



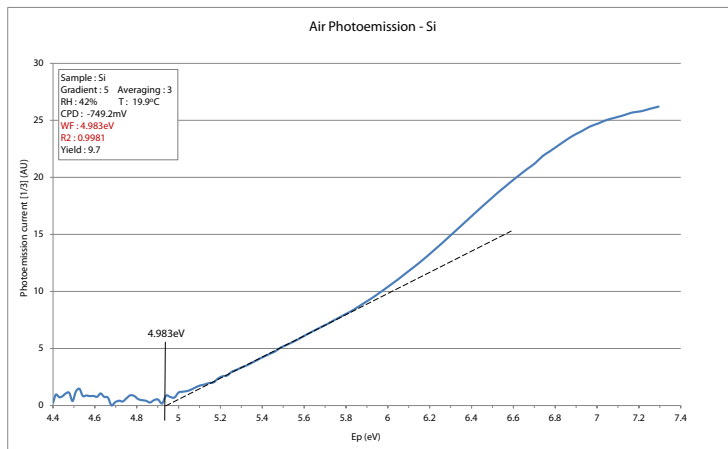
Photoemission in Air Systems

APS01, APS02, APS03, APS04

System Description

The Photoemission in Air Systems are KP Technology's newest addition to our large surface analysis range. The Air-PE systems measure the absolute work function of a material by Photoemission in Air, no vacuum required. With an excitation range of 3.3eV to over 7eV, the Air-PE systems are capable of measuring the absolute Work Function of Metals and with the addition of an SPV and SPS source, the full bands of Semiconductors can be measured in one system, no other product can do this.

Each APS system comes with our gold-standard Kelvin Probe system, capable of Contact Potential Difference Measurements, backed-up by the APS' Absolute measurements.



Photoemission in Air measurement of a Silicon Sample



Air Photoemission system APS02 - Scanning Kelvin Probe with Air Photoemission Spectrometry

Features

- Work Function by Photoemission in Air
- Density of States Measurements
- <3.3eV to >7.0eV Energy Range
- Measurement of all Semiconductor Bands
- Contact Potential Difference by Kelvin Probe

Applications

- Organic and Non-Organic Semiconductors
- Metals
- Thin Films
- Solar Cells and Organic Photovoltaics
- Corrosion



