PROPOSAL

to conduct scientific research at the Microscopy and Microanalysis Unit at the University of the Witwatersrand, Johannesburg

Proposal code

Proposal code is designated by MMU

Title: *

* = required field

User:

☐ Mr
☐ Mrs
☐ Ms

First Name (no initials) * | Middle Name | Last Name *

University / Company / Institution *

Dept. / Division *

City * | State / Province * | Country *

Email * | Telephone *

If you are a student, please indicate what degree you are working towards:

☐ Honours/4th year ☐ Masters ☐ PhD ☐ N/A, or not a student

Supervisor:

☐ Mr
☐ Mrs
☐ Ms
☐ Dr
☐ Prof

First Name (no initials) * | Middle Name | Last Name *

University / Company / Institution *

Dept. / Division *

City * | State / Province * | Country *

Email * | Telephone *

Proposal: (what is your research topic and what is it about?)

*

Objective: (what do you want / need to do, and what do you want / need to measure or characterize?)

*

Methods: (what other methods of characterization have you already used, or are currently using?)

*

Microscopy instrumentation required at the MMU: (check all that apply. If you don't know precisely which technique you want to apply, but know the type of microscope, just select that then)

TEM:	☐	**FEI Tecnai F30 (80-300kV)** **FEI Tecnai T12 (80-120kV)**	☐ TEM BF, DF ☐ STEM ☐ EDS ☐ Tomography ☐ HAADF ☐ EELS ☐ EFTEM ☐ Lorentz-TEM ☐ Cryo-TEM ☐ Single-Particle
SEM:	☐	**FEI Quanta 200 ESEM (1-30kV)** **FEI Quanta 400 F-ESEM (1-30kV)** **FEI Nova FIB/F-SEM (1-30kV)** **LEO 1550 F-SEM (1-30kV)**	☐ SE ☐ BSE ☐ EDS ☐ Low-Vac ☐ Hot / Cold stage ☐ EBSD ☐ FIB (slice and view) ☐ FIB (specimen prep.)
EPMA:	☐	**Cameca SX5-FE EPMA (1-30kV)**	☐ SE ☐ BSE ☐ Cathodoluminescence ☐ X-ray mapping ☐ WDS ☐ WDS quantification
AFM:	☐	**Veeco Dimension 3100** **Veeco CP2**	☐ Contact AFM ☐ Tapping mode AFM ☐ MFM ☐ EFM ☐ Force curves ☐ Liquid sample AFM
Light:	☐	**Leica TCP SP2 SE Confocal** **Olympus BX63** **Olympus IX71** **Zeiss Axioscope**	☐ BF / DF / DIC ☐ Flourescence ☐ Confocal ☐ Z-stack / 3D ☐ Profilometry ☐ Time-series ☐ Incubator chamber

Microscopy instrumentation required at the MMU: (check all that apply)

Specimen Prep.	☐ PIPS ion mill	☐ Ultramicrotome
	☐ Carbon coater	☐ Cryo-Ultramicrotome
	☐ Sputter coater (Au, Pt)	☐ Critical point dryer

Date : _____ *

_____ *
Print first and last name of user

_____ *
Print first and last name of supervisor

_____ *
Signature of user

_____ *
Signature of supervisor

I M P O R T A N T

1) After entering all information into this document save this document and send it as an email attachment to alexander.ziegler@wits.ac.za. This is for our own records at the MMU.

2) Additionally, print this page 5, complete all signatures required, and either:
   (a) scan and email to the above email address, or
   (b) bring it to the Microscopy and Microanalysis Unit

Both, *(a)* or *(b)* need to happen at least ONE WEEK BEFORE you want to start doing microscopy.

Incomplete, non-dated, and non-signed Proposals cannot be accepted nor processed.
Thank you.

BF = Bright Field Microscopy (the standard microscopy imaging mode).

DF = Dark Field Microscopy.

