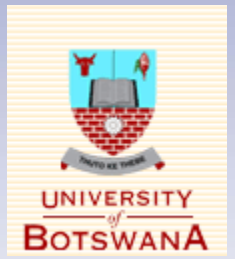
African Materials and Engineering Network (AMSEN): a Carnegie-IAS Regional Initiative in Science and Education



DST/NRF Centre of Excellence in Strong Materials (CoE-SM)

2004: Six Focus Areas:

- **Hardmetals Focus Area**
- **Ceramics Focus Area**
- **Diamond, Thin Hard Films and Related Materials Focus Area**
- **New Ultrahard Materials Focus Area**
- **Strong Metallic Alloys Focus Area**
- **Carbon Nanotubes and Strong Composites**

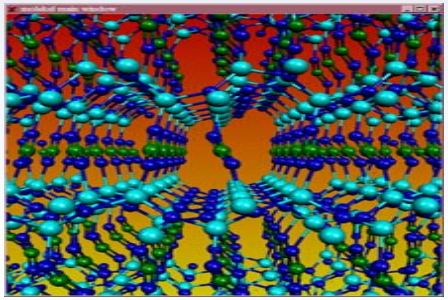
DST/NRF Centre of Excellence in Strong Materials (CoE-SM)

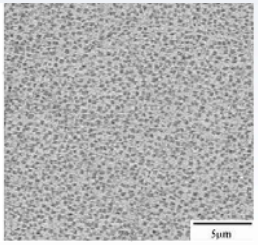
Development of applied materials that need good mechanical properties

Usually in aggressive environments:

- Temperature extremes
- High pressure
- Corrosive
- Radiation

Industry driven





Institutions involved in the CoE-SM

HARDMETALS FOCUS AREA
Wits (CHMT, EBE), UJ, NECSA

CERAMICS FOCUS AREA
Wits (CHMT, FEBE), NMMU + strong support from Element Six

DIAMOND, THIN HARD FILMS AND RELATED MATERIALS FOCUS AREA
Wits (Physics, FS), NECSA

NEW ULTRAHARD MATERIALS FOCUS AREA
Wits (Physics, FS) , UKZN + support from Element Six

STRONG METALLIC ALLOYS FOCUS AREA
Mintek (Advanced Materials), Wits (CHMT, FEBE) , NMMU, ULim

CARBON NANOTUBES AND STRONG COMPOSITES
Wits (Chemistry, & Physics, FS) (Mech. Eng., Chem Eng., FEBE), UJ

Overseas Collaborations:

- Fachhochschule Jena, Germany
- Bayreuth University, Germany
- Leeds University, UK
- NIMS, Japan
- Oxford University, UK
- Nottingham University, UK
- Los Alamos Nuclear Science Centre, USA
- Synchrotron Radiation Source, UK
- Technical University Darmstadt, Germany
- MIT, USA
- U. Kaiserslautern, Germany
- U. Paris-North, France
- CNRS, France
- ALS, Berkeley, USA
- Center for Nanotechnology, NASA, USA
- University of Roma-2, Italy
- Centre of Advanced Technologies, Algiers, Algeria
- ESRF, Element Six
- CERN-CRYSTAL project
- National University of Malaysia
- Anna University, India
- Indian Institute of Technology, Kanpur, India
- IBSA interactions
- McMaster University, Canada
- University of Mondragon, Spain

Nodes in AMSEN

DST/NRF Centre of Excellence in Strong Materials,
University of the Witwatersrand, South Africa
Prof. L.A. Cornish (Director)

University of Nairobi, Kenya
Prof. G.O. Rading (Deputy Director)

University of Namibia, Namibia
Prof. F.P.L. Kavishe (Head of Secretariat)

Federal University of Technology, Akure, Nigeria
Prof. J.O. Borode

University of Botswana, Botswana
Prof. P.K. Jain

AMSEN

AMSEN

Five Key Performance Areas

1. Research
2. Education & Training
3. Information Brokerage
4. Networking
5. Service rendering

Networking

- **Visits**
- **Collaborations – build on each other's**
- **Web page – build and each node will have a link**

Benefits of sufficient critical mass

Students!

Access to essential equipment

Awareness

Collaborations

Really good for leveraging other funds!

Aims

- Research
- Training + mentoring
- Build capacity
- Want to exploit the respective strengths of individual partner institutions for the collective benefit to build capacity.
- Research Teams: multi-disciplinary + broad-based

Research Plan

- Build strong teams of researchers in related fields of materials to supervise the students
- Assess the expertise and experience in the network has been assessed
- Identify overall research areas + members
- Set up individual projects will be set up, using a team of supervisors in the different universities
- Members complement each other
- Opportunity to bring less experienced members in the supervisory teams, so that they can be mentored in the area of undertaking research.
- Where possible, use post doctorate fellows to undertake research + help students

Research Plan cont.

