



BITRI

**BITRI CENTRE
FOR MATERIAL
SCIENCE**

WELCOME

THE BOTSWANA INSTITUTE FOR TECHNOLOGY RESEARCH AND INNOVATION (BITRI) IS A PARASTATAL UNDER THE MINISTRY OF TERTIARY EDUCATION, RESEARCH, SCIENCE AND TECHNOLOGY, ESTABLISHED IN 2012, TO CONDUCT NEEDS-BASED RESEARCH AND DEVELOPMENT IN FOCUSED AREAS.

The Mandate of BITRI is to identify, develop and/or adapt appropriate technology solutions that provides sustainable innovative solutions through co-creation and collaboration in line with national priorities and needs of Batswana.

BITRI will harness its institutional capacity as well as collaborate with other organizations and institutions. BITRI is situated at Maranyane House in Gaborone, Botswana. It has other campuses in Gaborone, Kanye as well as Palapye.

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Botswana Institute for Technology Research and Innovation Centre for Material Science Equipment

BITRI is establishing a world-class Centre for Material Science with state-of-the-art laboratory facilities for materials fabrication and characterisation that will serve the research needs as well as the commercial materials analysis needs of Botswana and the region across a variety of sectors. The list of equipment currently at the Centre is outlined in this document.

1.

AXIS SUPRA, X-RAY PHOTOELECTRON SPECTROMETER



This X-ray Photoelectron Spectrometer (XPS) system with high resolution scanning field emission Auger system (AES), Ultraviolet Photoelectron Spectroscopy (UPS) and Ion Scattering Spectroscopy (ISS) analyses the surface chemistry of a material in its as-received state, or after some treatment- This includes

analysis of inorganic compounds and metals alloys, semiconductors, polymers, elements, catalysts, glasses, ceramics, paints, papers, plant parts, make-up, teeth, bones, medical implants, bio-materials, ion-modified materials and many other materials.

SCANNING ELECTRON MICROSCOPE

The high resolution Carl Zeiss Gemini SEM500 Electron microscope is a complete material characterisation instrument, integrated with Energy Dispersive Spectroscopy and Wavelength Energy Dispersive Spectroscopy elemental analyses techniques. It is also equipped with secondary and backscatter electron detectors and can perform Electron Backscatter Diffraction and Transmitted Electron imaging (STEM).



POWDER X-RAY DIFFRACTOMETER (XRD)



Empyrean, PANalytical-X-ray diffractometer equipped with a robotic arm sample exchanger. This is a high definition crystal analysing system with ultimate X-ray platform for the analysis of powders, thin films, nanomaterials and solid objects for industrial applications such as soil mineral analysis, cement industry, mines, metal manufacturers and crystal synthesis.

X-RAY FLOURESCENCE ANALYSER (XRF)



The S8 TIGER spectrometer is a high end XRF instrument that is used for elemental analysis in various industrial applications, including oil, lubricants, refinery, cement and mining samples. It is a highly automated and heavy duty system to handle a large number of samples.

2.

DSC3+ STAR^e



Differential Scanning Calorimetry (DSC) allows you to determine the energy absorbed or released by a sample as it is heated, cooled or held at constant temperature. DSC can be used in the characterisation of Polymers and Pharmaceuticals.

TGA/DSC3+ STAR^e



Thermogravimetric Analysis (TGA) measures the mass of a sample as it is heated, cooled or held at constant temperature in a defined atmosphere while simultaneously collecting DSC information is at a temperature range from ambient to 1600 °C. This is used to determine the thermal stability and phase reaction temperatures of a compound. The furnace is linked to an FT-IR. This part allows the analyses of volatiles from the sample during heating.



OPTICAL TENSIO METER

The Theta Optical Tensiometer is a computer controlled and user programmable video based instrument designed for measurement of static/dynamic contact angle, surface/interfacial tension and surface free energy of solids.

FORCE TENSIO METER



The Sigma 700 is a modular high performance software and temperature controlled force tensiometer with the capability of measuring surface tension/interfacial tension, critical micelle concentration, powder wettability and the density of liquids.

FOURIER TRANSFORM INFRARED SPECTROMETER

The Shimadzu IRTracer-100 FT-IR spectrometer can handle both solid and liquid samples. It analyses functional groups in liquids and solids in a non-destructive manner. This aids in identifying the chemical composition of a compound.



3.

ULTRA VIOLET-VISIBLE SPECTROPHOTOMETER

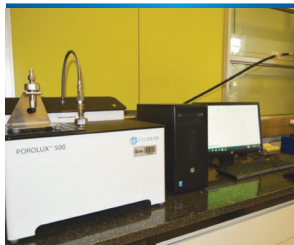
The Shimadzu UV-2600 can handle both solid and liquid samples. It utilises UV-Vis light to determine the absorbance (or transmission, reflectance) of chemical species.

