

# COMPANY PROFILE KP TECHNOLOGY



**PROF. IAIN D. BAIKIE**

Prof. Iain D. Baikie is the CEO and founder of KP Technology. He began developing Kelvin Probes for surface analysis in the early 1980s and has 30 years experience with development and applications. Prof. Baikie is the inventor of the Off-Null, Height Regulated (ONHR) Kelvin Probe system. Prof. Baikie has held tenures at Universities and Research Institutes in Europe and USA and has previously been Chairman of a UK University Physics Group. He has published extensively in the fields of surface science and materials research and has pioneered the introduction of modern educational tools in Physics Education.

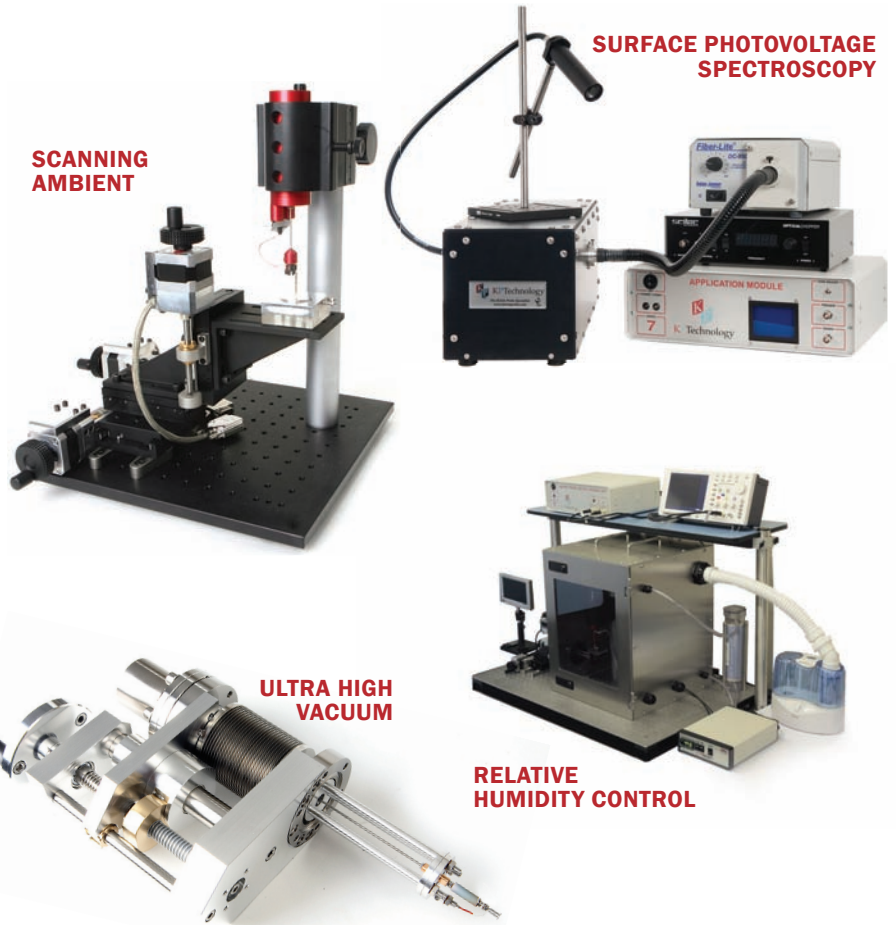


KP Technology was founded with the aim of bringing to the market new surface research tools. These tools would firstly allow specialists to investigate surface phenomena, secondly provide equipment pathways for non-specialists, and finally educate scientists, engineers and technologists in the capabilities of these emerging technologies.

Since inception in 2000, KP Technology has experienced rapid growth and now services over 170 companies and research institutes worldwide in their materials research and characterization requirements. Our Scottish-based team consists of electronic and software engineers, materials research associates, training, sales and administrative staff.

We offer a spectrum of dedicated Kelvin Probe Systems specially developed for applications in a variety of environments ranging from ambient, controlled atmosphere, relative humidity through to Ultrahigh Vacuum. No other company offers our range of products or equipment expertise. Our systems are available for sale and lease and we have several short term evaluation systems available to bona-fide educational institutes

KP Technology also performs a significant amount of material research and training consultancy, mostly based upon the work function or surface potential evaluation of client samples. References for this client service are easily found on the internet and include Universities, Research Institutes and National Laboratories.



**SCANNING AMBIENT**

**SURFACE PHOTOVOLTAGE SPECTROSCOPY**

**ULTRA HIGH VACUUM**

**RELATIVE HUMIDITY CONTROL**

# KELVIN PROBE THEORY THE BAIKIE SYSTEM

## THE BAIKIE SYSTEM

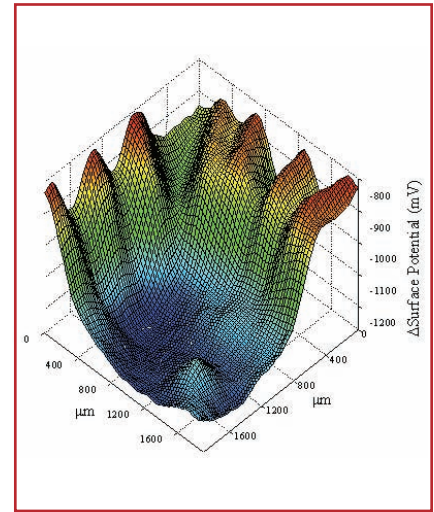
All KP Technology Systems are based upon unique features developed by Professor Iain Baikie. These features are unsurpassed by any other company.

- ◆ Highest work function/ surface potential resolution of 1 - 3 meV (standard with 2mm tip).
- ◆ Voice Coil driver provides very high rejection of driver talkover noise compared with piezoelectric systems.
- ◆ Off null signal detection system for vastly improved resolution - Our Signal-to-Noise (S/N) features remain unsurpassed in the field.
- ◆ Height regulation feature to control the tip to sample spacing during measurements and scans which allow for stable, reliable and repeatable results.
- ◆ Full digital control of all Kelvin Probe parameters.



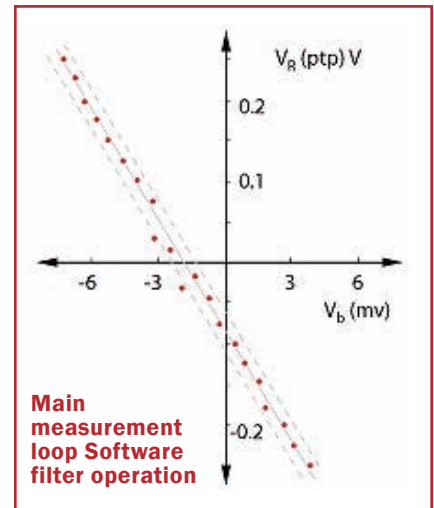
## SCANNING

By monitoring  $V_b$  at balance and scanning the tip, a 3D voltage map of a surface, or the surface reaction at a single point, such as gas adsorption, can be performed.



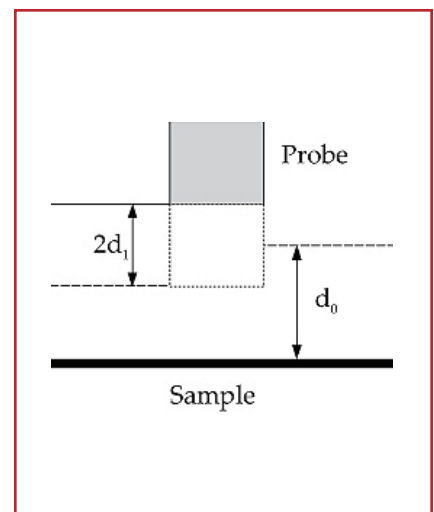
## OFF NULL

'Null' based measurement is prone to error and noise. KP Technology systems have an 'Off-Null' algorithm whereby the Kelvin Probe signal is measured at two or more values of  $V_b$ , for instance at high signal levels, and the balance point obtained by extrapolation.



## TRACKING

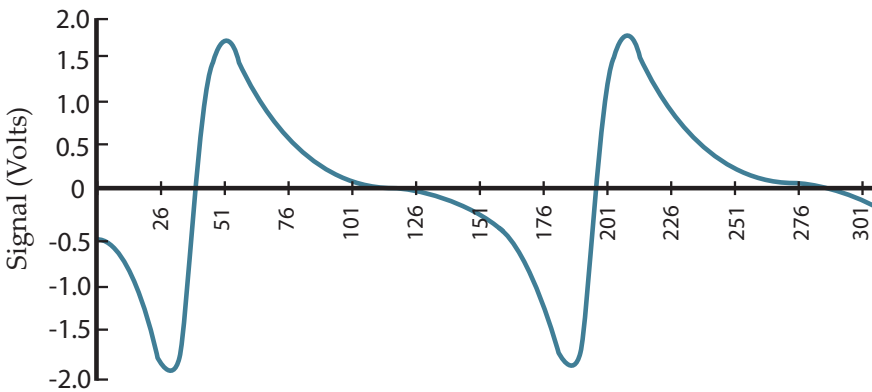
This method has further advantages. Firstly, the fractional capacity is measured to very high accuracy and this parameter can be used to provide feedback, allowing the tip to sample spacing to be held constant to  $\leq 1\mu\text{m}$  and additionally 'setup' information guaranteeing the probe measurement is constant. Without this, the tip height regulation, spurious changes in work function would occur and probe setup will be problematic. All KP Technology systems incorporate both methods for ease of operation.



