INSTYTUT FOTONOWY

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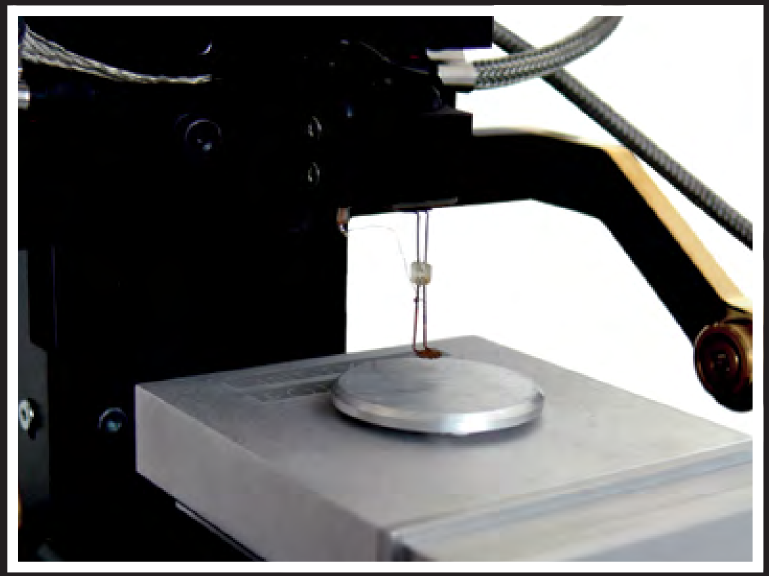
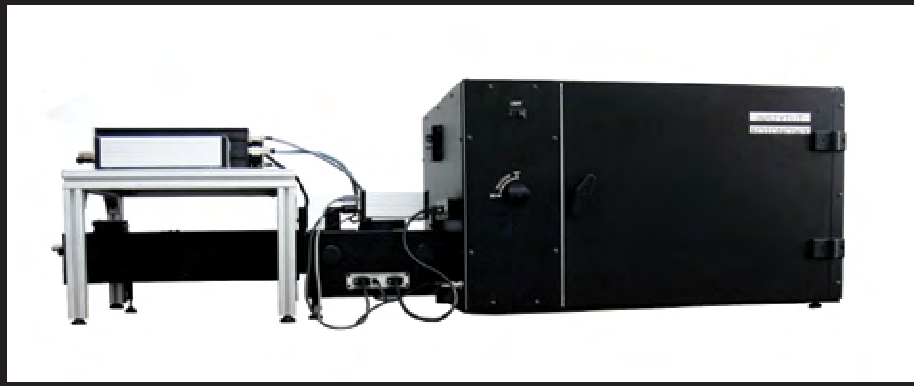
"There are many ways to waste your life.

Science is the most entertaining."





We design and manufacture laboratory instruments **for research institutions** and industrial applications

INSTYTUT FOTONOWY sp. z o.o.
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www.fotonowy.pl

▪ SPECTROMETERS ▪ LIGHT SOURCES ▪ PHOTOELECTROCHEMISTRY ▪ OPTOMECHANICS ▪ DETECTORS ▪ OTHER

About Us

We custom build tens of projects for scientific laboratories annually.
To accomplish that we needed to master design of electronics, mechanics and optics.

Instytut Fotonowy designs, develops and manufactures high-quality scientific equipment. We complete dozens of projects each year and we provide instruments for research laboratories all over the world.

The company was founded in 2007. Its name in Polish means "Photon Institute". It reflects the character of the organization. We earn money on designing and building laboratory equipment, mostly involved with detection, shaping and generation of light. Then we spend it on our own research.

Our scientific instruments are used in very diverse areas like atomic spectroscopy, nuclear physics, electrochemistry, photovoltaics, medicine, biotechnology, museum science and others. Expertise in those fields positions us in a unique spot to creatively solve often extremely challenging tasks. Our strength springs from a high level of flexibility in adjusting hardware and software functionality to the specific needs of customers. We develop state-of-the-art devices, which often become our serial products. Our systems are easily expendable and upgradeable due to a modular design.

If you have a scientific problem that no one else is willing to approach, we are probably the right place to either confront the idea with technological reality or to get a hint where the solution can be found.

WHOM DO WE HELP?

- companies that want to introduce or upgrade their products,
- inventors at universities that bring their ideas to be actually developed and sometimes commercialized,
- scientific laboratories in need for custom made instruments, repairs of equipment they already have or for calibration or consulting services.

PEOPLE

Our greatest strength comes from our talented engineers. Building commercial prototypes of scientific instruments from such diverse research areas requires both deep understanding of Nature and present-day knowledge of scientific frontiers. Those prototypes need to be designed to discover new science, after all.

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I. MEASUREMENT SYSTEMS

II. MEASUREMENT MODULES

I. MEASUREMENT SYSTEMS

Photoelectric Spectrometer
for quantum efficiency measurements

INSTYTUT FOTONOWY

Automatic, comprehensive characterization of semiconductors photoelectrical properties (photocurrent, photovoltage).

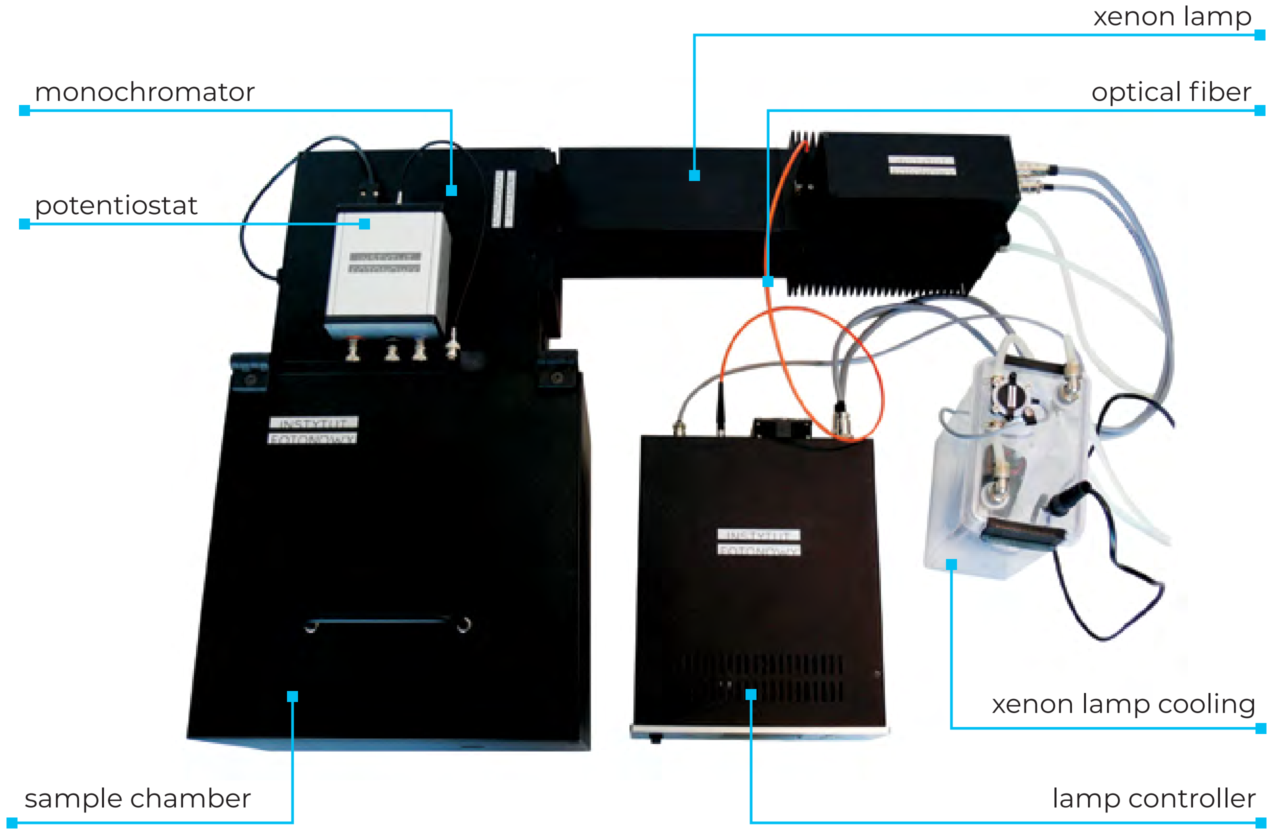
DESCRIPTION

The Photoelectric Spectrometer serves as a scientific tool to automatically characterize photoelectrical properties (photocurrent, photovoltage) of wide band gap semiconductors illuminated by relatively strong light in UV, VIS and NIR ranges as a function of incident light wavelength.

