

# APPLICATION FORM: Nelson Mandela University ENGAGEMENT EXCELLENCE AWARDS

(CONSULT THE ENGAGEMENT EXCELLENCE AWARDS POLICY AND READ THE APPLICATION FORM BEFORE COMPLETING THE TEMPLATE IN ORDER AVOID A DUPLICATION OF INFORMATION.)  
COMPLETE THIS FORM IN TYPESCRIPT. PROVIDE ONLY THE INFORMATION REQUESTED.

SECTION A: Application category					
<ul style="list-style-type: none"> <li>Indicate with an <b>X</b> in the appropriate box the award you are applying for.</li> <li>Your application will only be considered for the award you have applied for</li> </ul>	<p><input type="checkbox"/> Engagement Excellence Award – Science, Technology and Engineering</p> <p><input type="checkbox"/> Engagement Excellence Award – Social Sciences and Humanities</p> <p><input type="checkbox"/> Engagement Excellence Team Award</p> <p><input type="checkbox"/> Engagement Excellence Project Award – Science, Technology and Engineering</p> <p><input type="checkbox"/> Engagement Excellence Project Award – Social Sciences and Humanities</p> <p><input checked="" type="checkbox"/> <b>Emerging Engagement Excellence Awards</b> <i>(note that Professors and Associate Professors are not eligible for this category)</i></p>				
<b>Surname of Applicant/Team Leader</b>	Westraadt				
<b>First Name</b>	Johan				
<b>Initials</b>	JE				
<b>Title</b>	Dr.				
<b>Telephone numbers</b>	(041) 504 2301 / 079 694 6684				
<b>E-mail address</b>	<a href="mailto:johan.westraadt@mandela.ac.za">johan.westraadt@mandela.ac.za</a>				
<b>Employment position</b>	Research Fellow				
<b>Faculty</b>	Science				
<b>Department</b>	Physics				
<b>Division</b>	Centre for HRTEM				
<b>Immediate line-manager</b>	Prof. Jan Neethling				
<b>Eligibility: Are you permanently employed and/or on a long term (3 years or more) fixed contract?</b> <i>(indicate with an X)</i>	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; text-align: center;"><b>Permanent</b></td> <td style="width: 50%; border: none; text-align: center;"><b>Fixed term contract</b></td> </tr> <tr> <td style="border: none;"></td> <td style="border: none; text-align: center;"><b>X</b></td> </tr> </table>	<b>Permanent</b>	<b>Fixed term contract</b>		<b>X</b>
<b>Permanent</b>	<b>Fixed term contract</b>				
	<b>X</b>				
<b>If this is an application for one of the Engagement Excellence Project Awards, provide a brief title and description of the project</b> (250 words maximum)	<p><b><u>Title:</u></b></p> <p><b><u>Description:</u></b></p>				

<p><b>If this is an application for either the Excellence Awards or the Emerging Award, provide a brief description of your engagement activities and initiatives</b> (250 words maximum)</p>	<p><b>Description:</b> “<i>Innovation through observation</i>”</p> <p>As a researcher in the Centre for HRTEM my goal is to promote the use of advanced electron microscopy as a critical tool for innovation in applied materials research. This was done through the following engagement activities in 2017:</p> <ol style="list-style-type: none"> <li>1. Acting as <b>Editor in Chief</b> for the Microscopy Society of Southern Africa annual conference: The conference typically consists of 150-200 delegates from across Southern Africa. The short abstracts are rigorously peer reviewed and compiled into a printed copy of the proceedings. I also served on the executive committee of MSSA, who is responsible for the organisation of the conference.</li> <li>2. <b>Microscopy training</b> for students at other South African universities (UCT, Wits, UP, UJ and Stellenbosch): The training was done as <i>engagement activities</i> in addition to my normal job description. The research projects involve a very wide range of materials including manufacturing and processing of titanium, steel and ceramics.</li> <li>3. <b>Microscopy training</b> for members of industry: My main role is to provide microscopy support for students from Eskom. In addition to this, I assisted industrial members from Sasol and Element Six (1x PhD student) by providing training on the use of electron microscopes as a tool for industrial research.</li> <li>4. <b>Collaborative research</b> with local and international industries: I am involved in a number of research projects ranging from manufacturing, materials processing to life-assessment of power plants that have significant financial implications for the particular industry. Through this, we managed to attract additional external funding from various industrial clients (Element Six, Sasol and Eskom) to conduct applied industrial research.</li> </ol>
<p><b>Are your Engagement activities/projects/initiatives registered on the Engagement Management Information System (E-MIS) on SharePoint?</b>          If <i>not</i>, please ensure that they are before you submit this application.          Applications that are not registered and updated on the E-MIS will not be considered for Awards. The most recent date on E-MIS for each project update (achieved when ‘submit’ is clicked) must be in 2015.          Provide the exact titles (as featured on the E-MIS) for all of the Engagement activities/projects/ initiatives with which you are involved.</p>	<p><b>Titles:</b></p> <ol style="list-style-type: none"> <li>1. <i>Innovation through observation</i></li> </ol>