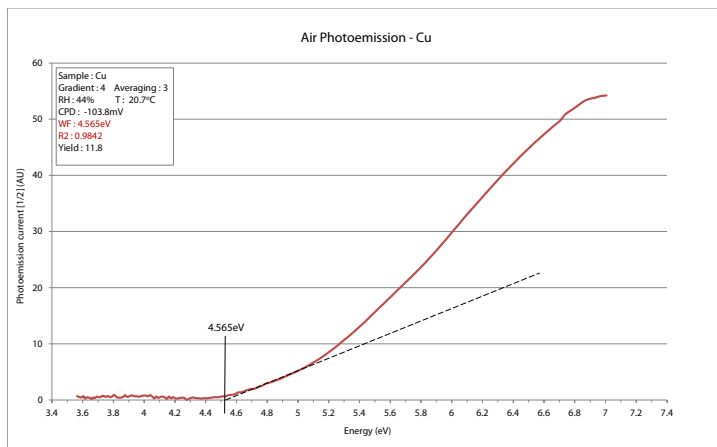
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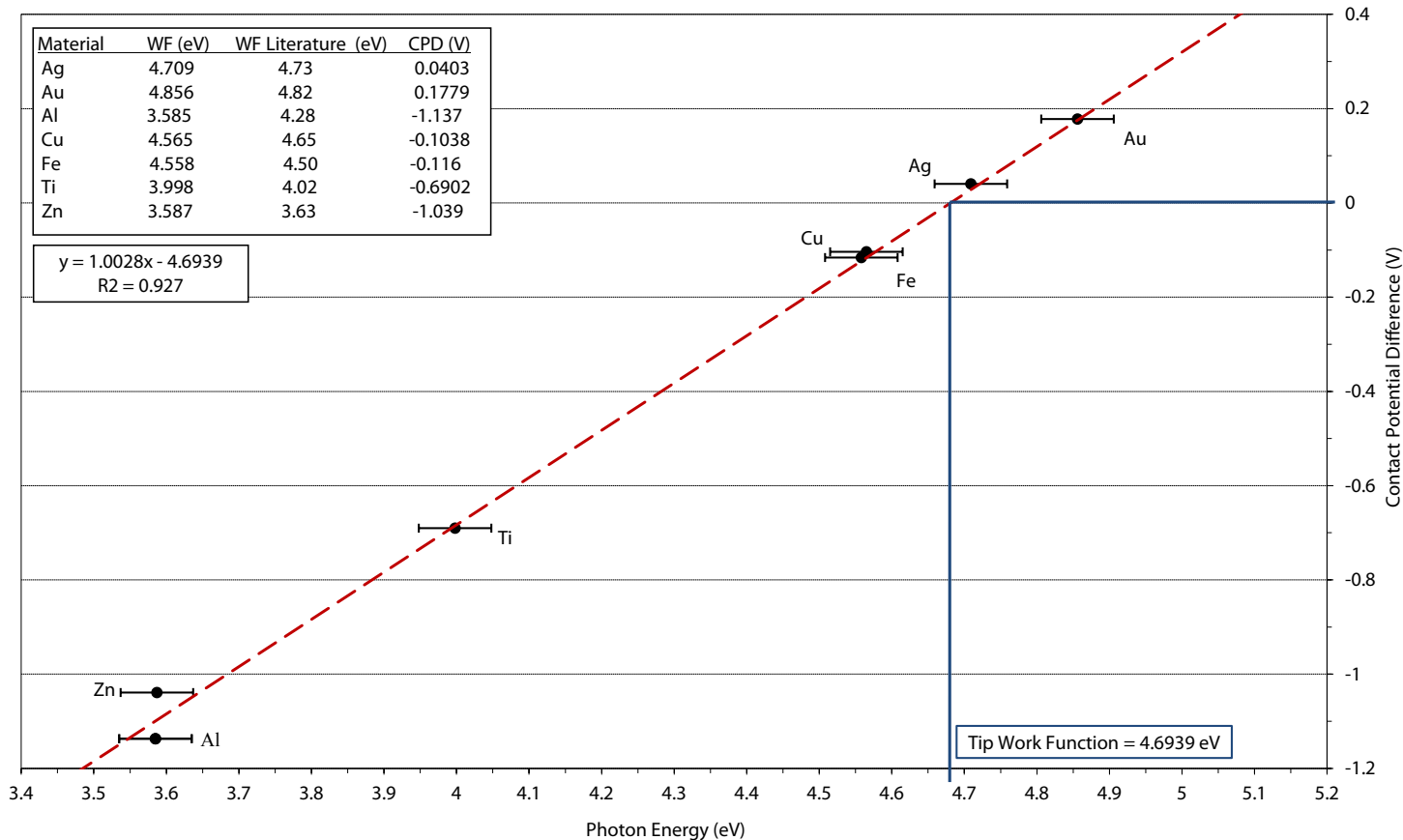
Measurement Principle

When light is incident on a material such as a metal or a semiconductor, the photons may have enough energy to liberate electrons from the surface, a process known as the Photoelectric Effect. Photons having insufficient energy will not liberate electrons, while photons of just enough energy will liberate a few electrons; photons of much more energy than the work function will liberate a lot of electrons.

The energy required for electrons to escape the material is termed the work function. By varying the energy of the incoming light, the absolute work function can be established. Based on Fowler's analysis of photoemission, the square root (cube root for Semiconductors) of the photoelectron yield is plotted on a graph versus the incident photon energy (image right).



Air Photoemission Curve of Copper Sample



Air Photoemission Measurements of a Selection of Metals.

Each metal is measured with the PE Mode and Kelvin Probe Mode of an APS02 system.

The Contact Potential is measured with the Kelvin Probe and the Work Function is measured by the air Photoemission Mode. When Work Function is plotted against CPD, a straight line is formed. A line is drawn at 0V CPD to the line and when traced down reveals the absolute Work Function of the Tip.