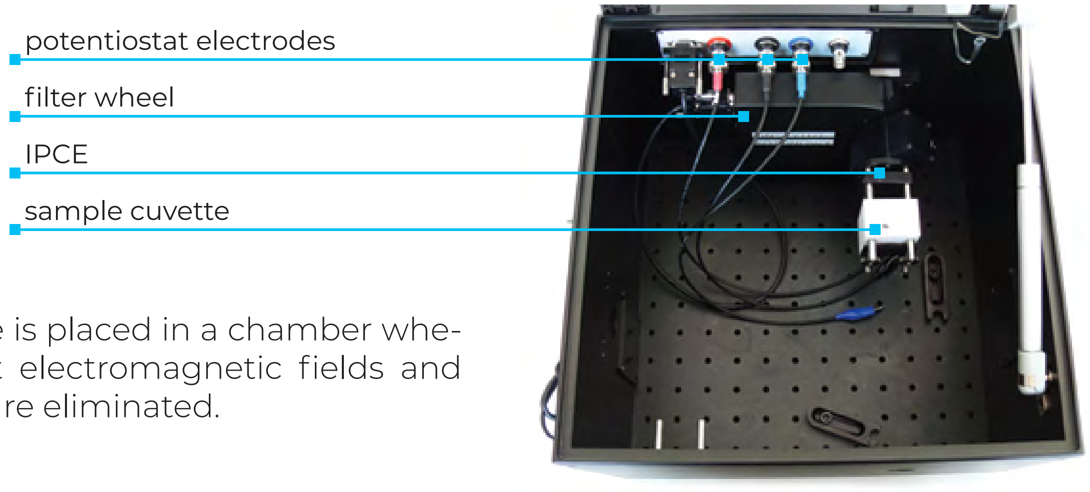
Quantities measured by the instrument:

- Electric current of the sample (chronoamperometry, CA),
- Open circuit potential (OCP) as a function of light wavelength,
- Photocurrent of the sample illuminated with white or monochromatic light,
- Current-voltage characteristics,
- Light transmittance of the sample (with calibrator),
- Light intensity on the sample (with calibrator),
- Action maps (photocurrent as a function of potential and wavelength),
- IPCE maps as function of potential and wavelength,
- Sample reflectance (with integrating sphere),
- APCE (Absorbed Photons to Converted Electrons) maps as a function of potential and wavelength.

SPECTROMETER MODULES



SAMPLE CHAMBER INTERIOR



The sample is placed in a chamber where ambient electromagnetic fields and stray light are eliminated.

Photoelectric Spectrometer

for quantum efficiency measurements

INSTYTUT FOTONOWY

Automatic, comprehensive characterization of semiconductors photoelectrical properties (photocurrent, photovoltage).

ADDITIONAL EQUIPMENT

The spectrometer is ready to be expanded with peripheral devices such as potentiostat, Kelvin probe, synchronous light chopper for lock-in amplified measurements, rotating disk electrodes, electromagnetic valves, LED illuminator, magnetic stirrer, automatic pipette, temperature controller, etc.

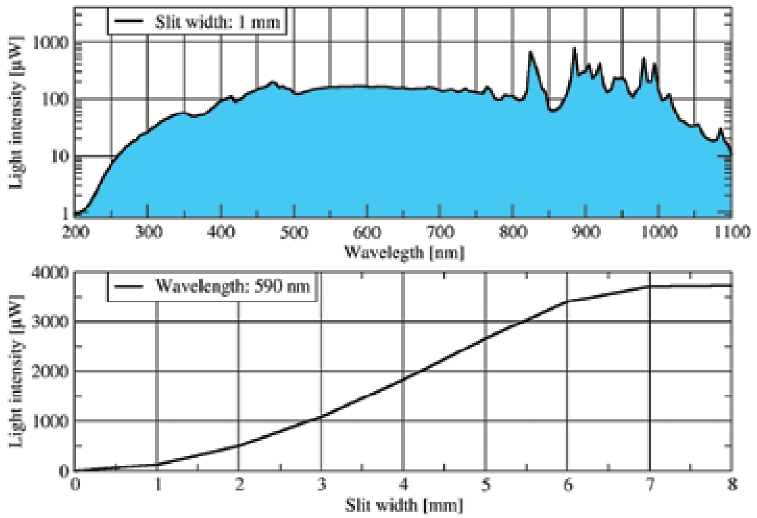
To mimic natural solar light, air mass Filters may be applied.

SPECIFICATIONS

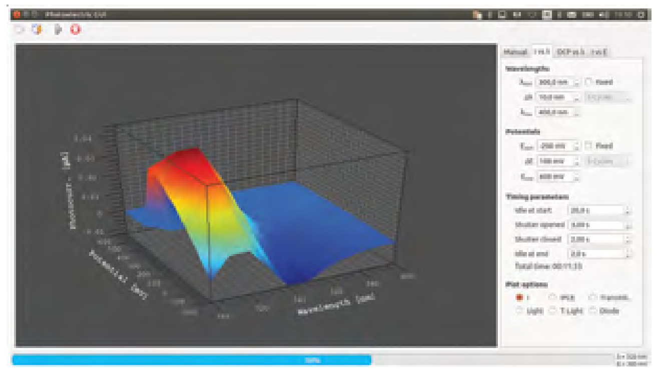
- Light source 150 W: Xe lamp, water cooled, with low EM emission igniter,
- Stabilization modes: current stabilization (distortions < 1%), power consumption stabilization and light intensity stabilization mode that keeps the sample illumination constant during experiment,
- Two gratings installed by default: 1200 grooves/mm with 300 nm blaze wavelength and 500 nm blaze wavelength,
- Up to four gratings could be installed,
- Maximum radiation intensity on the sample: 35 mW/cm^2,
- Edge (long pass) filters: 400 nm and 510 nm,
- Up to 6 filters,
- Number of I/O programmable TTL lines for synchronization with external devices: 16,
- Connectivity: USB 2.0,
- Automatic measurements mode.

Typical light intensity.

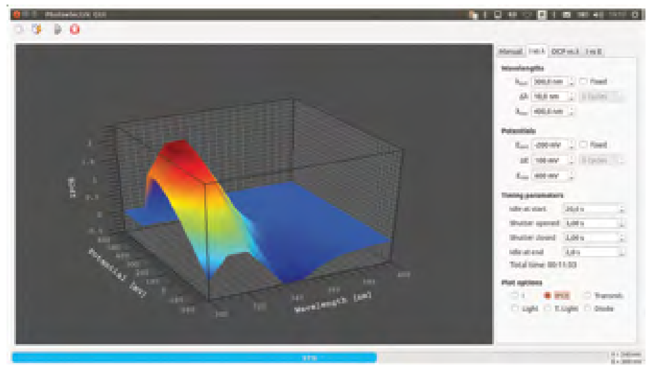
The light intensity produced on the sample by the xenon lamp varies with the wavelength and width of the output slit.



EXEMPLARY RESULTS



Photocurrent values versus light wavelength and applied potential.



IPCE Map

Mini Photoelectric Spectrometer

excellent for basic sample characterization

Photocurrent and OCP measurements under illumination from LED revolver.

DESCRIPTION

This is an entry level setup for photoelectrochemistry. It consists of a potentiostat, a LED revolver, a universal electrochemical cell and a set of electrodes: reference Ag/AgCl and platinum counter electrode. The device is ready for two and three electrode measurements. The LED revolver delivers irradiation from 1 of 10 LEDs in UV, VIS and NIR range. although this is a simplified version of a full photoelectric spectrometer, it is rich in measurement possibilities.

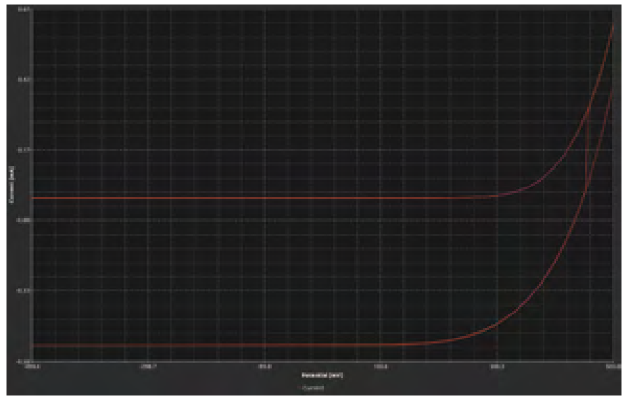
Quantities measured by the instrument:

- Current as a function of set bias potential,
- Open Circuit Potential (OCP),
- I-V characteristics of a sample under illumination.

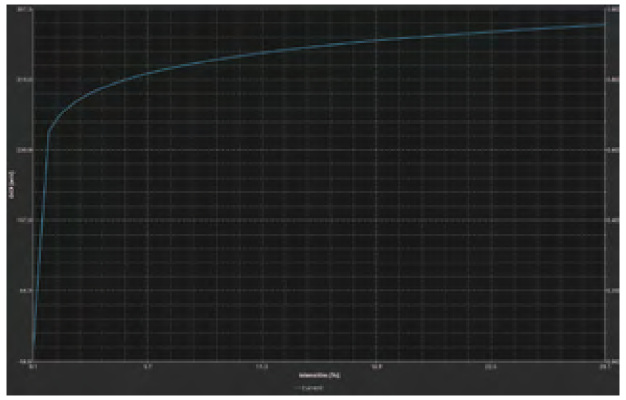
SPECIFICATIONS

- Current ranges: 10 mA, 1 mA, 100 μA, 10 μA, 1 μA, 100 nA,
- Current resolution: 1 pA,
- Potential ranges: -5 V do 5 V,
- Default LED set [nm]: 365, 385, 405, 450, 520, 590, 630, 740, 840, white,
- Typical LED power: 3 W,
- Measurement techniques: chronoamperometry, voltammetry, cyclic voltammetry, and more,
- Reference electrode: Ag/AgCl,
- Counter electrode: Pt,
- Computer connectivity: USB 2.0,
- PTFE electrochemical cell for both types of samples: transparent and opaque substrates.