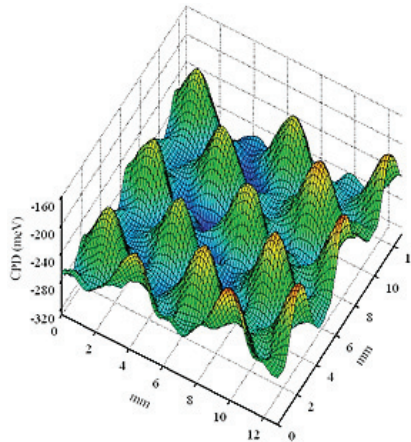
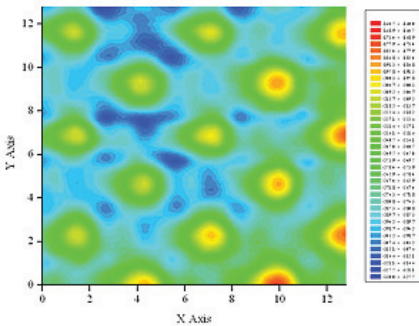
# KELVIN PROBE THEORY MEASUREMENT

The Kelvin Probe is a non-contact, non-destructive vibrating capacitor device used to measure the work function (wf) of conducting materials or surface potential (sp) of semiconductor or insulating surfaces. The wf of a surface is typically defined by the topmost 1-3 layers of atoms or molecules, so the Kelvin Probe is one of the most sensitive surface analysis techniques available. KP Technology Systems offer very high wf resolution of 1-3 meV, currently the highest achieved by any commercial device.

## KELVIN PROBE SIGNAL CHANGES OVER TIME



## 3D SURFACE WORK FUNCTION



The physical form of a Kelvin Probe is a head unit containing a voice coil driving system and integral amplifier suspended above a sample.

The vibrating tip and the sample forms a capacitor, having ideal, or parallel-plate, geometry.

As the tip vibrates electric charge is pushed around the external detection circuit. By careful control of the tip potential and automatic capture and analysis of the resulting waveform, both the potential across the capacitor and the capacitor spacing can be calculated to very high resolution. In scanning form the tip is steered across the sample surface using a high resolution 3-axis translator.

The spatial resolution of the tip is approximately the tip diameter. We typically use tips of 2 and 0.05 mm as standard tips in air and anything from a sharp tip to 10 mm diameter in Ultrahigh Vacuum.

The resulting 3D surface work function images contain information about surface structures, surface composition, thin films, defects, etc.

In time-varying mode artifacts such as oxidation (corrosion), defect relaxation, etc can be observed.

For semiconductor surfaces, both organic (Polymer) and inorganic (Si, Ge, CdS, etc) the Kelvin Probe is the only way to directly measure the Fermi-level. Changes in fermi-level, caused by illumination with white or monochromatic light, results in energy band shifts which can be used to characterize interface and bulk defect states. These techniques are termed Surface Photovoltage (SPV) and Surface Photovoltage Spectroscopy (SPS) for which KP Technology can supply both software and accessories for our systems.

The Traditional Kelvin Probe actually produces the work function difference between the tip and sample.

Typically the tip is calibrated against a reference surface, such as gold, first. However KP Technology is the only company to offer absolute Kelvin Probes, which combine the Kelvin method and Einstein Photoelectric effect to produce absolute work function values (in eV).

KP Technology has developed dedicated head units for ambient, controlled atmosphere, relative

humidity and ultrahigh vacuum environments.

All of our systems share the OFF-Null, Height Regulation (ONHR) method invented by Prof. Baikie and consequently produce stable high signal levels, repeatable and high resolution measurements.



# KELVIN PROBE THEORY WORK FUNCTION

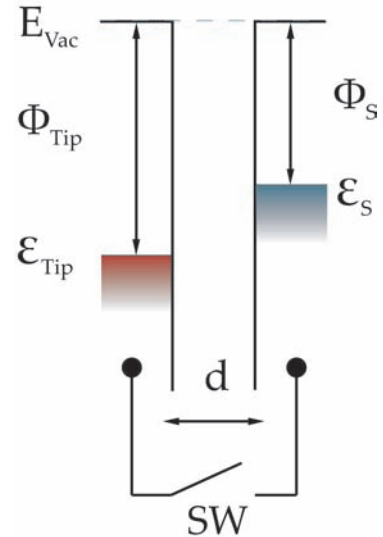
In brief the work function (wf) is the least amount of energy required to remove an electron from the surface of a conducting material, to a point just outside the metal with zero kinetic energy. When a group of atoms or molecules are brought together to form a solid the highest occupied energy level, or Fermi-level, is termed the work function. The work function is continuous across the interior of the solid. However, at the surface the electron energy is influenced by the exact state of the surface, e.g. type orientation and direction of the outer atoms and molecules. Thus different crystallographic orientations of the same solid may have different work functions. The work function of a surface can be modified by adsorbed layers, for instance in corrosion or oxidation of an iron surface, or by modification of composition or controlled contamination, as in the case of polymer or inorganic semiconductors. When two or more materials are brought together the Fermi-levels equalize by a flow of electrons from the lower work function to the high. Detecting these electrons is in essence the way all Kelvin Probe systems work.



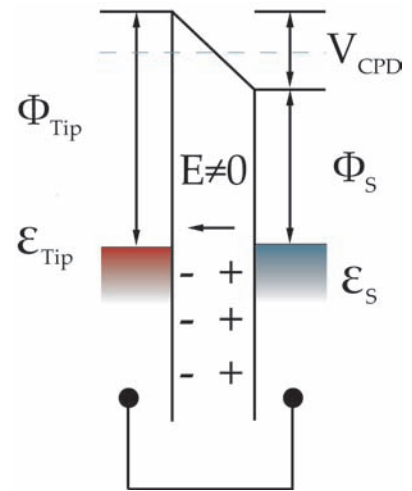
KPTechnology

FIGURES A TO C SHOW VARIOUS ELECTRON ENERGY DIAGRAMS FOR TWO CONDUCTING SPECIMENS, 1 AND 2.

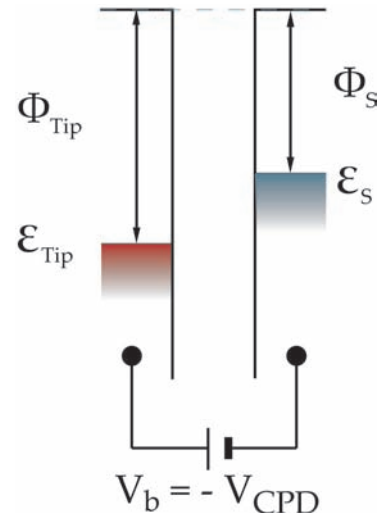
**FIGURE A**  
Electron energy level diagram for two conducting specimens, where  $\phi_{Tip}$  and  $\phi_S$  are the work functions of the materials, and  $\epsilon_{Tip}$  and  $\epsilon_S$  represent their Fermi levels. SW represents the open circuit.



**FIGURE B**  
If an external electrical contact is made between the two electrodes their Fermi levels equalise and the resulting flow of charge (in direction indicated) produces a potential gradient, termed the contact potential VCPD, between the plates. The two surfaces become equally and oppositely charged.



**FIGURE C**  
Inclusion of a variable "backing potential"  $V_b$  in the external circuit, permits biasing of one electrode with respect to the other. At the unique point where the (average) electric field between the plates vanishes, resulting in a null output signal or balanced circuit. In this way the WF difference between the two metals is of equal magnitude but opposite direction to the externally applied  $V_b$ .



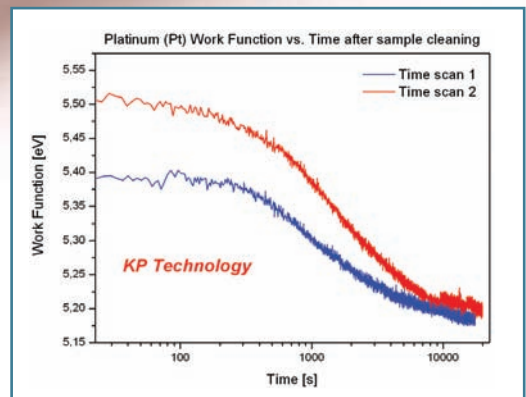
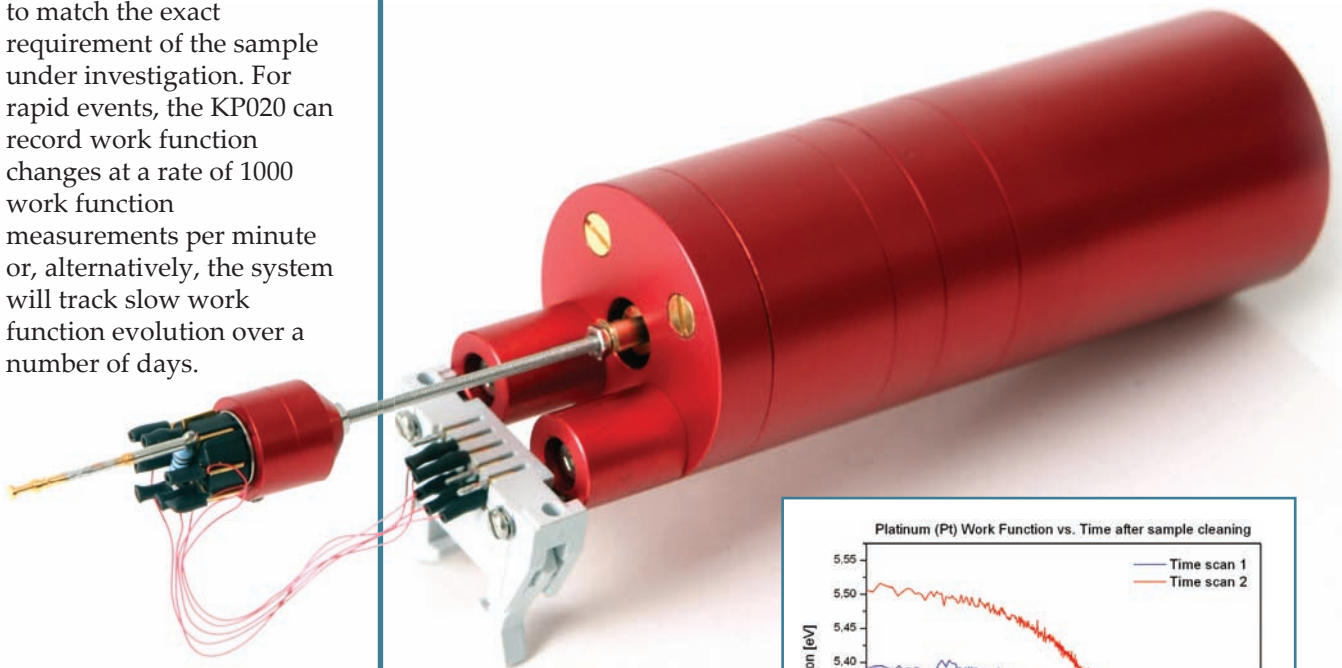
# SINGLE POINT KELVIN PROBE SYSTEM KP020