Visit <http://caec.mandela.ac.za/Engagement-Information-and-Development/Engagement-Management-Information-System>

## SECTION B: Engagement categories

- You are required to describe and report in detail on a minimum of two engagement categories (these are 1, 2, 3 and 4 below) in order to be considered for an award.
- If you or your team are involved in three or four of the engagement categories, report in detail on all of these categories.
- Applications that describe and can provide evidence of engagement activities across all four categories are encouraged.
- Refer to section 5 of the attached Engagement Excellence Awards policy which provides a guideline on the specific activities you should report on under each of the categories you have chosen.

**Report on your:**

### 1. Engagement through Community Interaction, Service and Outreach:

**Report on your:**

#### 2. Engagement through Teaching and Learning:

**Microscopy training** for students at other South African universities: Through my involvement with the microscopy society and the Centre for HRTEM, I receive numerous direct requests for access to our facilities. Most of these requests involve early-stage researchers (MSc) from engineering/metallurgy backgrounds, where the main aim of the research is the development of new materials. The main outcome of these activities was students graduating with post-graduate degrees and publications in conference proceedings. A list of projects and students is given in the portfolio. A selection of photos taken during the microscopy training is shown in the portfolio.

**Microscopy training** for members of industry: My main role is to provide microscopy support for students from Eskom. In addition to this, I assisted industrial members from Sasol and Element Six (1x PhD student) by providing training in the use of electron microscopes as tools for industrial research. A list of projects and members trained from industry is shown in the portfolio.

**Report on your:**

### 3. Engagement through Profession/Discipline-Based Service Provision:

Acting as **Editor in Chief** for the Microscopy Society of Southern African annual conference: For the 2017 conference held in Bela-Bela, I approached Prof Harry Bhadeshia from the Metallurgy Department at the University of Cambridge who is a world leader in the development of new steels. The NRF through KIC funded his costs to attend the conference. He presented the John Matthews Memorial plenary lecture and during his visit a symposium was held at the University of Pretoria (50+ delegates). He also gave talks at Nelson Mandela University and University of Cape Town on the use of neural networks in materials science. We currently have a standing collaboration on the use of neural-network machine learning software for applications in materials science and he agreed to host some of our PhD students and staff in his department for research visits.

**Report on your:**

### 5. Engagement through Research and Scholarship:

**Collaborative research** with local and international industry: I am involved in a number of research projects ranging from manufacturing, materials processing to life-assessment of power plants that have significant financial implications for each industry. Through this, we managed to attract additional external funding from various industrial clients (Element Six, Sasol, Eskom, eNtsa) to conduct applied industrial research. A full list of external funded projects is given in the portfolio.

External funding received for work completed in 2017: (R667k + R150k) = **R817k** [Excluding salary paid from external funds (Eskom), other short-term contract research payments and completed work yet to be invoiced]

**SECTION C: Descriptions**

**1. Describe the impact your Engagement activities have made on stakeholders/beneficiaries/communities and provide details on how these activities are acknowledged/recognized by:**

**1.1. External communities/stakeholders/beneficiaries:**  
(not staff and students)

**Eskom** – Increased skills and training for Eskom employees doing their post-graduate studies.

In recognition of quality of the microscopy work, Eskom RT&D decided to fund an additional project directly with the Centre for HRTEM for the development of an “**industrialized characterization procedure**” that could be implemented as an additional life-assessment method for power plant components.