FLUORESCENCE SPECTROMETER

The Shimadzu RF-6000 spectrofluorophotometer is an instrument used to measure fluorescence, bio-luminescence, chemo-luminescence and electro-luminescence. It also measures fluorescence quantum yield and fluorescence quantum efficiency.



POROLUX™500 POROMETER



The POROLUX™500 Porometer is a gas-liquid displacement porometer for the rapid measurement of through-pores in materials such as filters, nonwovens, membranes, hollow fibres, etc. The instrument is capable of measuring pore sizes ranging from 13 mm to 0.5 mm using 3 pressure sensors.

TSI 8130 AUTOMATED FILTER TESTER

The TSI 8130 Automated Filter Tester is used to test the efficiency of filter materials. Particle penetration and pressure drop are the two important parameters measured using this instrument.



INVERTED LIGHT MICROSCOPE



The MA200 inverted light microscope offers high stability, ease-of-use, with a large sample size option selection with both transmitted and reflected light modes which offers BF, DF, DIC, PH and limited fluorescence with high resolution lenses.

STEREO LIGHT MICROSCOPE



The Nikon SMZ25 stereomicroscope combines macro and micro imaging in one instrument for convenient viewing and manipulation of single cells to whole organisms.

4.

YFLOW PROFESSIONAL ELECTROSPINNING UNIT

The Yflow electrospinning unit (PED 1.0.S - 500) comes with single phase injector, multi-needle and coaxial injectors. The system is climate controlled, with the ability to electrospin at elevated temperatures. A camera inside the chamber enables easy visualisation of the Taylor cone. Disinfection of the chamber can be achieved by the use of the UV lamp in the device.



ELMARCO NANOSPIDER™ NS 1WS500U

The NS 1WS500U is a pilot scale needle-less Electro spinning unit able to produce nanofiber sheets that are 0.5 m wide and 1 km long.



BIOINICIA FLUIDNATEK LE-500 ELECTROSPINNING UNIT

The Bioinicia FLUIDNATEK LE-500 is a pilot-scale mono-needle, multi-needle and coaxial electrospinning unit with climate control and jet visualization camera to enable easy optimization of processes. The FLUIDNATEK LE-500 can produce nanofiber sheets that are 0.5 m wide.



BIOINICIA FLUIDNATEK LE-100 ELECTROSPINNING UNIT

The Bioinicia FLUIDNATEK LE-100 is a Laboratory scale electrospinning and electro spraying machine. The machine is equipped with motioned drum collector and fixed plate collector. It is capable of single phase and coaxial spinning which can be used for encapsulation technologies.



IME TECHNOLOGIES EC-DIG ELECTROSPINNING UNIT

The EC-DIG is a versatile electrospinning equipment with digital control specifically designed for experimental electrospinning research where flexibility, user-friendliness and performance are of importance.



IME TECHNOLOGIES EC-CLI ELECTROSPINNING UNIT



The EC-CLI is a unique electrospinning equipment with climate-control capabilities designed for demanding applications in which process control and reproducibility are crucial. Cylindrical collectors allow the fabrication of tubular nanofiber structures for tissue engineering.

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INDUCTIVELY-COUPLED PLASMA MASS SPECTROMETER

The Thermo iCAP Q ICP-MS is capable of analysing subparts per trillion to parts per million trace element levels in complex matrices.

XEVO G2-XS QTOF

The Xevo G2-XS QToF offers robustness, sensitivity, selectivity and mass accuracy at high speed. Its stepwave technology actively removes neutrals to reduce contamination and as a result delivering UPLC MS/MS sensitivity while at the same time offering a resolving power of 40 000 for mass ranges up to m/z 100 000.



6.

GC-MS

Thermo Scientific™ TSQ™ 8000 Evo Triple Quadrupole GC-MS/MS is a high throughput analytical system triple quadrupole GC-MS/MS system. It offers high sensitivity and acquisition of more information (number of compounds) per run. Its high efficiency timed SRM-capability results in higher sensitivity even in the most complex sample matrices without extensive sample clean up.



MICROWAVE PLASMA - ATOMIC EMISSION SPECTROMETRY (MP-AES)



It is used for simultaneous multi-analyte determination of major and minor elements. MP-AES employs microwave energy to produce a plasma discharge using nitrogen. Samples are typically nebulized prior to interaction with the plasma in MP-AES measurements. Most commonly determined elements can be measured. The Agilent 4200 MP-AES has detection limits down to sub ppb levels to weight percent (wt.%). It has a wide application in geochemical, chemical, petrochemical, food, agriculture and environmental industries and allied fields.