The KP020 comes with everything needed to produce reliable, repeatable measurements, due to the unique features provided by the 'Baikie System'. The easy to use system enables users to quickly record non-scanning data in a number of different modes to match the exact requirement of the sample under investigation. For rapid events, the KP020 can record work function changes at a rate of 1000 work function measurements per minute or, alternatively, the system will track slow work function evolution over a number of days.

Consider the SKP5050 for high resolution scanning work function measurements or the RHC020 for Relative Humidity analysis. For light sensitive samples, the SPV020 and SPS030 systems are highly recommended enabling the user to characterise semiconductor interface and bulk defect effects.



The Kelvin Probe is a non-contact, non-destructive vibrating capacitor device used to measure the work function (wf) of conducting materials or surface potential (sp) of semiconductor or insulating surfaces. The wf of a surface is typically defined by the topmost 1-3 layers of atoms or molecules, so the Kelvin Probe is one of the most sensitive surface analysis techniques available. KP Technology Systems offer very high wf resolution of 1-3 meV, currently the highest achieved by any commercial device.



“ We found that the KP Technology Kelvin Probe is a well engineered instrument with a clever design. Most of all, we are very happy with the excellent support that we have been experiencing. ”

*Dr H.J. Richter*  
Seagate Research Labs  
USA

# SINGLE POINT KELVIN PROBE SYSTEM KP020

## THE BAIKIE SYSTEM

All KP Technology Systems are based upon unique features developed by Professor Iain Baikie. These features are unsurpassed by any other company.

- ◆ Highest work function/surface potential resolution of 1 - 3 meV (standard with 2mm tip).
- ◆ Voice Coil driver provides very high rejection of driver talkover noise compared with piezoelectric systems.
- ◆ Off null signal detection system for vastly improved resolution - Our Signal-to-Noise (S/N) features remain unsurpassed in the field.
- ◆ Height regulation feature to control the tip to sample spacing during measurements and scans which allow for stable, reliable and repeatable results.
- ◆ Full digital control of all Kelvin Probe parameters.

## SYSTEM SPECIFICATIONS

- ◆ 2mm and 50 micron tips standard
- ◆ Work Function resolution of 1-3meV (2mm tip), 5-10meV (50 micron with optical table support)
- ◆ Manual Height Control (25.4mm KP translation)
- ◆ Tracking System with automatic control of tip to sample spacing
- ◆ Off-null detection system with parasitic capacity rejection

## SOFTWARE FEATURES

- ◆ Digital Control of all Kelvin Probe parameters
- ◆ Simple set-up procedure for signal optimisation
- ◆ Fast measurement mode for tracking real time work function changes (1000 work function points / min at ~20meV resolution)
- ◆ Export of data to scientific analysis software

## SYSTEM PACKAGE DESCRIPTION

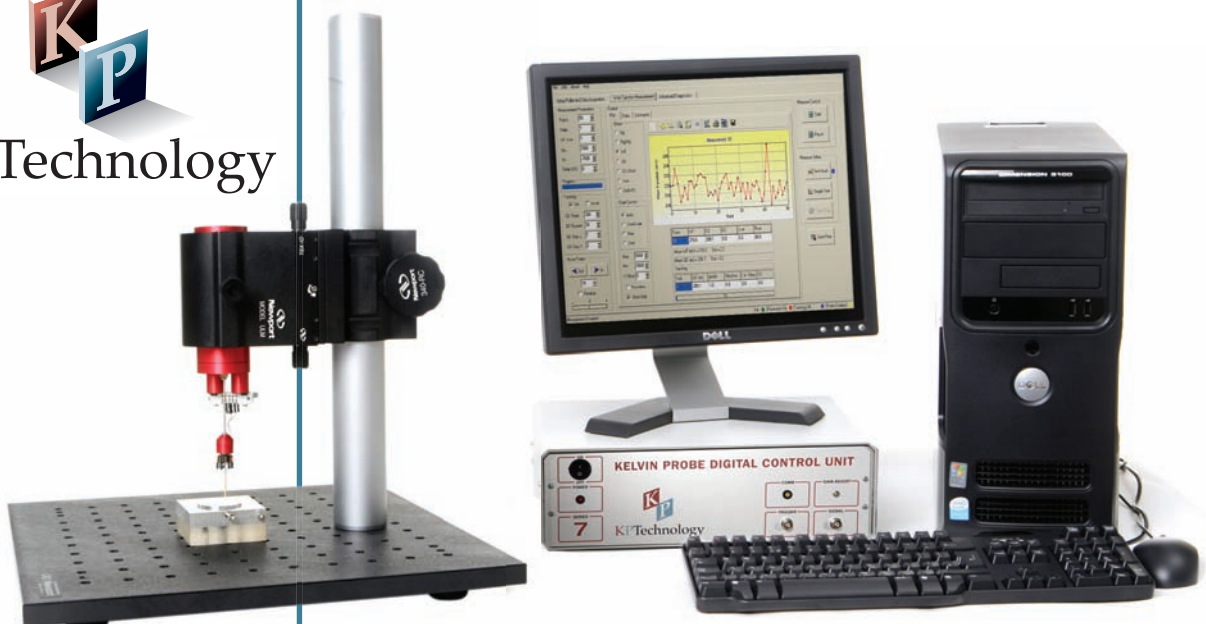
- ◆ Kelvin Probe Head Unit with Integrated Tip Amplifier
- ◆ 2mm and 50 micron tip
- ◆ 300x300x12.7mm optical breadboard base
- ◆ Faraday Screen
- ◆ Sample Holder
- ◆ Gold Aluminium Reference Sample
- ◆ Digital Control Unit
- ◆ Dell PC with monitor
- ◆ Pre-installed KP software and Data Acquisition system
- ◆ Spare Tip Amplifier
- ◆ Autosensing Power Supply Unit
- ◆ 12 Month Warranty

## ADDITIONAL OPTIONS

- ◆ Sample Heater
- ◆ Upgrade to High Performance combined Faraday Screen and Light Enclosure
- ◆ Upgrade to Scanning system
- ◆ Upgrade to RHC system
- ◆ Surface Photovoltage modules SPV020 and SPS030



KPTechnology



# SCANNING KELVIN PROBE SYSTEM SKP5050

The SKP5050 is a comprehensive scanning Kelvin Probe solution. As a natural upgrade from the KP020, it comes with everything needed to produce reliable, repeatable measurements, due to the unique features provided by the 'Baikie System'. System set-up is a dream, thanks to the high-resolution 3-axis stages, and users can quickly perform 50x50mm scans. A high performance faraday and light enclosure comes with the SKP5050 as standard, shielding the SKP5050 from unwanted electromagnetic interference and providing the perfect platform for our SPV020 and SPS030 systems.

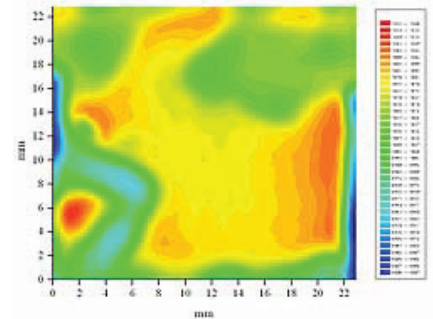
Tailor the system to your exact needs with the addition of larger sample holders or heaters, or consider the RHC020 to monitor work function changes under varying environmental conditions.

The SKP5050 has been our benchmark system for a number of years and has been applied successfully in research areas such as: organic thin-films, corrosion, semiconductors, roll to roll solar cells, OLED's, tribology. For advice on applications in your area call the Kelvin Probe Specialists and enjoy the benefits of 30 years of Kelvin Probe experience.