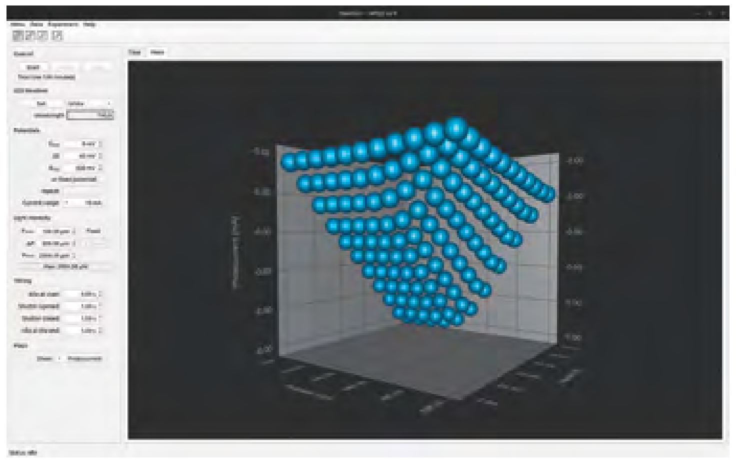
EXEMPLARY RESULTS



I-V characteristics



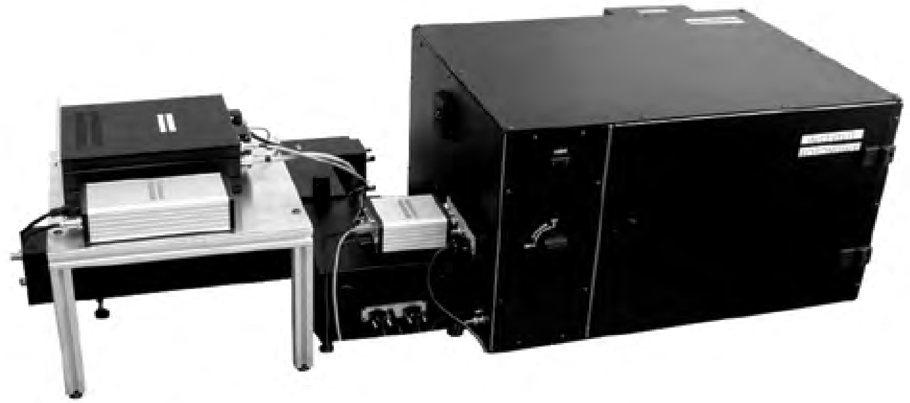
OCP versus light intensity



3D map of I-V curves for different light intensities

Photovoltaic Spectrometer
for solar cells characterization

INSTYTUT FOTONOWY



DESCRIPTION

Photovoltaic spectrometer is a complete setup for solar cells' spectral response investigation. A sample is illuminated by a monochromatic beam, up to a few millimeters in diameter, in the ultraviolet, visible and infrared range. Additionally, the sample may be excited by a normalized white AM1.5G light. The cell is placed on a motorized vacuum XY table, with a manual Z shift. The measurement is performed in a chamber that provides screening from external light.

Quantities measured by the instrument:

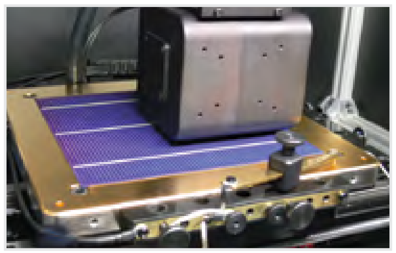
- Photocurrent,
- Sample retlectance,
- Sample transmittance.

Characteristics:

- External quantum efficiency,
- Internal quantum efficiency,
- Short-circuit current density.

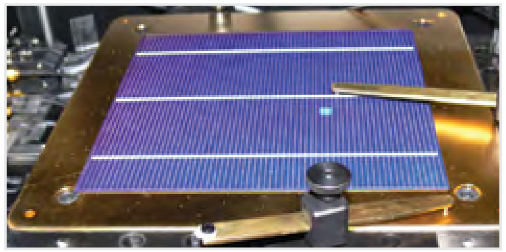
SPECIFICATIONS

- Spectral range: 200 nm – 1650 nm,
- Adjustable white light beam intensity: 0.01 – 0.1 W/cm²,
- Illumination homogeneity: 10 %,
- XY table range: 20 x 20 cm,
- Sample bias range: ± 2 V.

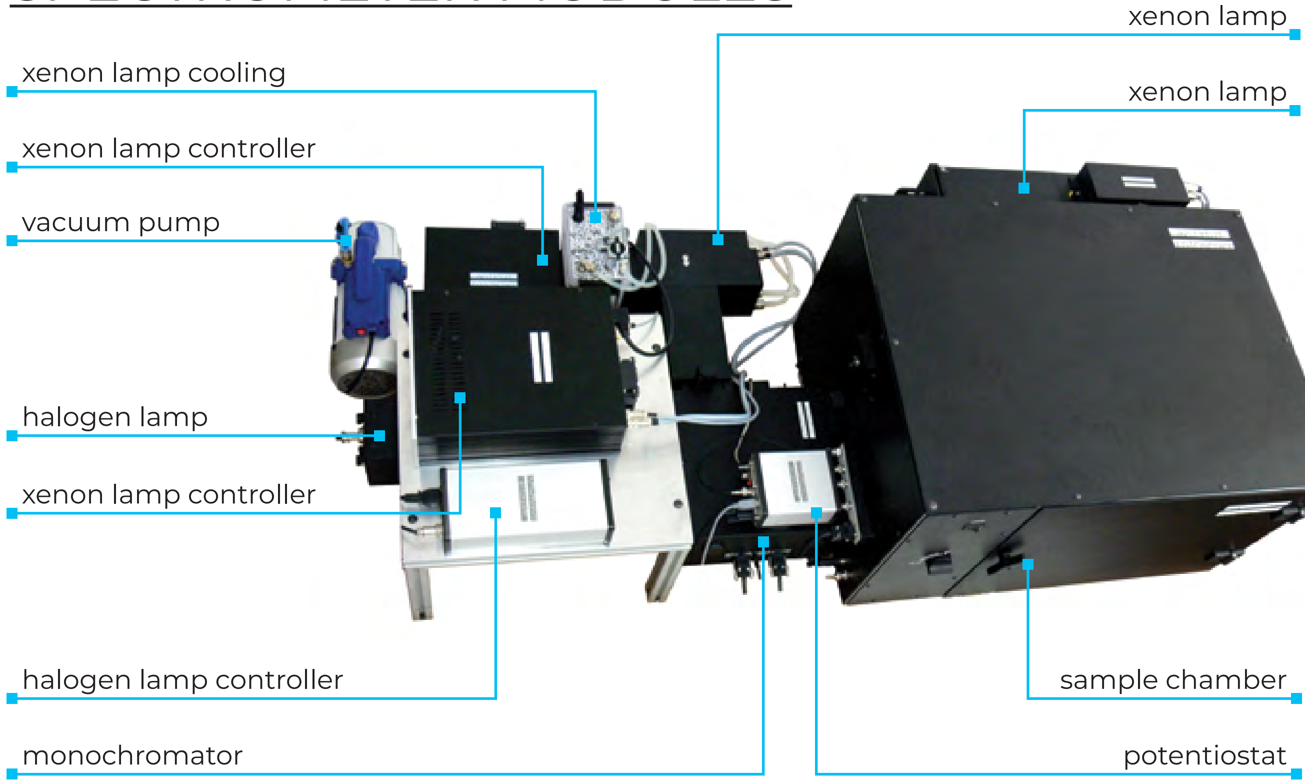


Reflected flux measurement

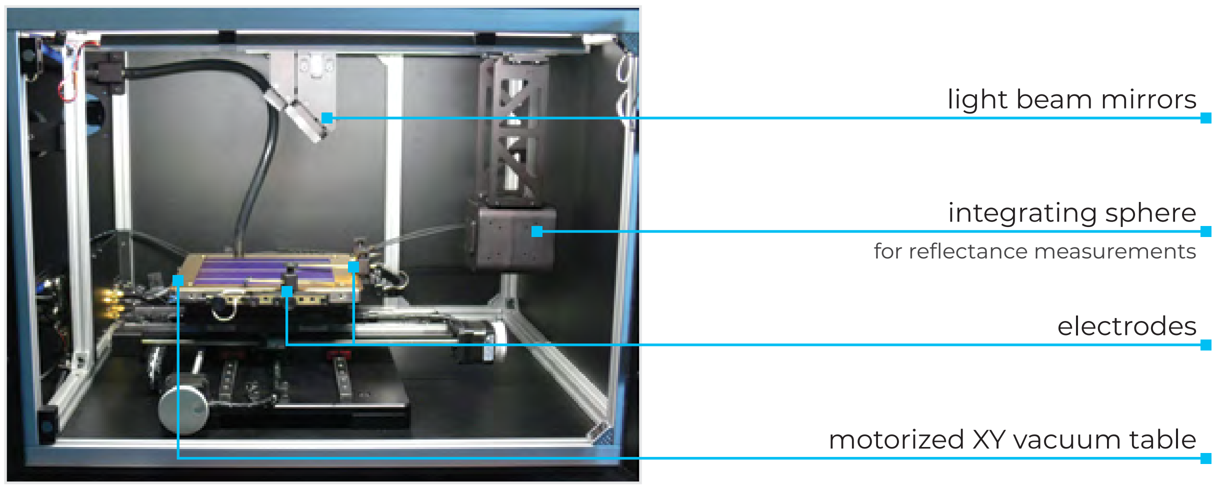
Photocurrent measurement



SPECTROMETER MODULES



SAMPLE CHAMBER INTERIOR



IMPS/IMVS

Intensity Modulated Photocurrent/Photovoltage Spectroscopy

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DESCRIPTION

The IMPS/IMVS is a complementary method to the devices that perform static photo-current/photovoltage measurements such as photoelectric spectrometer or mini photoelectric spectrometer.