- Students will have a home university, but will spend time in at least one other university, depending on each project
- Small groups of students within each team, to allow high quality supervision, and also for the students to be able to communicate with their peers.
- Presentations at conferences and workshops will be strongly encouraged, as will publication in journals
- Students must learn to communicate effectively: submit at least two research reports + give one presentation annually
- Fundamental research will be supported + encourage industrial participation, both for additional funding, but also to ensure relevant projects for the students. A good balance will be attempted between fundamental and applied research.

PhD Training

- Team of supervisors, in different universities, in different countries
- Students to have a home base - where a high proportional of their work will be done + major supervisor
- E-mail + visits
- At least 3 reports annually
- Conferences:

  Discipline specific +

  * African Materials Research Society (AMRS)
  * Microscopy Society of Southern Africa (MSSA)
  * South African Institute of Physics (SAIP)
- AMSEN Meeting alternately with AMRS: Namibia 2009
- Periodic workshops to be attached to AMRS and AMSEN

Example of a growing Research Team: Corrosion

- Prof. F. Kavishe (Namibia)
- Mr/Dr Peter Olubambi (Nigeria/Wits)
- Prof. L.A. Cornish (Wits)
- Mr J. van der Merwe (Wits)
- …….

Example template for a Researcher or team at an institution

Institution	**University of the Witwatersrand**
Investigators, affiliations	Dr. N. Sacks, Mr. J van der Merwe
Team	Hardmetals
Industrial input	Vanitec, Highveld Steel
Expertise and research interests	Wear, Corrosion, Physical & Mechanical Properties of Materials
Materials of interest	WC-Co alloys, stainless steels, PGM alloys
Experimental facilities	Potentiostats, high temperature furnaces, wear equipment, optical microscopes
Students available	4 MSc and 3 Undergraduate students
Proposed task	Assisting with student exchanges and training
Motivation	Well equipped group with much expertise to share with comrades in Africa
Impact for young researchers	Collaboration opportunities
Plan of work	Joint projects and postgraduate supervision
Other information	None

Contribution by All Nodes

- Recognized that some institutions have more facilities and expertise than others
- AMSEN will not be allowed to become one-sided
- Guarantee contributions from all nodes by ensuring that the personnel are part of at least some of the research teams
- Where limited expertise, researcher will be mentored.
- Access to equipment not at the home university by visits.
- Recommended, where possible, make applications for travel grants to visit institutions with the necessary equipment.
- All nodes will be encouraged to have active contacts with relevant local industries; will help the less experienced nodes to contribute to the AMSEN network.

Academic Retention Strategy

- Note poor remuneration!
- Possible remedies:
- Scheme for supplementation from industry
- Allow staff to be seconded to industry for short periods of time
- Allow staff to undertake consulting work
- Reward researchers for papers published and students graduated
- Give academic staff need to be given sufficient time to undertake research
- Support to go to conferences and undertake academic visits
- Funds: equipment, visits and training of the academics involved
- Exposure to other workers…

Research Unit Values (RUVs) for the different research outputs in AMSEN

Research output	**Research Unit Value (RUV)**	**Rationale and limit**
MSc student in the system	0.5	Up to a limit of 2.5 years
PhD student in the system	1.0	Up to a limit of 5 years
MSc student graduating	1.0	Up to a limit of 2.5 years
PhD student graduating	2.0	Up to a limit of 5 years
Conference paper: abstract at a local conference	0.25	Up to two papers at the same conference
Conference paper: abstract at an international conference, or full paper at a local conference	0.5	Up to two papers at the same conference
Journal paper accepted	1.0	

Communication Plans

- Mostly e-mails
- Visits within Research Teams
- Annual Report: inputs and outputs, progress…
- Short reports from the students
- Publications in journals will be strongly encouraged, as well as making presentations at conferences.

Table 2. Approximate Annual Budget (approximately US$ 296 000).

Item	Annual amount (US$)	Likely university	Comment
Graduate training costs: PhD bursaries	100 000	All	Depends on Research Team structure and number of students
Graduate training costs: MSc bursaries	65 000	All	Depends on Research Team structure and number of students
Salary replacement	8 000	All	Biased to where needed most
Travel and conferences, stipends for visiting faculty	25 000	All	Depends on Research Team structure and number of students
Equipment	25 000	Less well-equipped universities	Depends where needed most
Books, journals, databases	6 000	Less well-equipped universities	Depends where needed most
Running expenses for research projects	26 000	All	Biased towards needs of research project
Communications	5 000	All	
Secretariat office running expenses	8 000	University of Namibia	Secretariat
Salary of Secretariat Office Assistant (A secretary)	8 000	University of Namibia	Secretariat Office
Retention incentives	20 000	All	These will include extra visits, conferences and mentoring of staff (rather than students).

Finding students…

- Some universities advertised
- …or word of mouth…
- Already applications:
- Nigeria, Kenya, Namibia…
- + interest from Sudan, Swaziland…

Thank you!

A special thanks to the Carnegie-IAS Regional Initiative in Science and Education for giving us the opportunity