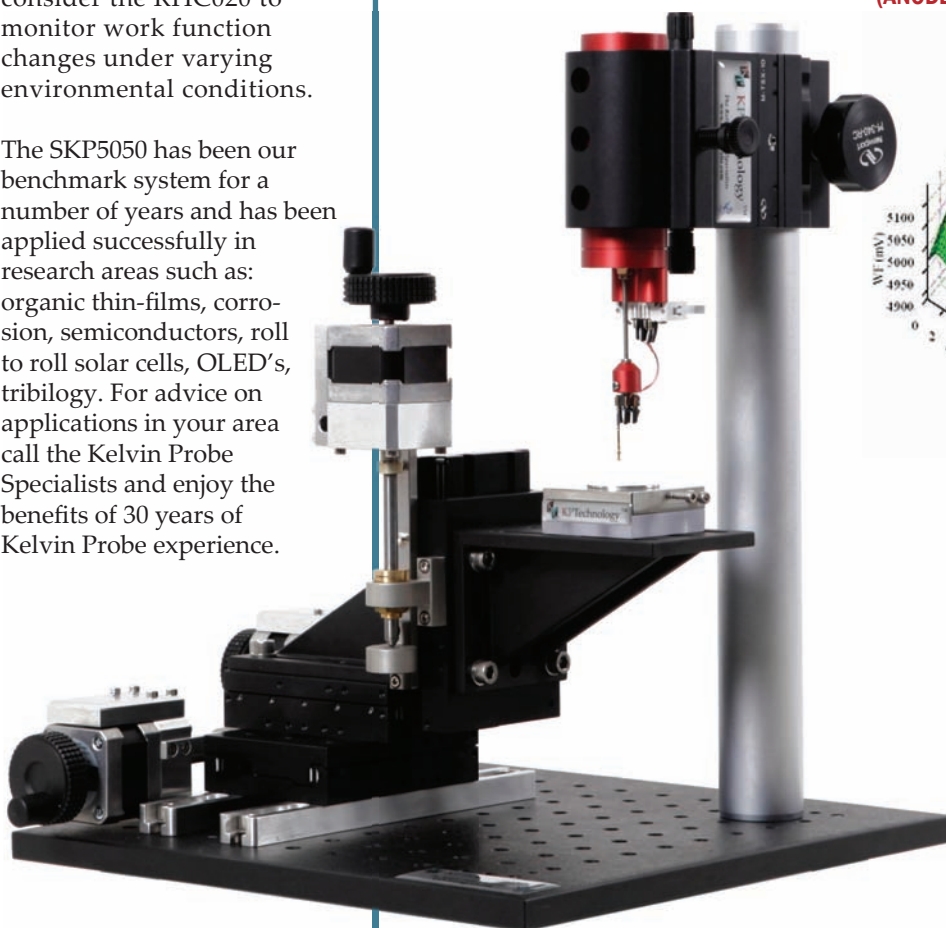
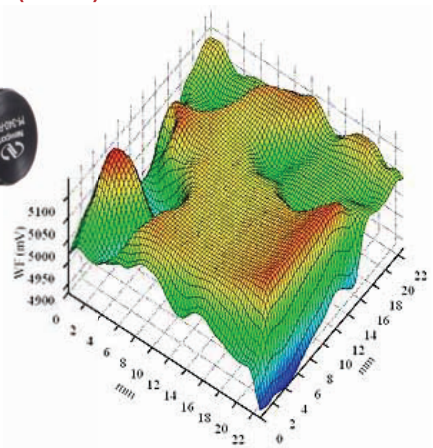
The Kelvin Probe is a non-contact, non-destructive vibrating capacitor device used to measure the work function (wf) of conducting materials or surface potential of semiconductor or insulating surfaces. The wf of a surface is typically defined by the topmost 1-3 layers of atoms or molecules, so the Kelvin Probe is one of the most sensitive surface analysis techniques available. KP Technology Systems offer very high wf resolution of 1-3 meV, currently the highest achieved by any commercial device.

“ I have been working the scanning Kelvin Probe and I have become quite comfortable with it. It is an excellent device and exquisitely sensitive. ”

*Prof. Andrew Ahn  
Harvard University, USA*



**NON HOMOGENOUS COVERAGE POLYMER  
(ANODE) TESTING**



# SCANNING KELVIN PROBE SYSTEM SKP5050

## THE BAIKIE SYSTEM

All KP Technology Systems are based upon unique features developed by Professor Iain Baikie. These features are unsurpassed by any other company.

- ◆ Highest work function/ surface potential resolution of 1 - 3 meV (standard with 2mm tip).
- ◆ Voice Coil driver provides very high rejection of driver talkover noise compared with piezoelectric systems.
- ◆ Off null signal detection system for vastly improved resolution - Our Signal-to-Noise (S/N) features remain unsurpassed in the field.
- ◆ Height regulation feature to control the tip to sample spacing during measurements and scans which allow for stable, reliable and repeatable results.
- ◆ Full digital control of all Kelvin Probe parameters.



KPTechnology



## SYSTEM SPECIFICATIONS

- ◆ 2mm and 50 micron tips standard
- ◆ Work Function resolution of 1-3meV (2mm tip), 5-10meV (50 micron with optical table support)
- ◆ 50mm x 50 mm maximum scan area
- ◆ 318 nanometer position resolution
- ◆ Tracking System with automatic motorized control of tip to sample spacing
- ◆ Additional Manual Height Control (25.4mm KP translation for coarse positioning)
- ◆ Off-null detection system with parasitic capacity rejection

## SOFTWARE FEATURES

- ◆ Digital Control of all Kelvin Probe parameters
- ◆ Simple set-up procedure for signal optimisation
- ◆ Fast measurement mode for tracking real time work function changes (1000 work function points / min at ~20meV resolution)
- ◆ Variable scan size and real-time 3D charting of sample work function
- ◆ Export of data to scientific analysis software

## SYSTEM PACKAGE DESCRIPTION

- ◆ Kelvin Probe Head Unit with Integrated Tip Amplifier
- ◆ 2mm and 50 micron tip
- ◆ High Performance 450x450x500 Faraday Screen and Light Enclosure
- ◆ 450x450x12.7mm optical base breadboard
- ◆ 3-axis motorised scanning stage
- ◆ Optical Camera with 9" TFT Monitor to monitor tip-sample position
- ◆ Sample Holder
- ◆ Gold Aluminium Reference Sample
- ◆ Digital Control Unit
- ◆ Dell PC with monitor
- ◆ Pre-installed KP software and Data Acquisition system
- ◆ Spare Tip Amplifier
- ◆ Autosensing Power Supply Unit
- ◆ Digital Oscilloscope for real-time signal display
- ◆ 24 Month Warranty

## ADDITIONAL OPTIONS

- ◆ Inline Tip Holder for 50 micron to 20mm diameter tips
- ◆ Sample Holder for Larger Sample such as Silicon Wafers
- ◆ Sample Heater
- ◆ Upgrade to RHC system

# ADVANCED SCANNING KELVIN PROBE SYSTEM ASKP200200

The ASKP200200 is the newest addition to the SKP family, and is a comprehensive scanning Kelvin Probe solution. The advanced system takes the best traits from the SKP5050 and adds an extra dimension, allowing the user to perform their analysis with even greater ease and versatility. The larger scanning stages are able to accommodate large (up to 8") or small samples with incredible accuracy, giving the user the opportunity to perform sample scans of up to 200x200mm.

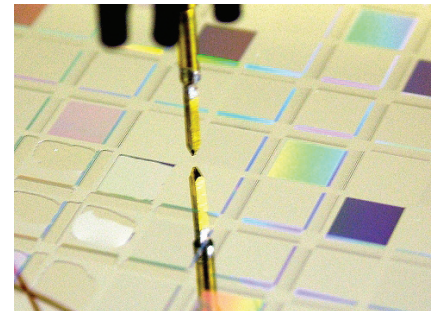
The system comes with a high performance faraday and light enclosure as standard, shielding the ASKP200200 from unwanted electromagnetic interference. This provides the perfect platform for investigating semiconductor or solar cell samples with the addition of our SPV020 or SPS030 modules.

The inline module included allows you to choose between high spatial and work function resolution scans using the sharp tips, or ultra high work function resolution scans using the additional 5 and 10mm tips.