Quantities measured by the instrument:

- Minority carriers lifetime (recombination time),
- Carrier transport time through a sample,
- Diffusion constant,
- Diffusion length (if sample thickness is known),
- Sample thickness (if sample diffusion length is known),
- Rate of charge transfers through interfaces,
- Many more kinetic quantities.

SPECTROMETER MODULES

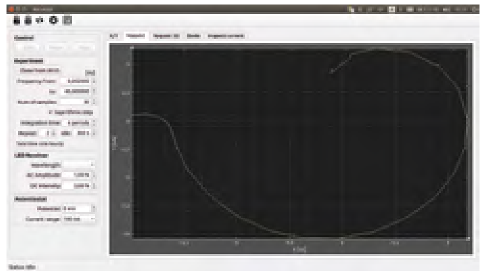
- LED revolver as the light source,
- Potentiostat for photocurrent and open circuit potential (OCP) measurements,
- Sample chamber that shields the sample from external EM fields and ambient light,
- Electrochemical cuvette with Pt and Ag/AgCl electrodes.

SPECIFICATIONS

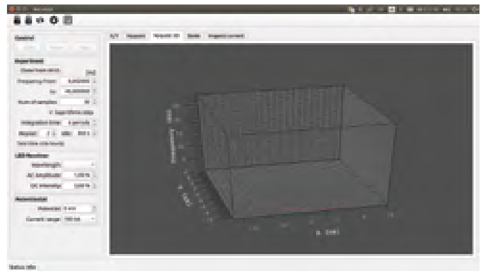
- Modulation frequency range: 1 μHz ÷ 10 kHz,
- Number of LED's 10,
- Current ranges: from 10 mA to 1 pA,
- Potential ranges: from -5 V to 5 V.

EXEMPLARY RESULTS

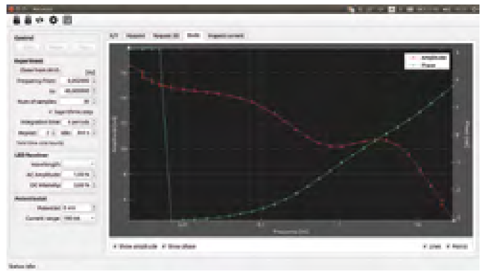
The measurement results shown below are obtained for nanocrystalline anatase on ITO foil in KNO_3 electrolyte.



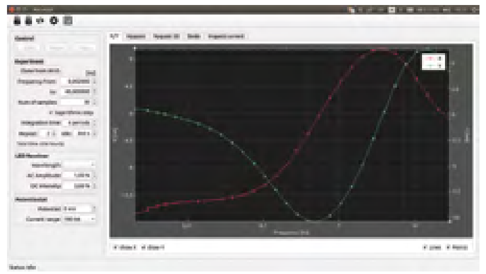
Nyquist (or Argand) plot showing real and imaginary part of photocurrent measured for range of light modulation frequencies.



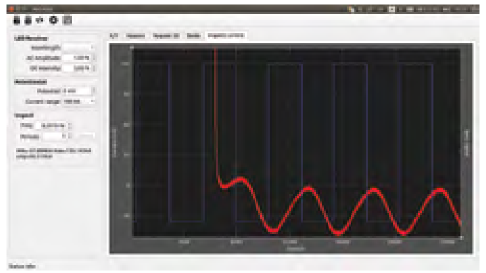
Nyquist (Argand) plot in 3D showing real and imaginary part of photocurrent as a function of light modulation frequencies.



Bode plot showing photocurrent amplitude and phase shift with respect to light modulation. The apparent phase jump is due to the assumed phase range from -π to π.



Real (X) and imaginary (Y) part of photocurrent as a function of light modulation frequency.



Photocurrent in time. Warning: the current sign convention assumed is normal in contrast to potentiostatic measurements (adopted by all the potentiostats in the world) where IUPAC (inverse sign) convention is used.

The measurements were performed and shared by prof. J. Kuncewicz (Jagiellonian University).

Impedance Camera
to observe impedance changes in time

INSTYTUT FOTONOWY

Time resolved impedance spectroscopy in wide scope of samples.

DESCRIPTION

The instrument is designed for Time Resolved Impedance Spectroscopy. It measures and records time evolution of impedance spectra.
In many applications, the impedance of a sample changes with time. Ordinarily, an impedance spectrometer would be used to measure the impedance for a range of frequencies. However, sometimes a sample changes are so fast that sequential measurements over frequencies are too slow to be useful. For example, an impedance spectrum might be hard to interpret if the sample properties have changed significantly during frequency sweep.
The impedance camera takes an entire spectrum in a single shot, so that all the frequencies are handled at the same time. Such a single time spectrum is called a frame, pretty much like a movie frame. Then one may acquire many such frames to record time development of sample's impedance spectra.
The camera is ideal to observe the real time impedance development of electrochemical sensors. The Impedance Camera is complementary to devices performing static photocurrent/photovoltage measurements like photoelectric spectrometers or a mini photoelectric spectrometer.

Quantities measured by the instrument:

- Current through the sample and voltage on the sample which are used to calculate impedance and are later presented on:
  - Nyquist (or Argand) plots in time,
  - Bode plots in time,
  - A time evolution of an impedance at a given frequency,
  - Difference plots to observe changes in the impedance in time

IMPEDANCE CAMERA MODULES

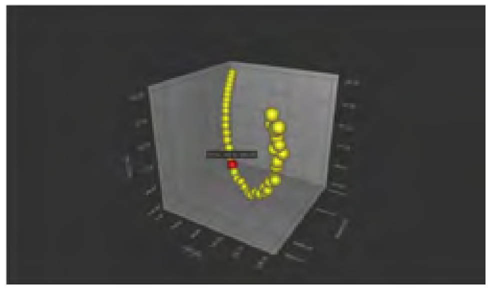
- Measurement electronics module,
- Measurement head,
- Connection cables,
- 12 V power supply.

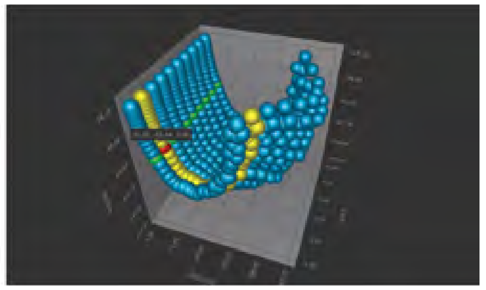
SPECIFICATIONS

- Frequency range: 1 mHz ÷ 1 MHz,
- Number of frequencies in a frame: **unlimited**,
- Current ranges: from 10 mA to 1 pA (depends on the measurement head),
- Potential ranges: from -1 V to 1 V.

EXEMPLARY RESULTS

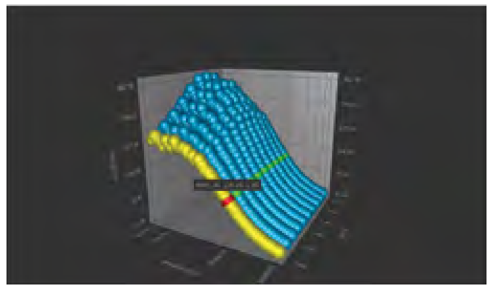
Nyquist (or Argand) plot shows real and imaginary part of impedance sequentially measured for specified range of frequencies. One can see the resistance increases in the middle of the measuring sequence and the impedance semicircles grow in diameter. The green color selects the same frequency measurement points in time. If only the capacitance was changed, in the RC circuit, all semicircles would be the same size but position of given frequency points would move along a circle.





A single frame 3D Nyquist (Argand) plot.

Bode plots amplitudes in time.



FPC-TDC Spectrofluorimeter

first photon counting

INSTYTUT FOTONOWY

For samples with low fluorescence efficiency.

DESCRIPTION

The instrument is designed to explore fluorescence decay over time for faint sources. Since the typical time scale of the fluorescence decay is in the range of 10^{-8} s, a much faster setup is required in order to observe such a quick phenomena. A sample is excited with a picosecond laser pulse and after the deexcitation, the system measures time of flight of a single photon from the sample, through the monochromator, to photomultiplier. The observed statistics of the measured times of flight reconstructs the shape of the fluorescence pulse from the sample. A crucial requirement for proper FPC-TDC spectrofluorimeter performance is a low probability (< 10%) per pulse that the photon reaches the detector. Thus, the instrument is peerless in measurements for materials with a low fluorescence yield. The appliance is adapted to examine and characterize electrochemical samples.

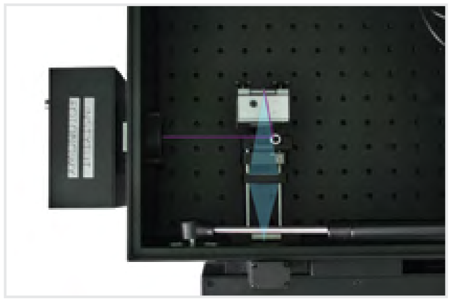
Quantities measured by the instrument:

- Fluorescence decay time in relation to wavelength of light and polarization potential (in case on an electrochemical sample),
- Emissive fluorescence spectrum,
- Current-voltage characteristics,
- Open circuit potential (OCP),
- Current flowing through the sample with a particular polarization potential.