**Element 6** – Increased skills and training for employees through post-graduate studies. (I am supervising one of their employees who is registered as a PhD student in the Centre for HRTEM)

**Sasol** – We perform failure analysis of different welded steel components using advanced electron microscopy. These failures has significant financial implications and the replacement protocol depends on the results of the microstructural analysis. We currently have **4** separate failure analysis projects for Sasol.

The **Microscopy Society of Southern Africa (MSSA)** conferences provide an unique opportunity for the various stakeholders for microscopy (local and international researchers, students, industry, manufacturers and NRF/DST) to interact. My involvement in the conference was to manage the refereeing process, compile the proceedings, organize the presentation programme and host the invited speaker.

**1.2. Internal communities/stakeholders/beneficiaries:**  
(staff and students)

**eNtisa** – *WeldCore*<sup>TM</sup> is an unique sampling process developed by Prof. Hattingh’s group. I performed various microstructural analyses on the extracted plugs and repair welds to add value to this sampling process for industry. We have a long-term collaboration with them in providing services and doing research that would add value to their activities. Through our collaboration, we share knowledge between the different entities.

**2. Describe how your Engagement activities contribute towards faculty/department/entity engagement goals and objectives.** *(Refer to your Department/Faculty/Entity's strategic plan here)*

The main aim of the Centre for HRTEM is to provide a broad community of South African scientists and students with a full range of state-of-the-art instruments and expertise for materials research. Through my involvement with MSSA, I get into contact with various researchers and students from other universities and I either facilitate access to the Centre for HRTEM or get directly involved with the research.

The external funding obtained from the contract industrial research contributes towards the running project costs for research, the service contracts of the microscopes and bursary supplements for MSc and PhD students registered in the Centre for HRTEM.

**3. Describe how your Engagement activities contribute towards the achievement of Vision 2020 Engagement Strategic Goals and Objectives.**

**Economic sustainability** – Cost savings due to deferred maintenance of power plants can have significant benefit for Eskom. Innovation for the manufacturing industry is critical, the information gained from our research can be used to refine production processes to gain a competitive advantage for our local manufacturing industries.

**Mutually beneficial partnerships** – Our core competence is in microstructural characterization and materials science. We rely on existing material development projects to make new and interesting materials for the investigations, thus each interested party are leveraging their own infrastructure in a mutually beneficial partnership.

**Ubuntu** – We are the only microscope unit in South Africa with this particular combined set of instruments. My aim through this project was to lower the barriers for access to the facilities at Centre for HRTEM, especially for students from non-microscopy research fields such as engineering and metallurgy, where the main aim of the research is in new materials development.

**4. Describe how your Engagement activities contribute towards:** *(Refer to any relevant media coverage, representation on boards or committees, scholarly publications, conference presentations etc.)*

**4.1. Addressing the needs of society and various external communities served by the university:**

Research reports outlining the progress made on each of the industrial research projects. *(Available on request)*  
Research publications and presentations are listed in Section 6 of this application.  
Serving as a member on the Microscopy Society of Southern Africa executive committee.

**4.2. Profiling and promoting the university's as an engaged university:**

The Centre for HRTEM is actively involved in the organizing of the annual MSSA conference. In addition, each year roughly 50% of the materials research abstracts submitted to the conference involve work done at the Centre for HRTEM.

The Centre of HRTEM at the Nelson Mandela University has unique facilities and actively operate on a national level. In this engagement project my aim was to facilitate access to the equipment.

**5. Describe how you have successfully integrated engagement into the Teaching and Learning and Research functions of the university.** (Refer to sections 5.1, 5.2 and 5.3 of the Engagement Excellence Awards Policy as a guideline)

Students and members of industry are mostly based outside the Eastern Cape and they do not always have time to travel to the Centre for HRTEM. In order to accommodate these non-traditional part-time students, I often make use of remote-microscope viewing facilities at Centre for HRTEM. Through this system, they can view the microscope images via the internet and two-way verbal communication is done via video conferencing. This results in significant cost and time saving for the researchers.

Students and researchers from engineering departments often need a more practical approach in the use of electron microscopes. Any training on the use of electron microscopy needs to be tailored such that it delivers the most value in a reasonable time-frame for each researcher. To this end, each project typically consists of a small feasibility study to first determine the most suitable characterization technique, before the project is accepted. This procedure helps to keep the study focused and improves the quality of the results given to the researcher.

**6. Provide details of scholarly outputs/contributions made to a body of knowledge as a result of your engagement activities.** (Refer to publications, new teaching programmes, technical reports, conference proceedings, etc.)