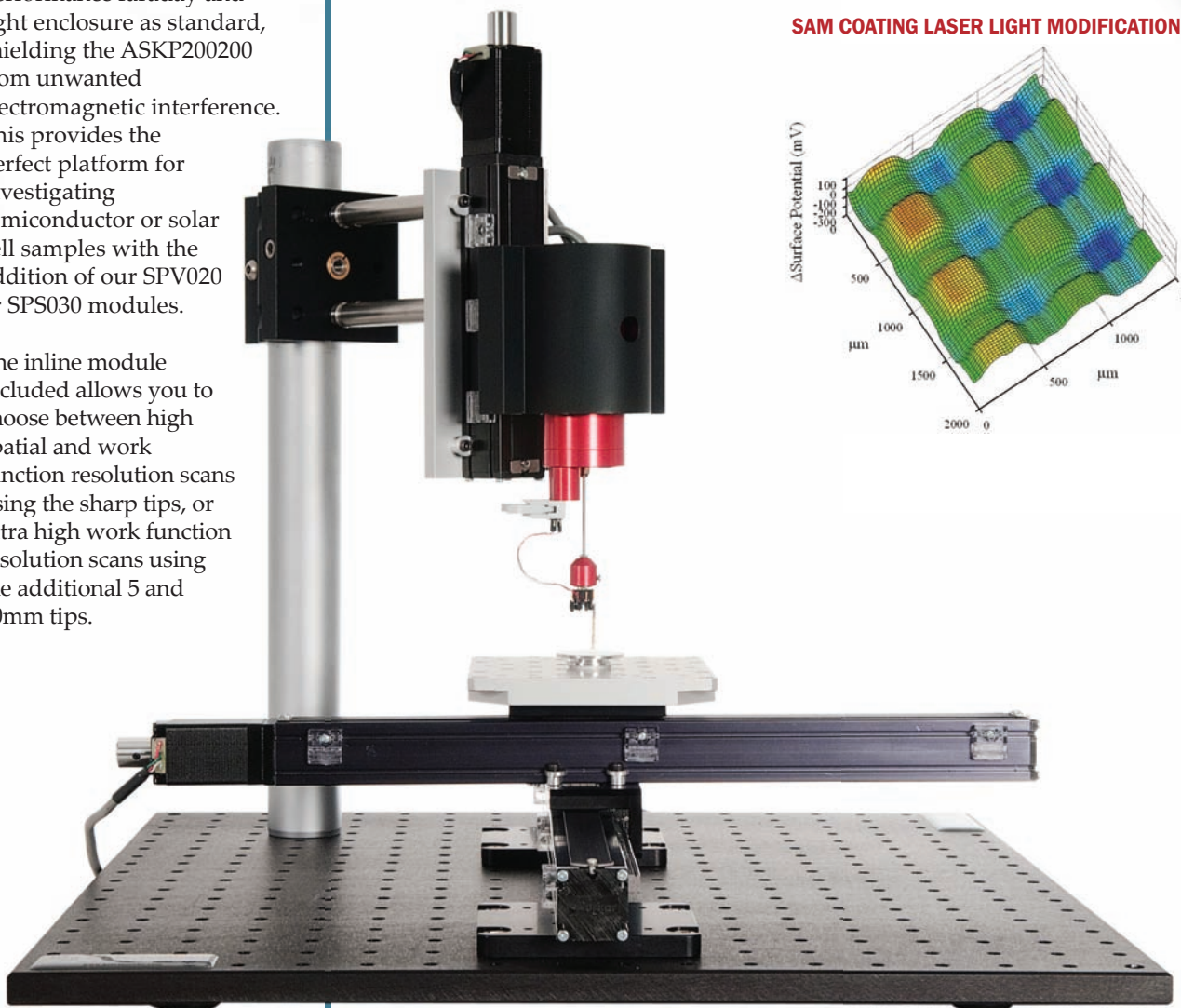
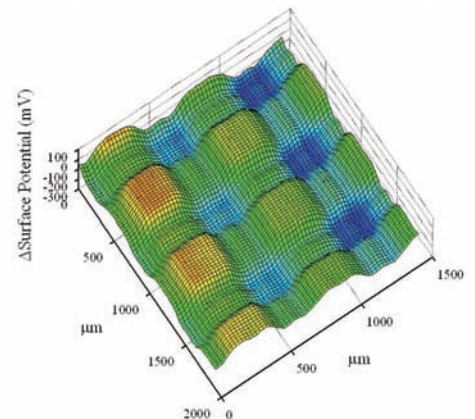
The Kelvin Probe is a non-contact, non-destructive vibrating capacitor device used to measure the work function (wf) of conducting materials or surface potential (sp) of semiconductor or insulating surfaces. The wf of a surface is typically defined by the topmost 1-3 layers of atoms or molecules, so the Kelvin Probe is one of the most sensitive surface analysis techniques available. KP Technology Systems offer very high wf resolution of 1-3 meV, currently the highest achieved by any commercial device.

“ I have been working the scanning Kelvin Probe and I have become quite comfortable with it. It is an excellent device and exquisitely sensitive. ”

*Prof. Andrew Ahn  
Harvard University, USA*



**SAM COATING LASER LIGHT MODIFICATION**



# ADVANCED SCANNING KELVIN PROBE SYSTEM ASKP200200

## THE BAIKIE SYSTEM

All KP Technology Systems are based upon unique features developed by Professor Iain Baikie. These features are unsurpassed by any other company.

- ◆ Highest work function/surface potential resolution of 1 - 3 meV (standard with 2mm tip).
- ◆ Voice Coil driver provides very high rejection of driver talkover noise compared with piezoelectric systems.
- ◆ Off null signal detection system for vastly improved resolution - Our Signal-to-Noise (S/N) features remain unsurpassed in the field.
- ◆ Height regulation feature to control the tip to sample spacing during measurements and scans which allow for stable, reliable and repeatable results.
- ◆ Full digital control of all Kelvin Probe parameters.



KPTechnology



## SYSTEM SPECIFICATIONS

- ◆ 10, 5, 2mm and 50 micron supplied
- ◆ Work Function resolution of 1-3meV (2mm tip), 5-10meV (50 micron)
- ◆ 200mm x 200 mm maximum scan area
- ◆ 7 micron (X,Y) 2 micron (Z) position resolution
- ◆ Tracking System with automatic motorized control of tip to sample spacing
- ◆ Off-null detection system with parasitic capacity rejection

## SOFTWARE FEATURES

- ◆ Digital Control of all Kelvin Probe parameters
- ◆ Simple set-up procedure for signal optimisation
- ◆ Fast measurement mode for tracking real time work function changes (1000 work function points / min at ~20meV resolution)
- ◆ Variable scan size and real-time 3D charting of sample work function
- ◆ Export of data to scientific analysis software

## ADDITIONAL INFORMATION

- ◆ Kelvin Probe Head Unit with Integrated Tip Amplifier
- ◆ 50 micron tip, 2mm tip, 5mm tip and 10mm tip
- ◆ High Performance 450x450x500 Faraday Screen and Light Enclosure
- ◆ 450x450x12.7mm optical base breadboard
- ◆ 3-axis motorised scanning stage
- ◆ Optical Camera with 9" TFT Monitor to monitor tip-sample position
- ◆ Sample Holder with reference sample recess
- ◆ Gold Aluminium Reference Sample
- ◆ Digital Control Unit
- ◆ Dell PC with monitor
- ◆ Pre-installed KP software and Data Acquisition system
- ◆ Spare Tip Amplifier
- ◆ Autosensing Power Supply Unit
- ◆ Digital Oscilloscope for real-time signal display
- ◆ 24 Month Warranty

## ADDITIONAL OPTIONS

- ◆ Sample Heater
- ◆ Surface Photovoltage modules SPV020 and SPS030

# CORROSION/ENVIRONMENTAL HOUSING KELVIN PROBE SYSTEM RHC020

The RHC020 is the ideal solution for monitoring samples in a controlled atmosphere. The 50x50mm sample heater can increase the sample temperature up to 100°C and advanced electronics and hardware systems monitor the temperature and humidity at all times. Thanks to the unique features of the 'Baikie System', the user has everything they need to produce reliable and, most importantly, repeatable results. For the ultimate in sample analysis, consider the addition of the SPV020 or SPS030 modules where variable intensity or different wavelengths of light can be used to stimulate your light sensitive samples.

The Kelvin Probe is a non-contact, non-destructive vibrating capacitor device used to measure the work function (wf) of conducting materials or surface potential (sp) of semiconductor or insulating surfaces. The wf of a surface is typically defined by the topmost 1-3 layers of atoms or molecules, so the Kelvin Probe is one of the most sensitive surface analysis techniques available. KP Technology Systems offer very high wf resolution of 1-3 meV, currently the highest achieved by any commercial device.

“ It is great to have access to work function data of our samples in such a fast and flexible way. The Kelvin Probe system is based on sophisticated technology, but it is extremely easy to use. One can start producing accurate data straight away and it is easy to get the most out of the system. KP Technology's engineers are fast to respond and competent problem-solvers. ”

*Dr. S. H. Mennema  
TNO Science & Industry*



# CORROSION/ENVIRONMENTAL HOUSING KELVIN PROBE SYSTEM RHC020

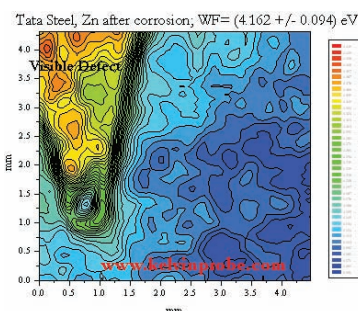
## THE BAIKIE SYSTEM

All KP Technology Systems are based upon unique features developed by Professor Iain Baikie. These features are unsurpassed by any other company.

- ◆ Highest work function/surface potential resolution of 1 - 3 meV (standard with 2mm tip).
- ◆ Voice Coil driver provides very high rejection of driver talkover noise compared with piezoelectric systems.
- ◆ Off null signal detection system for vastly improved resolution - Our Signal-to-Noise (S/N) features remain unsurpassed in the field.
- ◆ Height regulation feature to control the tip to sample spacing during measurements and scans which allow for stable, reliable and repeatable results.
- ◆ Full digital control of all Kelvin Probe parameters.