SPECTROMETER MODULES

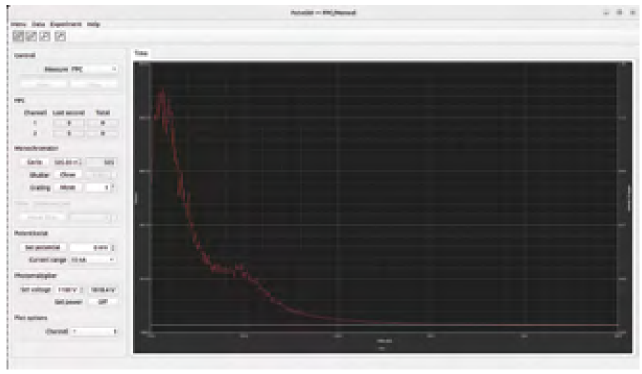
SPECIFICATIONS

- Time resolution: 27 ps,
- Maximum time of measurement: 500 ns,
- Photomultiplier: R928 Hammamatsu,
- Spectral range of Monochromator: 200 - 1200 nm,
- Laser wavelengths: 405 nm, 450 nm, 530 nm, 630 nm,
- Potentiostat: possibility of conducting wide range of electrochemical research,



EXEMPLARY RESULTS

Fluorescence induced by 420 nm laser in fluorescein sample. Result obtained by Instytut Fotonowy.



Transient Absorption Spectrometer
with electrochemistry extension

INSTYTUT FOTONOWY

Spectrometer for flash photolysis with YAG laser and electrochemical measurement module.

DESCRIPTION

Transient Absorption Spectrometer, also called Flash Photolysis Spectrometer is dedicated to measure transitions between quantum states in samples. Solid state sample in the ground state is energized to an excited state by an intensive laser pulse and immediately deexcitates back to the ground state. Process of deexcitation is monitored by measurement of the absorption of the white light in liquid samples or by measurement of the light reflected by the solid state sample.

Solid state samples may be submerged in electrolyte and its polarization potential may be set during the measurement.

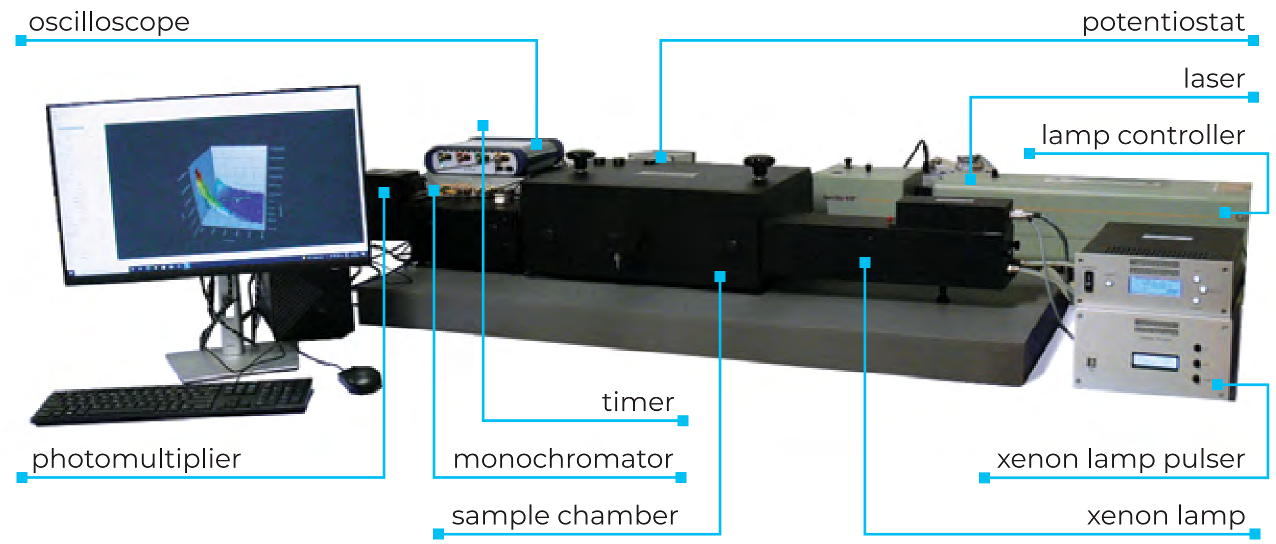
System provides functionality that enables measurement of fluorescence and phosphorescence excited by laser pulse.

Measurement system operation is very intuitive, dedicated software provides completely automated experimental procedures.

Quantities measured by the instrument:

- Transmittance/absorption or reflectance spectrum of the sample,
- Emisive fluorescence spectrum of the sample,
- Duration of the excited states generated in the sample by laser pulse,
- Laser beam intensity on input and output of the sample chamber,
- Current-voltage characteristics of the electro-chemical samples.

SPECTROMETER MODULES



White light source:

A xenon lamp provides light in UV, VIS and NIR range. The incident white light may be modified with filters, including Air Mass Filter, which provides standardized parameters of sun-like light. Filters may also be used on the output of the sample chamber (monochromator input).

White light beam passing through the sample or falling on the solid state sample is a parallel beam with a diameter of several milimeters (diameter may be adjusted to the experiment requirements).

Laser source

Laser source used in the measurement system may be adjusted to the experiment specification (beam power, its diameter and pulse duration).

Sample chamber

The sample chamber provides isolation of the measurement setup from abmient light. It is equipped with safety system that disconnects power supply of the xenon lamp and laser source after opening the chamber and system of easy and stable installation of several different experimental setups.

Inner measurement setups with different optical paths and sample cuvettes may be provided and adjusted to the individual experimental requirements.

Transient Absorption Spectrometer

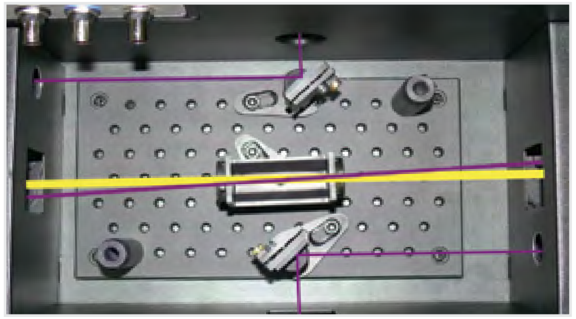
with electrochemistry extension

INSTYTUT FOTONOWY

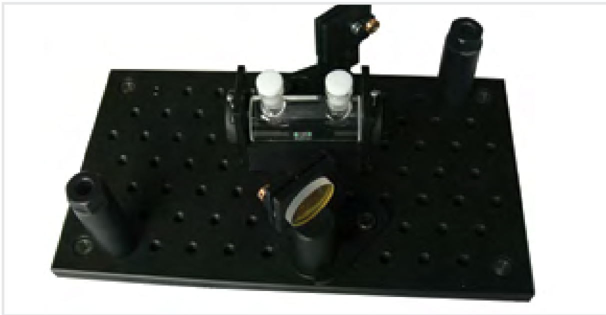
Spectrometer for flash photolysis with YAG laser and electrochemical measurement module

EXPERIMENTAL SETUPS

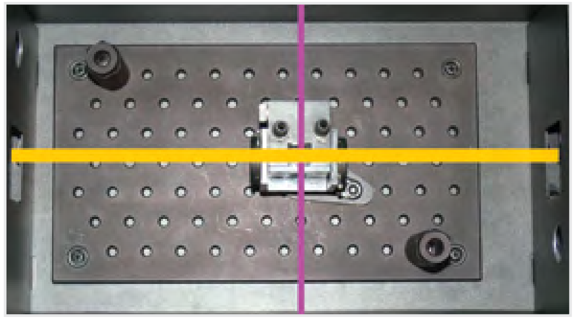
Parallel white light beam and laser beam passing through the sample.



Platform with cylindrical cuvette for transmitance/ absorption measurement of the liquid sample.

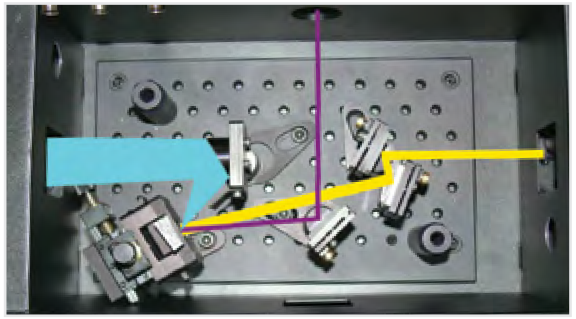


Perpendicular passing of the white light beam and laser beam through the sample.



Platform with powder sample cuvette for transmittance/absorption spectrum measurements.

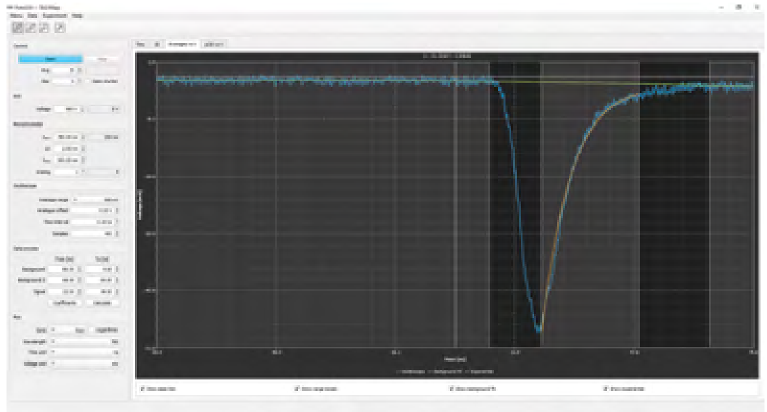
Measurement of solid state sample reflectance spectrum.