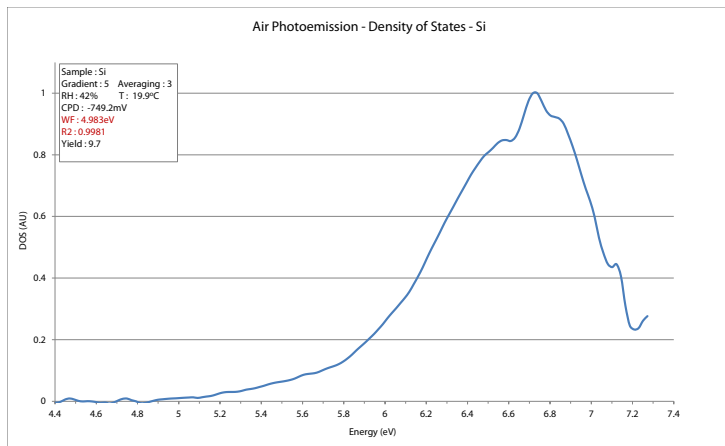


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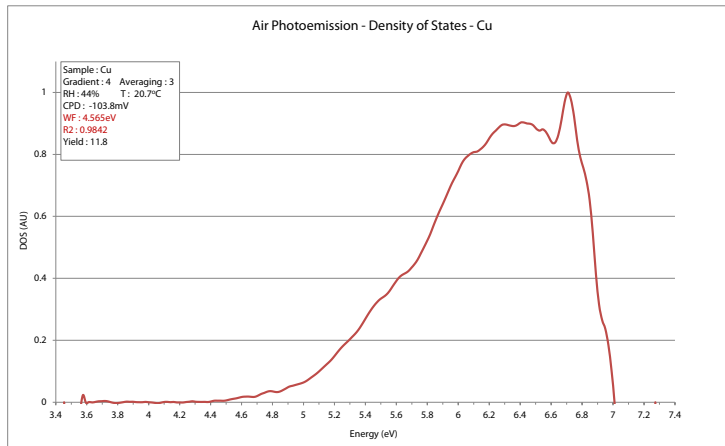
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Density of States

The properties of many materials are governed by the Density of States (DOS) near the Fermi Level. The Air Photoemission system is capable of probing the DOS by differentiating the detected photoelectron yields by the incident photon energy. The DOS measurement can thus be compared to molecular orbital calculations for the material under investigation. DOS data collected with the APS in air is shown to the right for Copper. The data for all measured samples is consistent with literature.