Conference publications (2017):

Adegbenjo AO, Lesufi M, Mphahlele MR, Olubambi PA and **Westraadt JE [University of Johannesburg]**

Analysis of a Spark Plasma Sintered Carbon Nanotube Reinforced Ti6Al4V Composite

Proceedings of the Microscopy Society of Southern Africa 47, 8 (2017)

*55th Annual Conference of the Microscopy Society of Southern Africa, 4-7 December 2017, Forever Resorts Warmbaths, Bela-Bela*

Marx G and **Westraadt JE [Eskom]**

CSEF Steel Subgrain Measurements using EBSD, TKD and TEM

Proceedings of the Microscopy Society of Southern Africa 47, 17 (2017)

*55th Annual Conference of the Microscopy Society of Southern Africa, 4-7 December 2017, Forever Resorts Warmbaths, Bela-Bela*

Minnaar EG, **Westraadt JE** and Neethling JH **[Element 6]**

Dislocation Densities in Polycrystalline Diamond Sintered at Ultra-high Pressure

Proceedings of the Microscopy Society of Southern Africa 47, 19 (2017)

*55th Annual Conference of the Microscopy Society of Southern Africa, 4-7 December 2017, Forever Resorts Warmbaths, Bela-Bela*

**Westraadt JE [Element 6]**

Graphite Formation in Polycrystalline Diamond with Solid Solution Binder Additions

Proceedings of the Microscopy Society of Southern Africa 47, 25 (2017)

*55th Annual Conference of the Microscopy Society of Southern Africa, 4-7 December 2017, Forever Resorts Warmbaths, Bela-Bela*

Marx G and **Westraadt JE (Poster) [Eskom]**

Quantitative Evaluation of the Secondary Phase Particles in Welded 12% Cr Creep Aged Steel

*Microscience Microscopy Conference – MMC 2017, 3-6 July 2017, Manchester, UK*

(Invited Poster) Minnaar E, **Westraadt JE** and Neethling J **[Element 6]**

Microstructural Characterisation of Polycrystalline Diamond Sintered at Ultrahigh Pressures

*Pre-conference Congress for Students and Early-Career Professionals in Microscopy and Microanalysis, 5 August 2017. Part of: Microscopy & Microanalysis 2017, 6-10 August 2017, St Louis, Missouri, USA*

(Invited Poster) Minnaar E, **Westraadt JE** and Neethling J **[Element 6]**

Microstructural Characterisation of Polycrystalline Diamond Sintered at Ultrahigh Pressures

*Microscopy & Microanalysis 2017, 6-10 August 2017, St Louis, Missouri, USA*

**Westraadt JE (Poster) [Sasol]**

Factors Controlling Nucleation and Growth of Graphite in Low-carbon Steels During Service Exposure  
*4th International ECCC Creep & Fracture Conference, 10-14 September 2017, Düsseldorf, Germany*

**Marx G and Westraadt JE (Poster) [Eskom]**

Quantitative Microstructural Evaluation of 12% Cr Creep Aged Steel Weldments  
*4th International ECCC Creep & Fracture Conference, 10-14 September 2017, Düsseldorf, Germany*

**(Invited Speaker) Westraadt JE [Eskom]**

STEM-EELS Characterization of Early Stage Spinodal Decomposition in Fe-Cr Alloys  
*16th Frontiers of Electron Microscopy in Materials Science International Conference - FEMMS 2017, 10-15 September 2017, Johannesburg*

**Journal publications (2017):**

**Matthews RP, Knutsen RD, Westraadt JE and Couvant T [Eskom]**

*Intergranular Oxidation of 316L Stainless Steel in the PWR Primary Water Environment*  
Corrosion Science 125, 175-183 (2017)

**Minnaar EG, Westraadt JE and Neethling JH [Element 6]**

*Microstructural Characterization of Polycrystalline Diamond Sintered at Ultrahigh Pressures*  
Microscopy and Microanalysis 23 (S1), 2288- 2289 (2017)  
*Microscopy & Microanalysis 2017*

**Student graduations (2017):**

Christiaan du Preez (MSc in Physics at Nelson Mandela University) - Main supervisor **[eNtsa]**

Lucas Anderson – Co-Supervisor for M.Eng degree **[University of Stellenbosch]**

**7. Describe the important role performed by you or the team in:**

**7.1. The leadership and management of the engagement activities and initiatives:**

I actively engage with internal entities (eNtsa), external industries (Element Six, Eskom and Sasol), local universities (UCT, UJ, Wits, UP and Stellenbosch) and international universities (Cambridge) to facilitate new collaborations. I was directly involved in most of the email communications with the researcher, research planning, microstructural analysis, and interpretation and reporting of the results generated for the various projects, with the help of my two PhD students (Etienne Minnaar and Genevève Marx) and Mr. William Goosen based at the Centre for HRTEM.