KP Technology



## SYSTEM SPECIFICATIONS

- ◆ 2mm and 50 micron tips standard
- ◆ Work Function resolution of 1-3meV (2mm tip), 5-10meV (50 micron with optical table support)
- ◆ 50mm x 50 mm maximum scan area
- ◆ 318 nanometer position resolution
- ◆ Tracking System with automatic motorized control of tip to sample spacing
- ◆ Additional Manual Height Control (25.4mm KP translation for coarse positioning)
- ◆ Off-null detection system with parasitic capacity rejection
- ◆ Automatic Relative Humidity Control to 1% (10-100% RH)
- ◆ 50 x 50mm Sample Heater

## SOFTWARE FEATURES

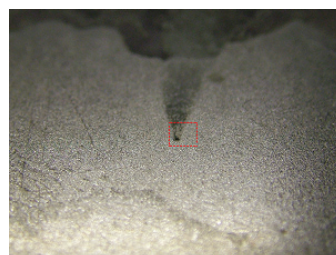
- ◆ Digital Control of all Kelvin Probe parameters
- ◆ Simple set-up procedure for signal optimisation
- ◆ Fast measurement mode for tracking real time work function changes (1000 work function points / min at ~20meV resolution)
- ◆ Variable scan size and real-time 3D charting of sample work function
- ◆ Export of data to scientific analysis software

## SYSTEM PACKAGE DESCRIPTION

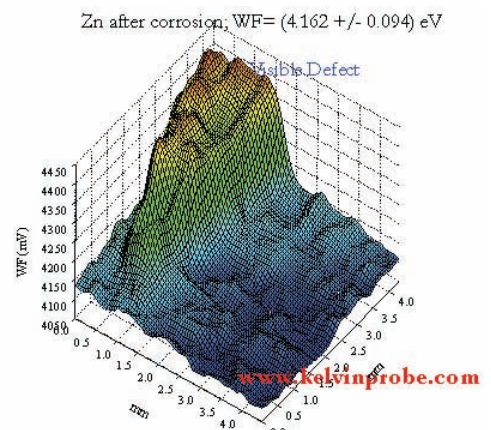
- ◆ Kelvin Probe Head Unit with Integrated Tip Amplifier
- ◆ 2mm and 50 micron tip
- ◆ High Performance 400x400x500mm Relative Humidity Chamber and Faraday Cage (80 litres)
- ◆ 450x450x12.7mm optical base breadboard
- ◆ 3-axis motorised scanning stage
- ◆ Sample Holder
- ◆ Gold Aluminium Reference Sample
- ◆ Digital Control Unit
- ◆ Dell PC with monitor
- ◆ Pre-installed KP software and Data Acquisition system
- ◆ Spare Tip Amplifier
- ◆ Autosensing Power Supply Unit
- ◆ Digital Oscilloscope for real-time signal display
- ◆ 24 Month Warranty

## ADDITIONAL OPTIONS

- ◆ Inline Tip Holder for 50 micron to 20mm diameter tips
- ◆ Automatic Temperature Control
- ◆ Surface Photovoltage modules SPV020 and SPS030



LOCAL ANODE CORROSION SAMPLE  
+ 30MIN 3% NA CL SUBMERSION



# KP GLOVEBOX / RELATIVE HUMIDITY KELVIN PROBE SYSTEM GB050

The GB5050 is the ideal solution for monitoring samples in a controlled atmosphere. Our advanced electronics monitor Oxygen, Pressure, Humidity and Temperature via sophisticated sensors. The GB5050 is equipped to handle automatic RHC control from 5%-100%. The optimal sample heater can increase the sample temperature up to 110°C. The presence of a Sample Load-Lock increases the efficiency of the system, with a controlled atmosphere being maintained whilst sample changes occur. The GB5050 is coupled with our most popular system, the SKP5050 scanning system; with its array of sensors, sealed Glovebox, Load-Lock, RHC control and Scanning Kelvin Probe, the GB5050 is one of our most advanced Kelvin Probe systems currently available on the market.

For the ultimate in sample analysis, consider the addition of the SPV020 or SPS030/040 modules, where variable intensity or different wavelengths of light can be used to stimulate your light sensitive samples.

The Kelvin Probe is a non-contact, non-destructive vibrating capacitor device used to measure the work function (wf) of conducting materials or surface potential (sp) of semiconductor or insulating surfaces. The wf of a surface is typically defined by the topmost 1-3 layers of atoms or molecules, so the Kelvin Probe is one of the most sensitive surface analysis techniques available. KP Technology Systems offer very high wf resolution of 1-3 meV, currently the highest achieved by any commercial device.

“ It is great to have access to work function data of our samples in such a fast and flexible way. The Kelvin Probe system is based on sophisticated technology, but it is extremely easy to use. One can start producing accurate data straight away and it is easy to get the most out of the system. KP Technology’s engineers are fast to respond and competent problem-solvers. ”

*Dr. S. H. Mennema  
TNO Science & Industry*

The GB050 is an adaptable scanning KP system, offering inert gas atmosphere and/or automatic Relative Humidity control. Applications include Organic Semiconductors, Corrosion and Controlled Environments. The system has all the features of the SKP5050 Scanning Kelvin Probe, coupled with Oxygen, Pressure, Temperature and Relative Humidity sensors. The system features a Load-lock for sample entry, the camera monitors KP Tip approach, and multiple ports allow for SPV and full-SPS integration.



# KP GLOVEBOX / RELATIVE HUMIDITY KELVIN PROBE SYSTEM GB050

## THE BAIKIE SYSTEM

All KP Technology Systems are based upon unique features developed by Professor Iain Baikie. These features are unsurpassed by any other company.

- Highest work function/surface potential resolution of 1 - 3 meV (standard with 2mm tip).
- Voice Coil driver provides very high rejection of driver talkover noise compared with piezoelectric systems.
- Off null signal detection system for vastly improved resolution - Our Signal-to-Noise (S/N) features remain unsurpassed in the field.
- Height regulation feature to control the tip to sample spacing during measurements and scans which allow for stable, reliable and repeatable results.
- Full digital control of all Kelvin Probe parameters.



KP Technology



**LOCAL ANODE CORROSION SAMPLE  
+ 30MIN 3% NAACL SUBMERSION**

## SYSTEM SPECIFICATIONS

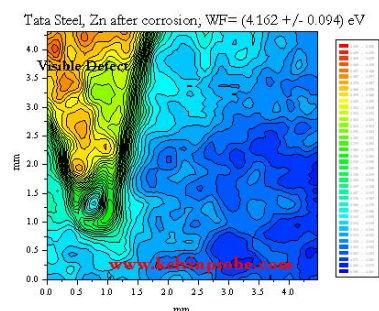
- In-Line Kelvin Probe with 2mm and 50 micron tips standard
- Work Function resolution of 1-3meV (2mm tip), 5-10meV (50 micron with optical table support)
- 50mm x 50mm maximum scan area
- Tracking System with automatic control of tip to sample spacing
- Internal and External Pressure differential sensors, Oxygen sensor, and dedicated Enviromental Software Suite
- Fast-Access Viewing Window
- Rear-window for Light-Injection and Camera system
- Neoperene gloves and Load-Lock for Sample-Exchange
- Automatic Relative Humidity Control to 1% (5-100% RH)
- Sample Heater up to 110°C (Optional)
- PC controlled SPV LED or QTH light source
- Full Surface Photovoltage Spectroscopy integration

## SOFTWARE FEATURES

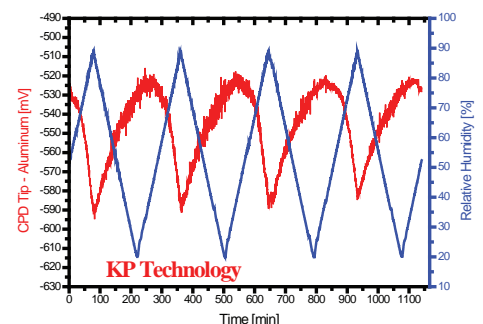
- Digital Control of all Kelvin Probe parameters
- Simple set-up procedure for signal optimisation
- Dedicated Enviromental Software Suite for Oxygen and Pressure
- Dedicated Software for Automatic Relative Humidity Control
- Temperature and RH plotting during work function measurements
- Fast measurement mode for tracking real time work function changes
- Variable scan size and real-time 3D charting of sample work function

## GB050 BASE SYSTEM PACKAGE DESCRIPTION

- Kelvin Probe Head Unit with Integrated Tip Amplifier
- 2mm and 50 micron Stainless Steel tips
- High Performance Enviromental Glovebox with Gloves, Load-Lock and Sensors mounted on a 900x600mm optical Breadboard
- 3-axis motorised scanning stage
- Sample Holder and Sample Heater
- Gold Aluminium Test Sample
- Digital Control Unit
- High-specc PC with monitor
- Pre-installed KP software and Data Acquisition system
- Spare Tip Amplifier
- Autosensing Power Supply Units
- Digital Oscilloscope for real-time signal display
- 24 Month Warranty



**WF Scan of Zinc after Corrosion**



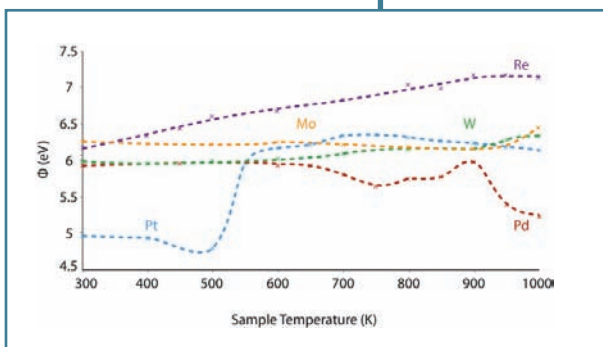
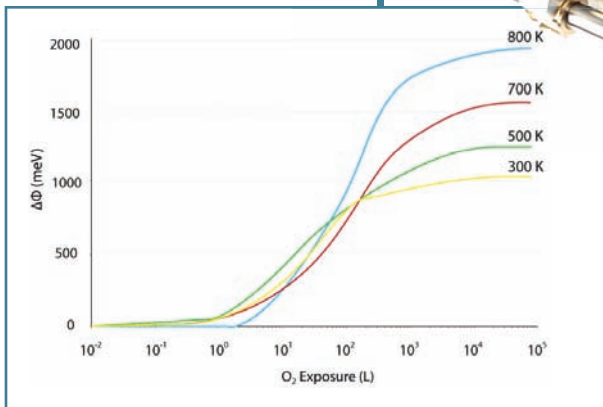
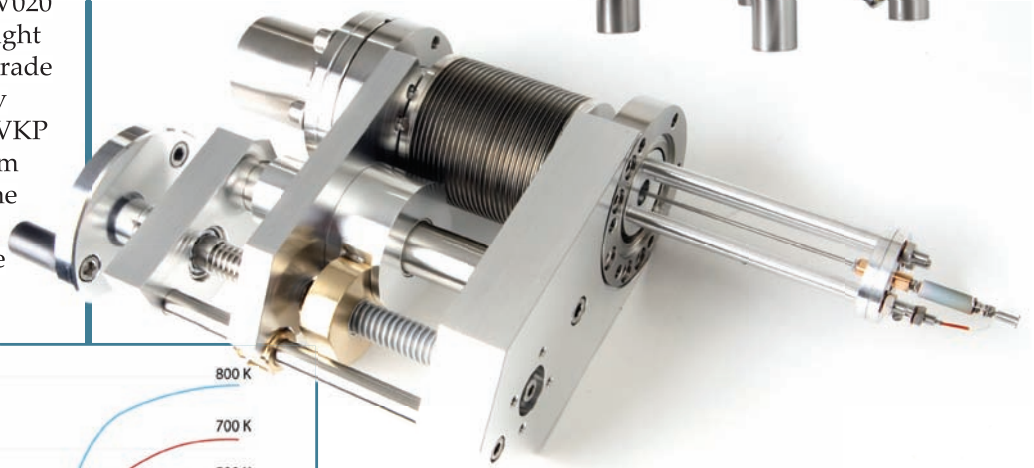
**WF of Gold with RH Cycling over Time**