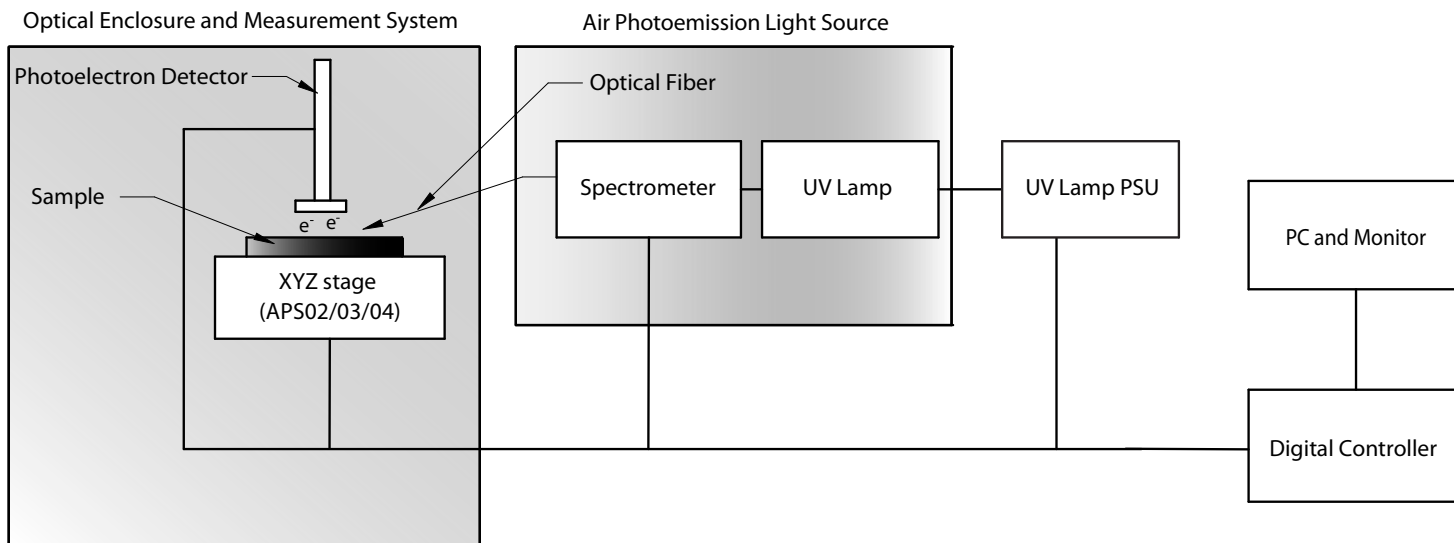


Silicon Sample Density of States



Copper Sample Density of States

System Overview



The Optical Enclosure houses the sample in complete darkness prior to measurement. The Photoelectron detector measures the liberated electrons driven off by the UV Light emitted by the Spectrometer.

The UV Bulb is powered by an external PSU and is controlled by software. The UV light is injected into the Spectrometer and a variable wavelength of light is produced. The energy range of this light is <3.3eV to >7.0eV.

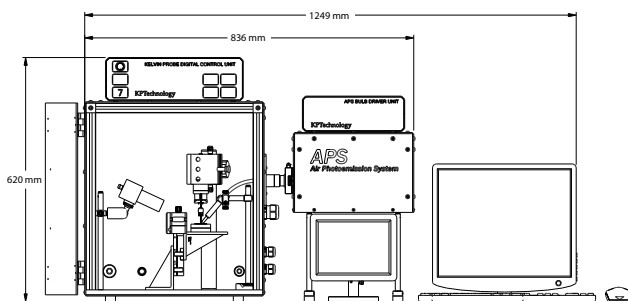
The Digital Controller controls every aspect of the system and is controlled by the dedicated software GUI. The measurement from the Photoelectron Detector is passed to the Digital Controller, to the PC and plotted in software, producing the PE curve.



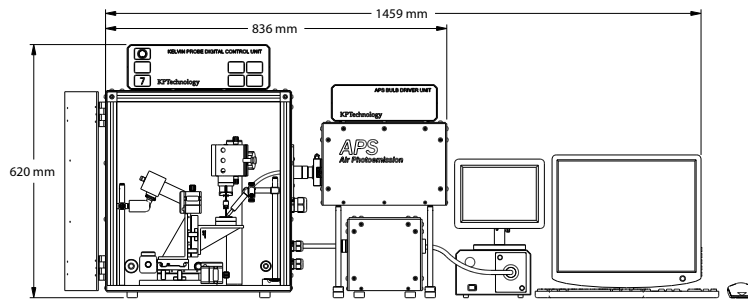
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System Specifications	APS01	APS02	APS03	APS04
Kelvin Probe 3-Axis Scanning		✓	✓	✓
Surface Photovoltage			✓	✓
Surface Photovoltage Spectroscopy				✓
Tip Material / Diameter	2mm Gold Tip			
Work Function Resolution	<3meV			
Height Control (Auto)	25mm Automatic			
Kelvin Probe Mode	Full CPD measurements			
CPD Measurement Time	CPD measurements in <1 min			
PE Mode	Full Photoemission measurement			
WF Measurement Time	PE measurement in <5 mins			
DOS Measurements	Full access to DOS Information			
Optical System	Colour Camera with Zoom Lens and Monitor for positioning			
Oscilloscope	Digital TFT Oscilloscope for Real Time Signal			
Test Sample	Gold, Aluminium and Silver Test Samples			
Faraday Enclosure Base (mm)	450 x 450mm Optical Enclosure			
Control Supplied	PC Control with Dedicated Software			
Warranty	12 Months			



APS02 Photoemission system



APS04 Photoemission system with surface Photovoltage Spectroscopy

The Company

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.

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. Along with a strong Research and Development Division and over 300 systems shipped worldwide, this has placed KP Technology as the Number one supplier of Kelvin Probes in the world.

Contact

For quotation requests, further information or to discuss any research or particular measurements, please feel free to contact us:

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www.kelvinprobe.com
www.airphotoemission.com

KP Technology was the proud winner of the Queens Award for Enterprise: International Trade 2013