**7.2. The level and extent of partnerships/collaborations/networks/linkages formed internally and externally:**

**a. Internally** (*inter-departmental, inter-faculty and interdisciplinary*):

**eNtsa (Mechanical Engineering), Nelson Mandela University**  
Contact person: Prof Danie Hattingh (Director at eNtsa)

<p><b>b. Externally</b> (at local, national and international level):</p>	<p><b>Department of Metallurgy at University of Pretoria</b> Contact person: Prof Roelf Mostert (HOD)</p> <p><b>Centre for Materials Engineering at University of Cape Town</b> Contact person: Prof Rob Knutsen (Director)</p> <p><b>CoE in Strong Materials at University of the Witwatersrand</b> Contact person: Prof Lesley Cornish (Director)</p> <p><b>School of Mining and Metallurgy at the University of Johannesburg</b> Contact person: Prof Peter Olubambi (Head)</p> <p><b>Materials Engineering at the University of Stellenbosch</b> Contact person: Dr Thorsten Becker</p> <p><b>Tata Steel Professor of Metallurgy at the University of Cambridge</b> Contact person: Prof Harry Bhadeshia (Director)</p> <p><b>Research Testing and Development, Eskom, Johannesburg</b> Contact person: Marthinus Bezuidenhout (Director)</p> <p><b>New Product Development, Element Six, Springs</b> Contact person: Dr Humphrey Sithebe (Principle Scientist)</p> <p><b>Metallurgy, Sasol Synfuels, Secunda</b> Contact person: Charl Orsmond (Principle Scientist and Head of Unit)</p>
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**SECTION D: Signature**

Applicant Signature		Date	29-May 2018
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**SECTION E: FOR OFFICE USE**  
(Administered by the Engagement Office)

Resolution regarding application from Awards Committee:	
Feedback to applicant:	



## **SECTION F: Portfolio of Evidence**

Attach any relevant documents as a portfolio of evidence to support your application. **Limit this portfolio of evidence to a maximum of 20 pages.** This can include photographs, promotional material, commendations from stakeholders/beneficiaries etc., publication references, (extracts from) annual or project reports to funders/sponsors etc., or any other relevant materials that may serve as evidence.

### **List of supporting documents submitted along with this application as addendums:**

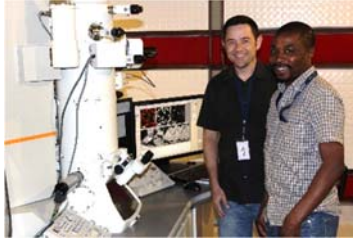
Please ensure that the documentary evidence below is clearly cross-referenced with the relevant section and number in the application template, for example Section B1 or Section C4.

1. Selection of photos for engagement project – **Section B2**
2. Overview of research activities for ultra-hard materials (Element Six) – **Section B5**
3. Overview of research activities for Power Plant Steels (Eskom and Sasol) – **Section B5**
4. Overview of research activities on titanium alloys (UCT, Stellenbosch) – **Section B5**
5. List of research projects grouped per collaborator - **Section 7.2**

## Selected list of photos taken during microscopy training for students and members of industry



Mr Velile Vilane (UCT)



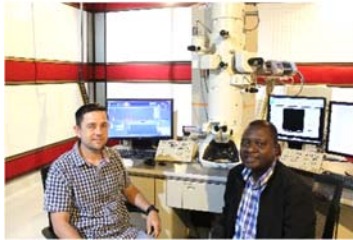
Dr Innocent Shuro (UCT)



Ms Phylis Makarunje (Wits)



Ms Mphahlele and Ms Lesufi are master students (UJ).



Mr Kofi Anan (UP)



Dr Vinod Kurup (UP)



Ms Melisha Jivanji (Element 6) and Mr Ettienne Minnaar (CHRTEM) doing research related to ultra-hard materials.