# UHV KELVIN PROBE SYSTEM UHVKP020

The UHVKP020 is the perfect complementary tool for any Ultra High Vacuum (UHV) chamber. Reliable and repeatable results are obtained with ease, thanks to the unique features provided by the 'Baikie System'. The high quality linear translator included, enables simple tip to sample positioning, and the unrivalled tracking system holds the tip separation constant at all times during the measurement. For thin film studies, sub-monolayer coverage detection is trivial.

Consider adding the SPV020 or SPS030 modules for light sensitive studies, or upgrade to the only commercially available 'Absolute' UHVKP system. For a full vacuum solution take a look at the UHV mini system with sample heater for a wide range of UHV studies.

The Kelvin Probe is a non-contact, non-destructive vibrating capacitor device used to measure the work function ( $wf$ ) of conducting materials or surface potential ( $sp$ ) of semiconductor or insulating surfaces. The  $wf$  of a surface is typically defined by the topmost 1-3 layers of atoms or molecules, so the Kelvin Probe is one of the most sensitive surface analysis techniques available. KP Technology Systems offer very high  $wf$  resolution of 1-3 meV, currently the highest achieved by any commercial device.



“ The Kelvin Probe that you developed is wonderful because the distance is kept in measurement using gradient constant function. It is hard to set the distance between sample and probe with other systems. We have two Kelvin Probes: the KP Technology System is better in sensitivity, ease of use and customer service. ”

*Dr. Shinjiro Yagyu  
National Institute for Materials Science  
Ibaraki, Japan*

# UHV KELVIN PROBE SYSTEM UHVKP020

## THE BAIKIE SYSTEM

All KP Technology Systems are based upon unique features developed by Professor Iain Baikie. These features are unsurpassed by any other company.

- ◆ Highest work function/ surface potential resolution of 1 - 3 meV (standard with 2mm tip).
- ◆ Voice Coil driver provides very high rejection of driver talkover noise compared with piezoelectric systems.
- ◆ Off null signal detection system for vastly improved resolution - Our Signal-to-Noise (S/N) features remain unsurpassed in the field.
- ◆ Height regulation feature to control the tip to sample spacing during measurements and scans which allow for stable, reliable and repeatable results.
- ◆ Full digital control of all Kelvin Probe parameters.



**KP**Technology



## SYSTEM SPECIFICATIONS

- ◆ Work Function resolution of 1-3meV (2-10mm tip)
- ◆ User Defined Tip size (2-10mm standard)
- ◆ User Defined Kelvin Probe Length (Flange to Sample Distance)
- ◆ DN40 (2.75" mounting port) – other options available
- ◆ 50mm Manual Translator (100mm option)
- ◆ Vacuum Compatibility (2 x 10-11mbar)
- ◆ Tracking System with automatic control of tip to sample spacing
- ◆ Off-null detection system with parasitic capacity rejection

## SOFTWARE FEATURES

- ◆ Digital Control of all Kelvin Probe parameters
- ◆ Simple set-up procedure for signal optimisation
- ◆ Fast measurement mode for tracking real time work function changes (1000 work function points / min at ~20meV resolution)
- ◆ Export of data to scientific analysis software

## SYSTEM PACKAGE DESCRIPTION

- ◆ Kelvin Probe Head Unit with Integrated Tip Amplifier
- ◆ Digital Control Unit
- ◆ Dell PC with monitor
- ◆ Pre-installed KP software and Data Acquisition system
- ◆ Spare Tip Amplifier
- ◆ Autosensing Power Supply Unit
- ◆ 12 Month Warranty

## ADDITIONAL OPTIONS

- ◆ Motorized Translation
- ◆ UHVS KP
- ◆ Absolute UHV KP
- ◆ Surface Photovoltage modules SPV020 and SPS030



# CONTROLLED GAS / CORROSIVE GAS / UHV MULTI-SYSTEM KPMS050

The KP Technology Multi-System is our most versatile system, easily configurable to suit the client's requirements. For the ultimate in Controlled and Corrosive Gas atmospheres, the KPMS050 is unsurpassed by any other Kelvin Probe System; from High Temperature Heating, Full SPS and Gas-Inlets, to Motorised Z-Axis, Sample Translation and Photoemission, this Kelvin Probe system is made completely bespoke for the user's needs.

The KP Multi-System offers fast, reliable and repeatable results thanks to the unique features provided by the 'Baikie System'.

The KPMS050 is well suited to a range of Surface Science studies and can be used to measure absolute work function, surface photovoltage, near Fermi-level photoemission and thermionic emission.

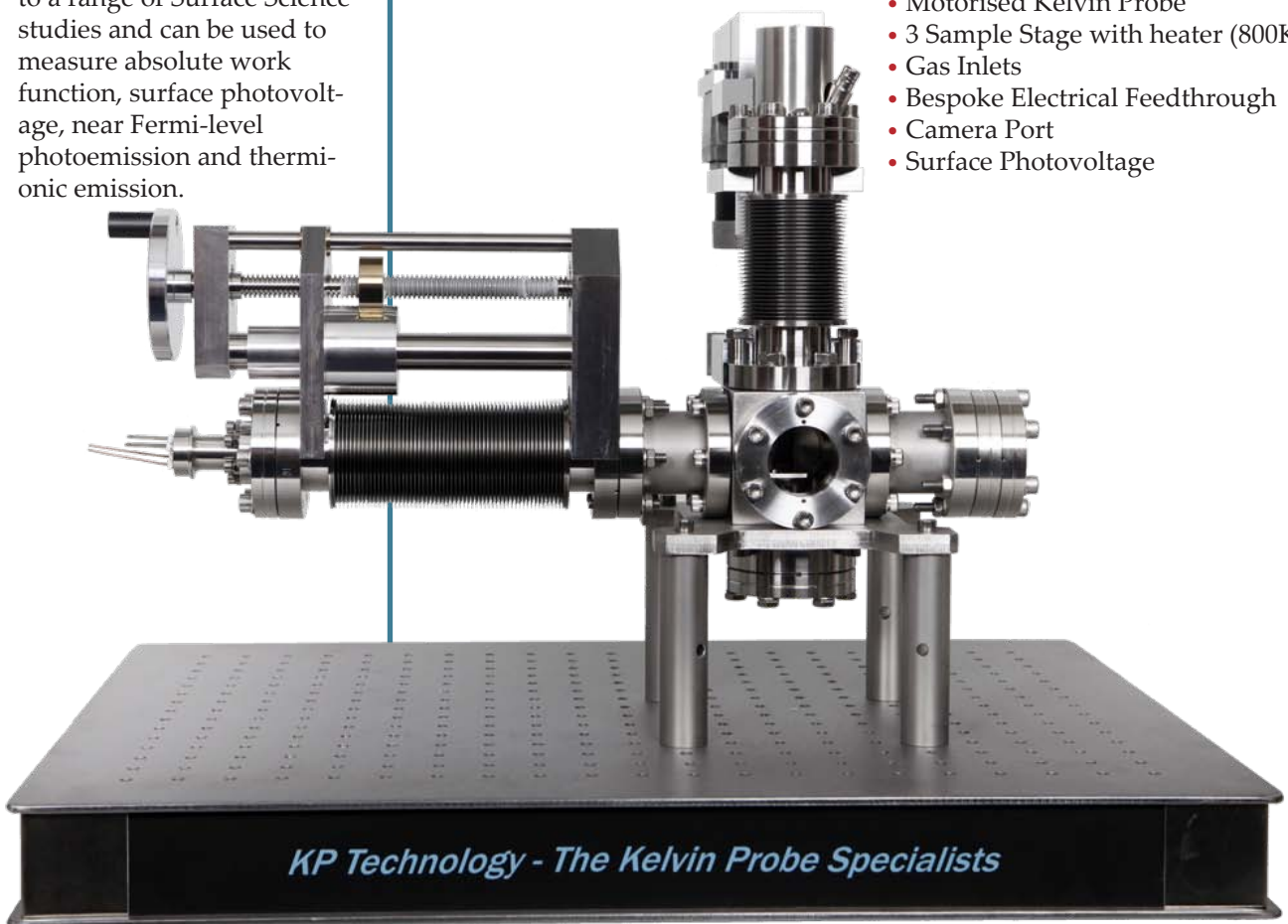
The Kelvin Probe is a non-contact, non-destructive vibrating capacitor device used to measure the work function (wf) of conducting materials or surface potential (sp) of semiconductor or insulating surfaces. The wf of a surface is typically defined by the topmost 1-3 layers of atoms or molecules, so the Kelvin Probe is one of the most sensitive surface analysis techniques available. KP Technology Systems offer very high wf resolution of 1-3 meV, currently the highest achieved by any commercial device.