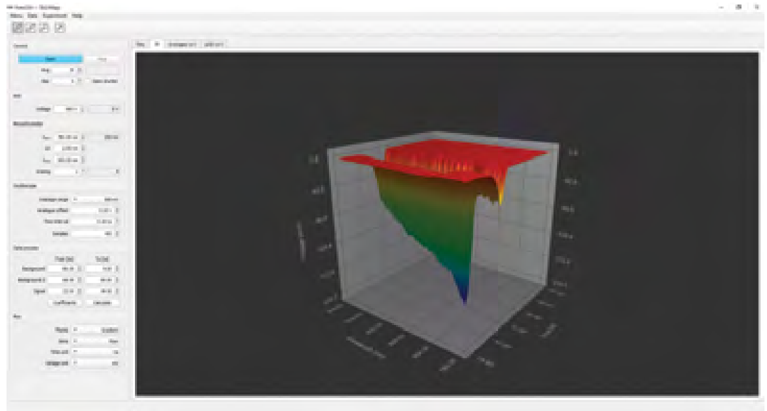


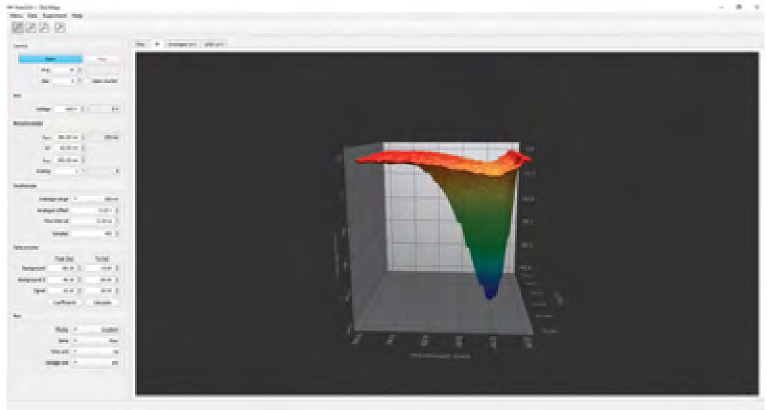
Platform with solid state sample cuvette.

EXEMPLARY RESULTS

Results presented below are provided by Chemistry Deputy of Jagiellonian University in Cracow. Visualisation of the measurement data are realized with FotoGUI software, which is a component of the whole experimental system.







Micro Fading Tester

to specify optimal illumination of art pieces

INSTYTUT FOTONOWY

Determination of color fading rate under irradiation.

DESCRIPTION

The Micro Fading Tester (MFT) examins behavior of dyes under irradiation. MFT tests allow to rank objects in collections by their sensitivity to light. Color change under illumination is tested in a non-destructive way. This approach allows to adopt exhibition policies to actual data obtained for each tested object rather than use general assumptions which could be either too conservative and unnecessarily limit viewers access to the object or too optimistic and lead to irreversible light-induced damages.

The scientific grade instrument is equipped with up to 6 ultra precise LEDs on a motorized holder. One can perform light aging of samples with UV, Vis or NIR LED source and assess the color change with a white LED.

The micro fading tests can be performed for nearly all classes of materials found in museum collections and is particularly suited to study fugitive objects (works on paper: manuscripts, prints, watercolors, canvas paintings, textiles). The MFT instrument may be regarded as portable and so it can be moved within the museum to the objects' location, which is particularly important in the case of large artefacts (e.g. wall paintings, sculptures, maps) or objects of significant value.

Quantities measured by the instrument

- Total color change (ΔE) of the selected point in function of time and radiometric/photometric dose,
- Reflectance of the sample,
- Spectrum in VIS range,
- Colorimetric values.

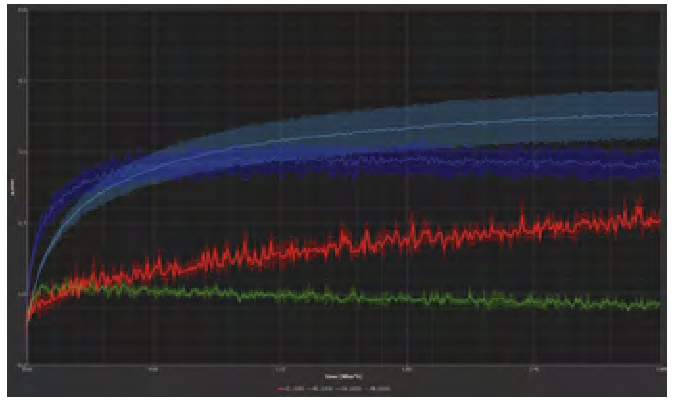
SPECIFICATIONS

- Spot diameter: 0.5 mm,
- Spectral range: 400-750 nm,
- Spectral resolution: 2.50 nm,
- Vertical motion range: -80 to 200 mm,
- Light source: up to 6 motorized LEDs,
- Focus point search: automatic,
- Maximum light intensity at focus: about 4 mW (depends on selected LED),
- PC connectivity: USB 2.0,
- Size: 250 x 400 x 440 mm (w x l x h),
- Size when folded: 440 x 400 x 80 mm (w x l x h),
- Mass: 5 kg,
- Tripod mounting brackets enables portable measurements,
- Full controll of the light output intensity,
- Automatic test ending when specified criteria is met (time, dose, color change),
- Automatic radiometric and photometric calibration of the light source with the light calibrator,
- Automatic generation of reports,
- Results averaging feature.

0.5 mm spot diameter

EXEMPLARY RESULTS

Aging results for oil paints with: Prussian Blue (PB), Strontium Yellow (SY), Carmine--based Lake (CL), Red Lead (RL) pigments. Results were performed and shared by dr Tomasz Łojewski (AGH University of Science and Technology).



Single-Point Kelvin Probe

to investigate work function

INSTYTUT FOTONOWY

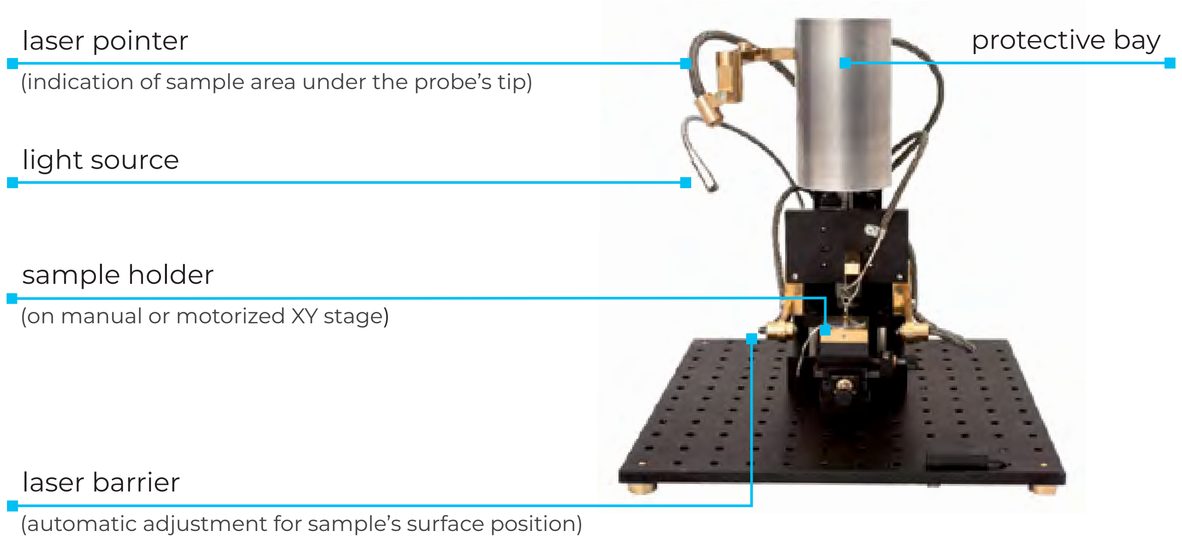
High precision work function measurements of semiconducting and conducting materials.

DESCRIPTION

The Kelvin probe system allows precise measurement of the work function of different semiconducting and conducting materials with high precision and accuracy.

The non-contact measurement involves oscillating capacitor, one electrode of which is a specimen, the other is oscillating reference electrode made of a gold grid. Thus, the measured value is referenced to the workfunction of gold (5.1 eV). Resolution of the measurement can reach 0.1 meV with sufficiently long integration time. The Kelvin probe system can be used in various types of surface studies, including: corrosion, photocorrosion of semiconducors, adsorption/desorption, surface charging, catalytic activity - also in real time. The whole system enables investigation of both organic and inorganic semiconductors, solar cells and any photoactive materials and devices The whole system is accommodated in grounded Faraday cage for reduction of electrical noise and the influence of stray light.