Mr Ryan Matthews (Eskom), Ms Genevève Marx (CHRTEM) and Dr Rodney Genga (Wits) at the annual MSSA conference prize giving 2016.



Prof Harry Bhadeshia and Ms Genevève Marx at the MSSA conference dinner 2017.

# Power Plant Steels



**Fig 10:** The Centre for HRTEM and MSSA brought renowned steel expert, Sir Harry Bhadeshia, to South Africa in December 2017. Sir Bhadeshia visited South Africa, on invitation by Dr Johan Westraadt from the Centre for HRTEM, to present the 39<sup>th</sup> John Matthews Memorial Lecture at MSSA 2017 in Bela-Bela. Sir Bhadeshia is the Tata Steel Professor of Metallurgy at the Department of Materials Science and Metallurgy at the University of Cambridge in the UK. His travels were jointly funded by the NRF and MSSA. As part of his visit, Sir Bhadeshia presented satellite colloquia hosted by the Department of Materials Science and Metallurgical Engineering at the University of Pretoria, the Centre for HRTEM at the Nelson Mandela University and the Centre for Materials Engineering at the University of Cape Town.

## Training

Name	Role	Training Level
Mr Matthews	EPPEI PhD, Eskom Employee	Level 3
Ms Marx	CHRTEM PhD	Level 4

## Graduation, April 2017

Person	Degree
Mr du Preez	CHRTEM MSc

## Faculty Exchange and Capacity Development

Person(s)	Place	Date	Comments
Johan Westraadt	Roscherville, JHB	11 Jan	Eskom Power Plant Engineering Institute (EPPEI) meeting
Dr Johan Westraadt	Eskom Research and Innovation Centre (ERIC), Roscherville	23 Feb	EPPEI UoT-HDI Interactive Workshop
Dr Johan Westraadt	Centre for Materials Research, UCT	14 June	Visited Prof Rob Knutsen.
Ms Genevève Marx	Manchester University	7 July	Visit to the Electron Microscopy Centre and Materials Science Centre (Host: Professor Grace Burke, Director: Materials Performance Centre, Manchester University)
Dr Johan Westraadt	Johannesburg	10 July	Visit to Eskom
Dr Johan Westraadt	eNtsa, NMU	10 Nov	Eskom Working Group Meeting
Dr Johan Westraadt	Eskom RT&D (Research Testing and Development), Germiston	22 Nov	Stakeholders Review of the Eskom Research Programme
Approximately 50 metallurgists from all over South Africa. Dr Johan Westraadt from the CHRTEM attended this event.	University of Pretoria	4 Dec	Bainite colloquium presented by Sir Harry Bhadeshia.
CHRTEM and eNtsa staff and students	CHRTEM	8 Dec	Colloquium presented by Sir Bhadeshia: "The use of neural networks in materials science"
UCT staff and students	UCT	11 Dec	Colloquium presented by Sir Bhadeshia: "The use of neural networks in materials science"

# Ultra-hard Materials

Research on the nanoscale characterisation of poly- and nano-crystalline diamond products (PCD and NCD) used as drill bit inserts for oil and gas drilling is carried out in collaboration with Element Six (UK and SA).

industries), depends on their micro and nanostructures and TEM and HRTEM at NMU are used for the nano and atomic scale analyses of these materials.

The Centre also collaborates with the DST Centre of Excellence in Strong Materials hosted by Wits University. The properties of these hard materials and hard metal alloys used as cutting and machining tools (e.g. in the mining and automotive