“ We found that the KP Technology Kelvin Probe is a well engineered instrument with a clever design. Most of all, we are very happy with the excellent support that we have been experiencing. ”

*Dr H.J. Richter*  
*Seagate Research Labs*  
*USA*

The Multi-System comprises UHV fittings compatible with Controlled-Gas, Corrosive Gas and Ultra-High Vacuum Environments. The system is based upon a 'Corner-Cube' with 6 bespoke ports; The Image below is a completely bespoke Multi-System configuration which features:

- Motorised Kelvin Probe
- 3 Sample Stage with heater (800K)
- Gas Inlets
- Bespoke Electrical Feedthrough
- Camera Port
- Surface Photovoltage



# CONTROLLED GAS / CORROSIVE GAS / UHV MULTI-SYSTEM KPMS050

## THE BAIKIE SYSTEM

All KP Technology Systems are based upon unique features developed by Professor Iain Baikie. These features are unsurpassed by any other company.

- Highest work function/surface potential resolution of 1 - 3 meV (standard with 2mm tip).
- Voice Coil driver provides very high rejection of driver talkover noise compared with piezoelectric systems.
- Off null signal detection system for vastly improved resolution - Our Signal-to-Noise (S/N) features remain unsurpassed in the field.
- Height regulation feature to control the tip to sample spacing during measurements and scans which allow for stable, reliable and repeatable results.
- Full digital control of all Kelvin Probe parameters.



KP Technology



## KPMS050 OPTIONS

- Absolute UHVKP via Photoemission (Includes Software)
- Gas-Inlets via Swage-Lok Adapters
- Sample Translation (Motorised or Manual)
- Sample Heating (up to 800K)
- Motorised Z-Axis Translation (50mm to 200mm+)
- Camera System (Includes Camera, Monitor, Mount and Lenses)
- Bespoke Sample Holder (SEM-clips, Magnetic, Push-Fit, etc.)
- Surface Photovoltage via PC Controlled LEDs or QTH Source
- Full Surface Photovoltage Spectroscopy
- Fast-Access Door
- LEDs for sample illumination
- Bespoke Tip Sizes and Shapes (Standard, Mesh, Crescent, etc.)

## BASE SYSTEM SPECIFICATIONS

- Work Function resolution of 1-3meV (2-10mm tip)
- User Defined Tip size (4mm standard)
- DN40 (2.75" mounting port) – other options available
- 50mm Manual Translator (100mm option)
- Vacuum Compatibility (2 x 10<sup>-11</sup>mbar)
- Tracking System with automatic control of tip to sample spacing
- Off-null detection system with parasitic capacity rejection

## BASE SOFTWARE FEATURES

- Digital Control of all Kelvin Probe parameters
- Simple set-up procedure for signal optimisation
- Fast measurement mode for tracking real time work function changes (1000 work function points / min at ~20meV resolution)
- Export of data to scientific analysis software

## BASE KPMS050 PACKAGE DESCRIPTION

- Kelvin Probe Head Unit with Integrated Tip Amplifier
- Digital Control Unit
- PC with monitor
- Pre-installed KP software and Data Acquisition system
- Spare Tip Amplifiers
- Autosensing Power Supply Units
- 24 Month Warranty



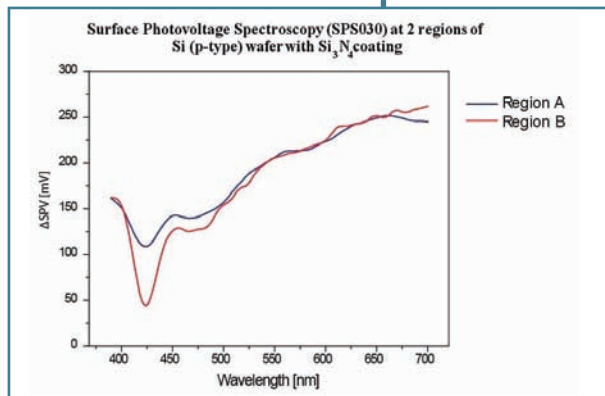
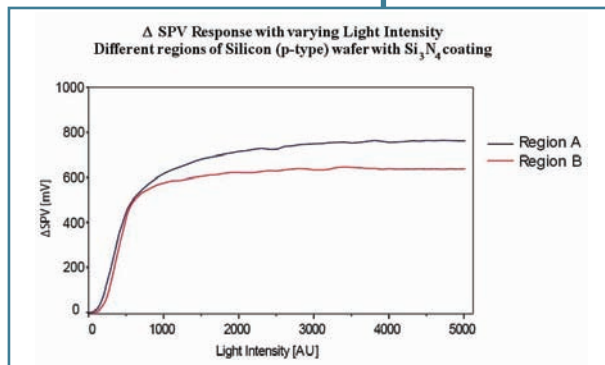
# SURFACE PHOTOVOLTAGE SPECTROSCOPY MODULE SPS030

The SPS030 is the perfect all-in-one solution for in-depth studies of light sensitive materials such as solar cells, semiconductors or light sensitive dyes. The system offers a comprehensive range of measurement modes including DC and AC surface photovoltage potential studies utilising the in-built optical chopper. Total digital control of all parameters including light intensity and wavelength (400-700 or 400-1000nm) gives the opportunity to investigate the quality of samples, and characterise interface and bulk defect states.

The flexible fiber optic allows easy positioning of the light source for either above sample or through sample (below) illumination with the use of one of our special sample holders, ideal for larger silicon wafers.

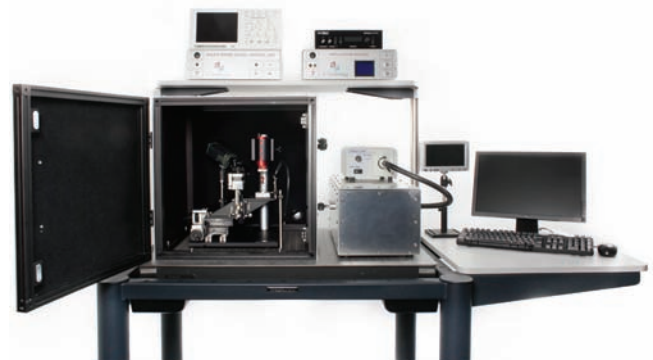
## SYSTEM SPECIFICATIONS

- ◆ 150W DC QTH light source with fiber optic illumination
- ◆ Wavelength Range: 400-700nm (25nm FWHM)  
400-1000nm (45nm FWHM)
- ◆ Application Module Digital Control Unit
- ◆ Optical Chopper or KP Trigger Measurement modes
- ◆ Upgraded SPS Software Package
- ◆ 12 month Warranty



“ The Kelvin Probe that you developed is wonderful because the distance is kept in measurement using gradient constant function. It is hard to set the distance between sample and probe with other systems. We have two Kelvin probes: the KP Technology System is better in sensitivity, ease of use and customer service. ”

*Dr. Shinjiro Yagyu*  
National Institute for Materials Science  
Ibaraki, Japan



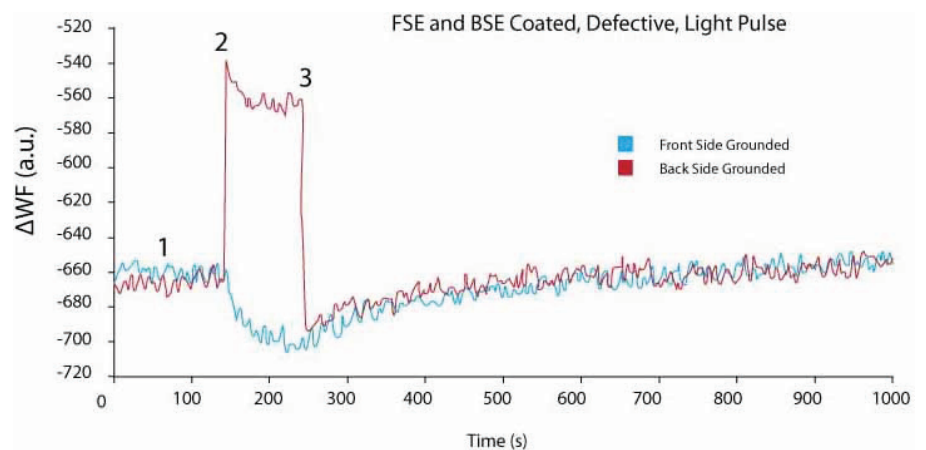
Pictured with Science Desk

# SURFACE PHOTOVOLTAGE MODULE SPV020

The SPV020 module is the ideal upgrade to any of our Kelvin Probe systems, for anyone with an interest in light sensitive materials such as solar cells, semiconductors or light sensitive dyes. To investigate sample defects, simply measure the voltage transients by pulsing the light and measure ~1000 surface potential points per minute. Vary the light intensity of the 150W DC regulated Quartz Tungsten Halogen bulb to achieve open circuit potential or investigate the quality of your latest roll to roll solar cells.

## SYSTEM DESCRIPTION

- ◆ 150W DC QTH light source with fiber optic illumination or High Intensity Luxeon LED
- ◆ Digital Variable Intensity Light Source Control (0-100%)
- ◆ Upgraded SPV Software Package
- ◆ 12 Month Warranty



KP Technology