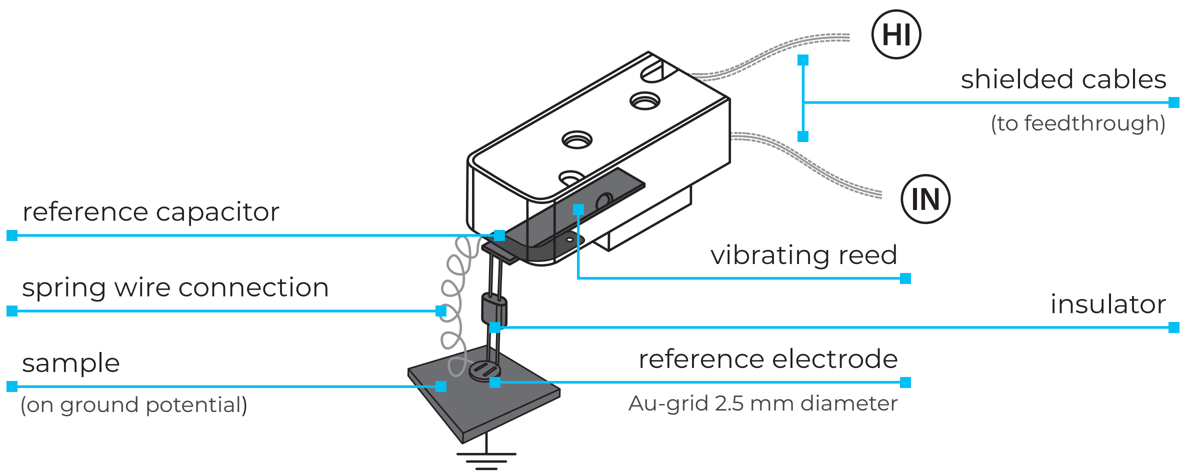
KELVIN PROBE MODULES



Probe tip

The probe tip is the component fully designed and manufactured by Instytut Fotonowy. It provides large signal, even from a distance of 0.5 mm above the sample. Thus, it does not matter if examined sample surface is rough or polished.

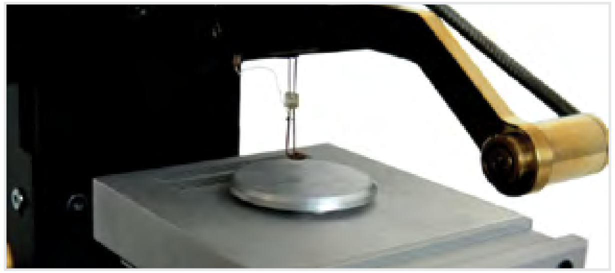
The tip oscillations are generated with an electromagnet.

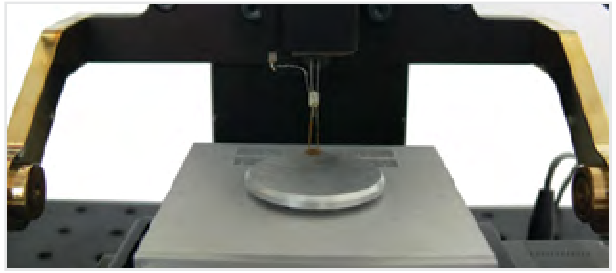


Single-Point Kelvin Probe

to investigate work function

High precision work function measurements of semiconducting and conducting materials.





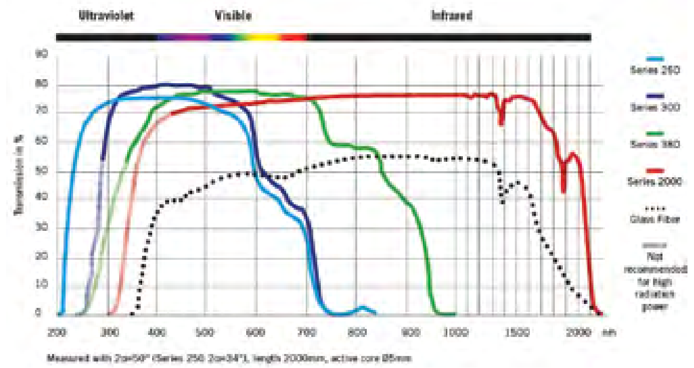
Faraday's cage

The entire probe is covered with a Faraday cage, shielding it from the environment.

SPECIFICATIONS

Voltage range	from -5 V to 5 V
Voltage measurement nominal resolution	0.15 mV
Measurement technology	2-channel lock-in amplifier
Sample holder	translation stage X-Y, manual (default) or motorized
X-Y stage stroke	15 mm x 15 mm
Tip type	Au mesh, dia. 2.5 mm
Tip Z positioning	motorized Z stage
Positioning with respect to a sample	light barrier
Tip Z positioning resolution	10 µm
Spectral range for wave guides	200 nm .. 2000 nm (depending on a waveguide)
Liquid waveguides selection (Lumatec)	
Auxiliary sensors	humidity and temperature
Internal Faraday cage illumination	white LED
X-Y positioning aid	laser sample placement indicator
PC connectivity	USB 2.0
Size	40 x 40 x 45 cm
Weight	10 kg

SPECTRAL CHARACTERISTICS

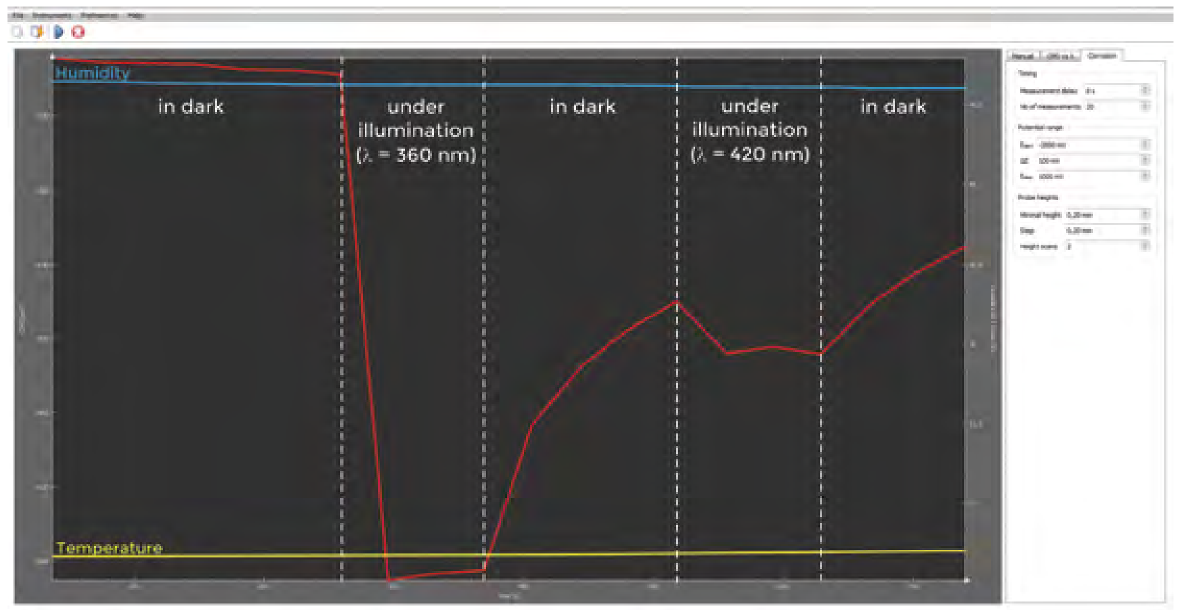


EXEMPLARY RESULTS

The following result comes from prof. Radecka group (AGH, Cracow, Poland).

The surface photovoltage spectrum of an antase sample. Photovoltage is measured as a variation of the surface potential on pulsed illumination vs. gold grid reference electrode.

Since measurements are performed in ambient air, the instrument records the air humidity and temperature. Those two parameters may affect the work function of a sample.



Scanning Kelvin Probe

to investigate electrical surface states of the sample

INSTYTUT FOTONOWY

Dedicated to measure electron work function and charge distribution over the sample surface.

DESCRIPTION

Scanning Kelvin Probe allows measurements of work function of different semiconducting and conducting materials not only in single point but over the entire sample surface. It can also determine charge distribution on a sample surface - including dielectrics! Kelvin Probe equipped with light source enables to examine surface states of electrons of the sample. Surface states of electrons play a significant role in electric charge transfer, which is especially important for photovoltaic materials and in photoelectrochemistry.

Possibility of scanning the sample surface and to examine its electrical properties enables precise assessment of the quality of the material, its homogeneity and enables gathering the series of data that may be used to evaluate work function more precisely.

SPECIFICATIONS

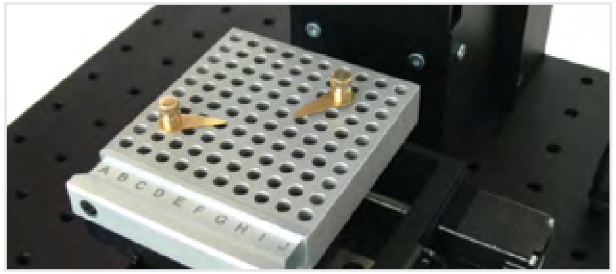
- The sample is located on XY table on one of two provided stands. Motorized table enables to move the sample in range of 5 cm in both, X and Y, directions.
- Each time the probe approaches the sample being examined, an accurate distance between the sample surface and probe is measured with 50 µm precision.
- Independence of the vertical axis precision in determination of work function.
- The probe is equipped with a laser pointer that illuminates a spot the probe will hoover above during measuremnt.
- The optical fiber above the probe allows to illuminate the sample with light from a monochromator or from a LED revolver.
- During sample handling, the probe is hidden under metal cover which prevents the probe from being accidentally damaged.