## Collaborators



- Element Six, UK & SA
- DST CoE in Strong Materials, Wits



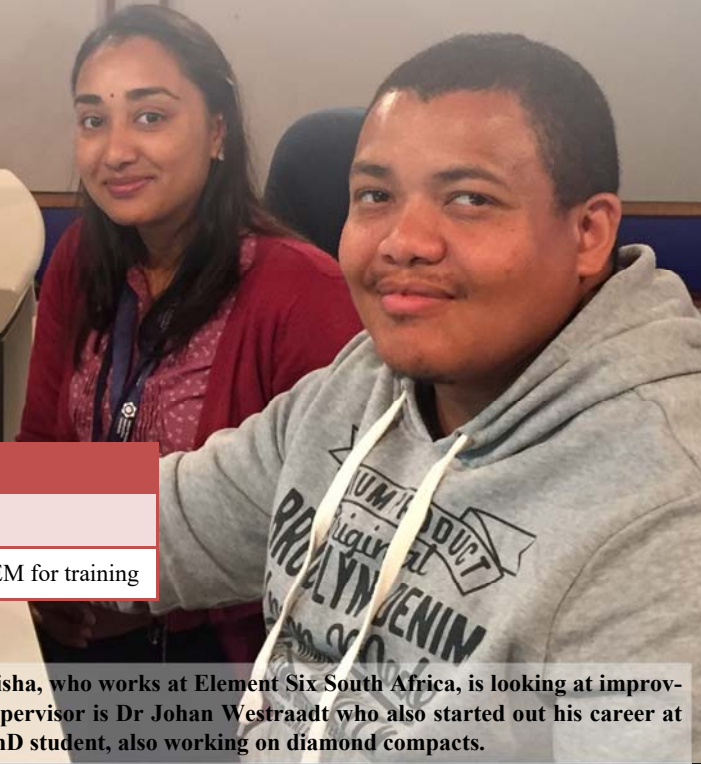
**Fig 12:** Etienne Minnaar from the Centre for HRTEM (right) with Dr Nester Zaluzec from Argonne National Laboratory in the USA. Dr Zaluzec is a renowned physicist, best known as the inventor of the Scanning Confocal Electron Microscope. Etienne, a final year PhD student, won the best poster award (twice!) at the recent meeting of the Microscopy Society of America, Microscopy & Microanalysis 2017, held in St Louis, Missouri (6-10 August). His invited poster entitled “Microstructural Characterisation of Polycrystalline Diamond Sintered at Ultrahigh Pressures” took first prize at the pre-conference “Congress for Students and Early-Career Professionals in Microscopy and Microanalysis” held on 5 August. Etienne also received the Microscopy Society of America Student Poster Award on 8 August. Dr Zaluzec is a friend of the Centre for HRTEM, and had invited Etienne to attend Microscopy & Microanalysis 2017.

## Training

Name	Role	Training Level
Mr Minnaar	CHRTEM PhD	Level 4
Ms Jivanji	CHRTEM PhD & Element Six SA Employee	Level 2

## Faculty Exchange and Capacity Development

Person(s)	Place	Date	Comments
Dr Johan Westraadt	Johannesburg	10 July	Visit to Element 6
Ms Melisha Jivanji	CHRTEM	6-10 Nov	Visited the CHRTEM for training



**Fig 13:** CHRTEM PhD student, Melisha Jivanji, visited the Centre (6-10 Nov). Melisha, who works at Element Six South Africa, is looking at improving the performance of polycrystalline diamond compacts used in drill bits. Her supervisor is Dr Johan Westraadt who also started out his career at Element Six. With Melisha is Mr Etienne Minnaar, FIBSEM operator and fellow PhD student, also working on diamond compacts.

The Centre is collaborating with the Department of Mechanical Engineering at NMU on the characterisation of friction stir welded (FSW) joints of materials consisting of titanium-aluminium-vanadium alloys (Ti-6Al-4V), high strength low alloy steel and aluminium alloys with important applications for the aerospace industry, Eskom and the automotive industry. FSW is a relatively new solid-state joining process, and can be used to join aluminium, titanium and other alloys that are difficult to weld by conventional fusion welding.

In 2016, the Centre commenced co-supervision of an MSc project in the department of Mechanical and Mechatronic Engineer-

## Collaborators



- Department of Mechanical Engineering, NMU
- Mechanical and Mechatronic Engineering, Stellenbosch
- Hulamin
- Department of Materials Science and Engineering, The Ohio State University, USA
- SiMaP, Grenoble, France

## Faculty Exchange

Person(s)	Place	Date	Comments
Mike Lee	Hulamin Offices, Pietermaritzburg	15 Feb	MOU meeting. An MOU between Hulamin and NMU has been signed by both parties. Results of the feasibility study on 12 samples supplied by Hulamin were found to be acceptable. Hulamin was embarking on new aluminium alloy products for emerging markets and they intended on keeping R&D activities within South Africa. The possibility of setting up a bursary program for postgraduate students enrolled at NMU to work on Hulamin projects will be investigated. A delegation from Hulamin will visit the CHRTEM facilities at a future date.
Jan Neethling	Bernkastel-Kues, Germany	14-17 May	CAMM 2017 Workshop - Possibilities and Limitations of Quantitative Materials Modeling and Characterization CAMM (Centre for the Accelerated Maturation of Materials) is a unit of the Department of Materials Science and Engineering at The Ohio State University.
Mr Vilane	CHRTEM	25-29 Sep	Research and training

ing at Stellenbosch University on micro-scale residual stress in selective laser melting (SLM) manufactured Ti-6Al-4V. The Centre also signed an MOU with Hulamin and is analyzing aluminium alloys for Hulamin.