ELEMENTAL ANALYSER

The 2400 Series II CHNS/O Elemental Analyzer is capable of operating in three modes: CHN, CHNS and Oxygen. It is fully automated, and includes EA Data Manager Software.

The system allows you to determine weight percent carbon, hydrogen, nitrogen, sulfur or oxygen in organic and other types of materials. It has the capability of handling a wide variety of sample types in the fields of pharmaceuticals, polymers, chemicals, environmental and energy, including solids, liquids, volatile and viscous samples.



PRICE LIST FOR USAGE OF EQUIPMENT AT THE BITRI CENTRE FOR MATERIAL SCIENCE

ANALYTICAL EQUIPMENT

Rate Per Hour (in Botswana Pula, BWP)				
Equipment	Industry outside Botswana	Industry in Botswana	University outside Botswana	University in Botswana
Automated Filter Tester	455	350	210	150
Differential Scanning Calorimeter (DSC)	585	450	350	250
Differential Thermal Analysis (TGA-DSC-FTIR)	585	450	350	250
Elemental Analyser	585	450	350	250
Fluorescence Spectrophotometer	455	350	210	150
Force Tensiometer	455	350	210	150
Fourier Transform Infrared Spectrophotometer (FTIR)	455	350	210	150
Gas Chromatograph-Mass Spectrometer (GC-MS/MS)	585	450	350	250
Inductively Coupled Plasma-Mass Spectrometer (ICP-MS)	585	450	350	250
Inverted Light Microscope	455	350	210	150
Stereo Light microscope	455	350	210	150
Liquid Chromatograph-Mass Spectrometer (LC-MS/MS)	585	450	350	250

Rate Per Hour (in Botswana Pula, BWP)				
Equipment	Industry outside Botswana	Industry in Botswana	University outside Botswana	University in Botswana
Microwave Plasma Atomic Emission Spectrometer (MP-AES)	585	450	350	250
Optical Tensiometer	455	350	210	150
Particle Size Analyzer	455	350	210	150
Porometer	455	350	210	150
Scanning Electron Microscope (SEM)	950	760	475	380
Tensile Tester	455	350	210	150
Ultraviolet-Visible Spectrophotometer (UV-Vis)	455	350	210	150
X-ray Diffraction Spectrometer (XRD)	455	350	210	150
X-ray Fluorescence Spectrometer (XRF)	455	350	210	150
X-ray Photoelectron Spectrometer (XPS)	1430	1100	980	700

FABRICATION EQUIPMENT

Rate Per Day (in Botswana Pula)				
Equipment	Industry outside Botswana	Industry in Botswana	University outside Botswana	University in Botswana
IME EC-CLI	1,300.00	1,000.00	800.00	500.00
IME EC-DIG	1,300.00	1,000.00	800.00	500.00
FLUIDNATEK LE100	1,300.00	1,000.00	800.00	500.00
Yflow Electrospinning Unit	1,300.00	1,000.00	800.00	500.00
4SPIN® C4S-LAB	1,300.00	1,000.00	800.00	500.00
FLUIDNATEK LE500	2,340.00	1,800.00	1,200.00	800.00
ELMARCO NANOSPIDER NS 1WS500U	2,340.00	1,800.00	1,200.00	800.00
Microwave digester	1,300.00	1,000.00	800.00	500.00
Freeze dryer	1,300.00	1,000.00	800.00	500.00
High Energy Ball Mill	1,300.00	1,000.00	800.00	500.00
Tube Furnace	1,300.00	1,000.00	800.00	500.00
Vacuum Oven	1,300.00	1,000.00	800.00	500.00

SAMPLE PREPARATION EQUIPMENT

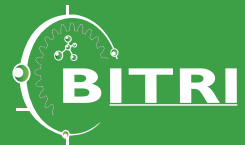
Rate Per Sample (in Botswana Pula)				
Equipment	Industry outside Botswana	Industry in Botswana	University outside Botswana	University in Botswana
Quoram coater - Per run	455	350	210	150
Struess Electron microscopy sample polishing	455	350	210	150
Struess Geological slides	800	364	320	200
Sample hot mounting	455	350	210	150
Sample cold mounting	455	350	210	150
Sample coating	455	350	210	150
Vibration polishing for EBSD	455	350	210	150

TERMS & CONDITIONS

1. All prices are in Botswana Pula (denoted BWP).
2. All prices and charges shall be deemed to include all direct and indirect costs of whatever kind.
3. The prices and charges shall be fixed, unless the agreement specifies the circumstances which may lead to price adjustments, as well as the way in which such adjustments are to take place.
4. Errors & Omissions Excepted.

TECHNOLOGY SOLUTIONS

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TO US
FOR YOU



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BITRI invites all interested parties to use the facilities for a fee.
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