday 2 November – Wednesday 22 November (18 days)

#### **RE-EXAMINATION PERIODS**

• January re-examinations: Monday 9 January – Tuesday 24 January (including extension of 2016 normal examinations)

• **February re-examinations:** Thursday 9 February – Friday 17 February (during term time)

• Second Semester: Monday 10 July – Friday 14 July

• December re-exam: Monday 11 December – Wednesday 13 December

#### NOTE:

In the event of exams being disrupted, the University reserves the prerogative to extend the exam period for a reasonable time beyond the planned end of exams.

#### **GRADUATION CEREMONIES**

#### Autumn graduation

- Thursday 30 March Friday 31 March (George)
- Tuesday 4 April Tuesday 11 April (Port Elizabeth)

#### **Summer graduation**

- Thursday 14 December 2017
- Friday 15 December 2017

#### STUDENT RECESS PERIODS

- 14 April 23 April
- 21 June 16 July
- 23 September 1 October
- 23 November 31 December

#### PUBLIC AND SCHOOL HOLIDAYS 2017

Semester 1	Sun	1 January	New Year's Day
-	Mon	2 January	Public Holiday
	Tues	21 March	Human Rights Day
	Fri	14 April	Good Friday
	Mon	17 April	Family Day
	Thurs	27 April	Freedom Day
	Fri	28 April	University Holiday
	Mon	1 May	Workers' Day
	Fri	16 June	Youth Day
Semester	Wed	09 August	National Women's
2			Day
	Sun	24	Heritage Day
		September	
	Mon	25	Public Holiday
		September	
	Sat	16	Day of
		December	Reconciliation
	Mon	25	Christmas Day
		December	
	Tues	26	Day of Goodwill
		December	

For more information, please visit <u>https://www.nmmu.ac.za/About-NMMU/Academic-</u>Calendar-2017