Internationally, research is focused on advanced electron microscopy techniques and materials modeling in collaboration with Prof Hamish Fraser from The Ohio State University.



**HONORARY PROFESSOR**

**Prof H Fraser**

**Center for the Accelerated Maturation of Materials  
The Ohio State University, Columbus, USA**

*NMU is a member of the Titanium Centre of Competence  
hosted by the CSIR*

## Training

Name	Role	Training Level
Mr Vilane	CME PhD	Level 2

## Graduation, December 2017

Person	Degree
Mr Anderson	SU MSc

# List of external projects not relating to my main job description

## eNtsa, Nelson Mandela University

Contact person: Prof Danie Hattingh (Director at eNtsa)

- Friction-stir and laser beam welding of Ti6Al4V – Mandindwa Mashinini
- Friction-stir hydro-pillar processing of P91 – Louis Von Wielligh
- Effect of graphitisation on the mechanical properties steels – Christiaan du Preez (MSc Physics, Main Supervisor- graduated April 2017)
- Small punch creep testing of line-pipe steels – Dreyer Bernard

## Department of Metallurgy at University of Pretoria

Contact person: Prof Roelf Mostert (HOD)

Descriptive titles for different projects:

- Carbide free bainitic rail steels – Asimenye Kapito
- Development of advanced high-strength steels – Vinod Kurup
- Characterisation of micro-alloyed steels – Kofi Annan

## Centre for Materials Engineering at University of Cape Town

Contact person: Prof Rob Knutsen (Director)

- Effect of hydrogenation on the microstructure of cast Ti6Al4V – Velile Vilane (Co-Promotor of PhD)
- Microscopy training for Dr. Innocent Shuro

## CoE in Strong Materials at University of the Witwatersrand

Contact person: Prof Lesley Cornish (Director)

- Infiltration of carbon preforms – Phyllis Makarunje

## School of Mining and Metallurgy at the University of Johannesburg

Contact person: Prof Peter Olubambi (Head)

- Analysis of a Spark Plasma Sintered Carbon Nanotube Reinforced Ti6Al4V Composite (Lesufi M and Mphahlele M)

## Materials Engineering at the University of Stellenbosch

Contact person: Dr Thorsten Becker

- Measuring residual stress in laser printed Ti6Al4V using FIB-DIC – Lucas Anderson (Co-supervision of MEng – graduated December 2017)

### **Tata Steel Professor of Metallurgy at the University of Cambridge**

Contact person: Prof Harry Bhadeshia (Director)

- Use of neural networks in material science  
Zuko Mthwesi registered as a PhD student in Centre for HRTEM (Promotor)

### **Research Testing and Development, Eskom, Johannesburg**

Contact person: Marthinus Bezuidenhout (Director)

Main job description – Provide microscopy support to the various projects related to the EPPEI programme. In addition, we received additional funding for the development of an “**Industrialized characterization procedure**” that can be used as an additional method to determine the remaining-life of power plant components. A payment of R667k was made for work done in 2017.

### **New Product Development, Element Six, Springs**

Contact person: Dr Humphrey Sithebe (Principle Scientist)

- Synthesis and characterization of thermally stable PCD – Melisha Jivanji (PhD at Centre for HRTEM, Promotor). A payment of R150k was made for work done in 2017.
- Characterisation of PCD made at ultra-high pressures - Ettienne Minnaar(PhD at Centre for HRTEM, Promotor)

### **Metallurgy, Sasol Synfuels, Secunda**

Contact person: Charl Orsmond (Principle Scientist and Head of Unit)

- We perform contract research on failures from the plant. We are currently involved in four different projects with this group. Ms Vicky Hayward from Sasol is currently receiving training on the use of the microscopes for the failure analysis.