E-Diff = Electron Diffraction.

STEM = Scanning Transmission Electron Microscopy. STEM is distinguished from conventional transmission electron microscopes (TEM) by focusing the electron beam into a narrow spot which is scanned over the sample in a raster.

HAADF = High Angle Annular Dark Field Microscopy. HAADF imaging is a method of mapping samples in STEM mode. The image is formed only by very high angle, incoherently scattered electrons, and is highly sensitive to variations in the atomic number of atoms in the sample (Z-contrast images).

EFTEM = Energy Filtered Transmission Electron Microscopy. In EFTEM only electrons of particular kinetic energies are used to form the image. The technique can be used to aid chemical analysis of the sample in conjunction with complementary techniques such as electron crystallography.

Tomography = 3D-visualization of the sample (note: time consuming post-microscopy image processing is required).

Cryo-TEM = Cryo-Transmission Electron Microscopy. The sample is studied at cryogenic temperatures (generally liquid nitrogen temperatures). Cryo-TEM allows the observation of biological specimens that have not been stained or fixed in any way, showing them in their frozen hydrated environment.

Lorentz-TEM = Lorentz-Transmission Electron Microscopy. The sample is studied in a field-free environment (reduced magnetic field at the objective lens). This technique allows for magnetic samples to be inspected inside a TEM.

Single-Particle = Single-Particle analysis involves recording of a very large number of TEM images of identical particles, followed by post-microscopy time consuming image processing to refine a final electron density structure.

EDS = (or EDX) Electron-Dispersive X-ray Spectroscopy is an analytical technique used for the elemental analysis or chemical characterization of a sample.

EELS = Electron Energy Loss Spectroscopy measures the amount of energy loss of the incident electrons through inelastic scattering in the TEM sample. This technique allows determining the sample chemistry and electronic configuration.

SE = Secondary Electron imaging mode in a Scanning Electron Microscope (the standard SEM imaging mode).

BSE = Back-Scattered Electron imaging mode in a Scanning Electron Microscope, allows distiguishing between light and heavy elements in the sample.

EBSD = Electron Back-Scattered Diffraction is a microstructural-crystallographic technique used to examine the crystallographic orientation of many materials, which can be used to elucidate texture or preferred orientation of any crystalline or poly-crystalline material.

Low-Vac = Low-vacuum imaging settings on the Scanning Electron Microscope allow for some moisture inside the sample under examination, but excludes water or any other solution/suspension to be placed inside the microscope.

FIB = Focused Ion Beam imaging mode and specimen treatment mode in a Scanning Electron Microscope. The specimen is irradiated with Gallium ions to either remove sample material or for imaging purposes.

AFM Contact mode, Non-Contact mode, and Taping mode = In the AFM static mode of operation, the cantilever is "pulled" across the surface of the sample and the contours of the surface are measured directly using the deflection of the cantilever (Contact mode). In the dynamic mode, the cantilever is externally oscillated at or close to its fundamental resonance frequency (Non-Contact mode). The oscillation amplitude, phase and resonance frequency are modified by tip-sample interaction forces. At ambient conditions, most samples develop a liquid meniscus layer. Because of this, keeping the probe tip close enough to the sample for short-range forces to become detectable while preventing the tip from sticking to the surface presents a major problem for non-contact dynamic mode in ambient conditions.

STM = Scanning Tunneling Microscopy allows imaging surfaces at the atomic level.

MFM = Magnetic Force Microscopy is a variety of the AFM, where a sharp magnetized tip scans a magnetic sample. The tip-sample magnetic interactions are detected and used to reconstruct the magnetic structure of the sample surface.

FM and OM = Flourescence Microscopy and Light Optical Microscopy

DIC = Differential Interference Contrast microscopy is an optical microscopy illumination technique used to enhance the contrast in unstained, transparent samples.

Z-Stack and Time-series = A series on images in Z-direction or in time.