Sample holders

The Kelvin Probe set includes two types of sample stands:

- Sample with bottom contact

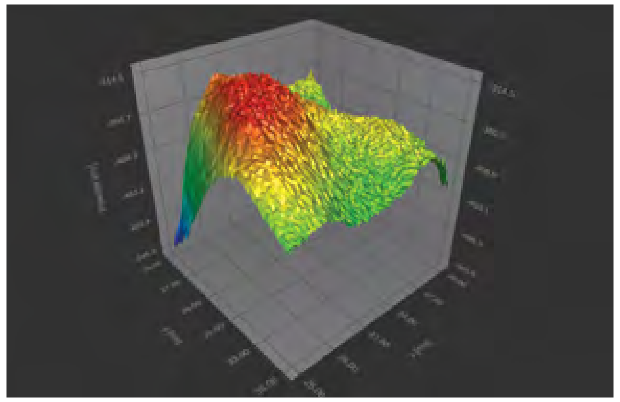
- Freely shaped solid state sample with top contact



EXEMPLARY RESULTS

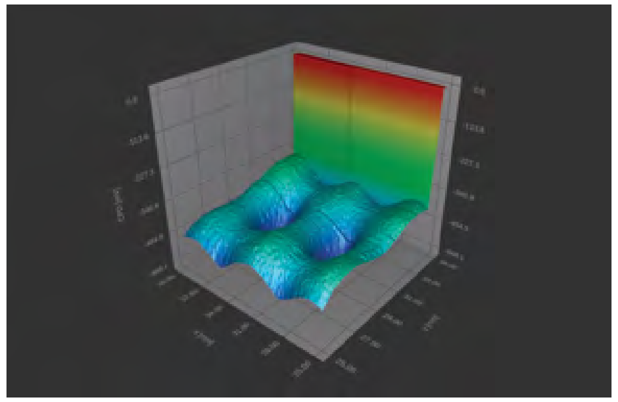
Aluminium surface

Distribution of the electric potential on the sample surface:



Metal surface sample with periodic holes

Evaluated CPD values on surface:



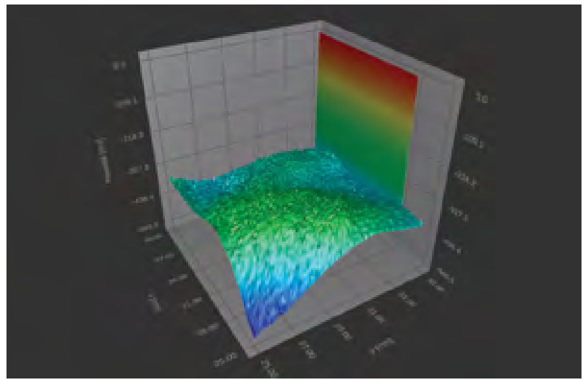
Scanning Kelvin Probe

to investigate electrical surface states of the sample

Dedicated to measure electron work function and charge distribution over the sample surface.

Preview during ongoing measurement

Distribution of the electric potential on the sample surface:

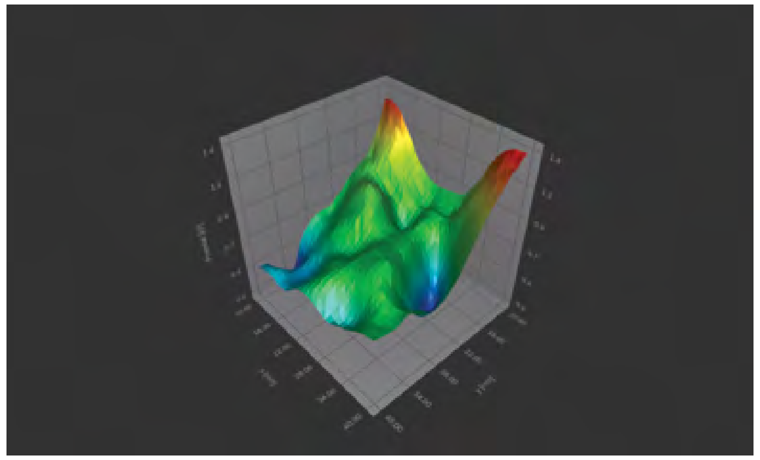


ELECTROSTATIC VOLTMETER

The measurement method applied and the desgin of the instrument makes the instrument unique and peerless in testing charged dielectric surfaces. The system enables to specify the electrostatic charge (up to several kV) distribution on the sample surface.

EXEMPLARY RESULTS

PTFE on alluminium foil - Electric potential from the surface charge of the sample.



Light Calibrator
for photoradiometry calibration

The light calibrator serves as photometer and radiometer in UV, VIS and IR range.

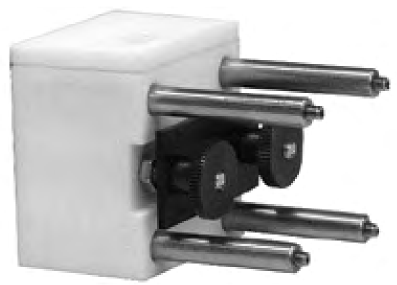
DESCRIPTION

The light calibrator functions as a photo-radiometer. It measures light intensity reaching a detector of 10 mm x 10 mm area expressed in W/cm^2. It also works as photometer measuring light intensity per 1 cm^2 as perceived by human eye and expressed in luxes (lx). Notably, the instrument can accurately measure both monochromatic and white light.
Light calibrator is a device with a wide range of applications in measurement systems where incident light parameters must be specified.

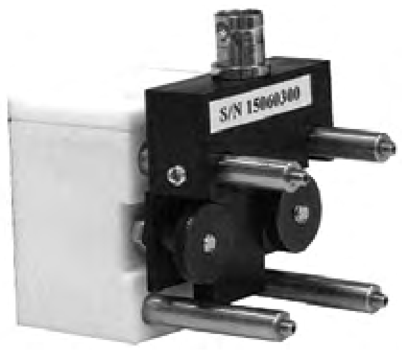
Calibrator head for 30 mm cage system

The head is equipped with NIST traceable calibrated photodiode with an active area of 1 cm^2, that measures light power passing through the output window of the universal electrochemical cell.

The cell without the calibrator head



The cell with the calibrator head



PARAMETERS

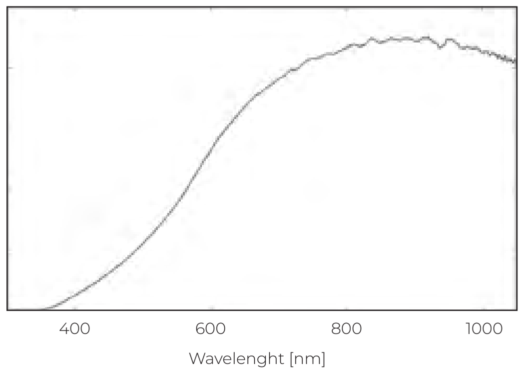
Basic parameters of the calibrator:

- Number of channels: 1,
- Spectral range: 200 – 1100 nm,
- Sensor size: 10 mm x 10 mm,
- Broadband measurements: white LED, Xenon light, sun light,
- Number of current ranges: 5,
- Maximum current: 20 mA,
- Power supply: USB socket,
- PC connection: serial (USB).

Halogen Illuminator
high intensity of illumination

SPECIFICATIONS

- Power output: 150 W,
- Digital control of light's power,
- Reflector type- elliptic or parabolic,
- Air cooling,
- Power supply: 230 V.



Halogen spectrum

LED Revolver

changeable light source for sample illumination

INSTYTUT FOTONOWY

Multiple LEDs light source for laboratory and scientific uses.

DESCRIPTION

LED revolver is a light source with 10 high power LEDs placed on a revolving disc. Only one of the LEDs can be turned on at the time. LED selection, light intensity, duration and other parameters are driven from a PC software. The device has a cage (Thorlabs or TECHSPEC from Edmund Optics compatible) type of sample holder with a manually adjustable lens that is used to focus light on a sample or on a waveguide.

The LED revolver can be used wherever a strong LED light is needed. LEDs may be custom selected. The LED revolver can be freely oriented depending on the application, can also be mounted on an optical stand.

SPECIFICATIONS

- Spectral range of available LEDs: 280 nm - 1000 nm,
- Focal length: 25 mm,
- Number of LEDs per disc: 10,
- Disc rotation: automatized,
- Light beam focus: manual,
- Works potentiostats, Kelvin probes, IPCE calibrator, and more,
- Light intensity adjustment: from PC,
- LED positioning on optical axis: automatized,
- Light on/off duration: from PC (automatic turn off time may be set),
- PC connectivity: USB 2.0,
- Power supply: 230 V, 50 Hz or 115 V, 60 Hz,
- Dimensions: 121 x 112 x 132 mm (l x w x h),
- Ramp feature: smooth light intensity increase/decrease after turning on/off, transition time set in [s],
- Light intensity modulation: adjustable frequency[Hz] or period [s], with a given amplitude 'Amp [%]' and 'Bias [%]'.

LED selection list

Nr	Mean wavelenght [nm]	Width [nm]	Max. current [nA]	Max. light power [mW]
1	340-350	10.0	500	75.50
2	360-370	9.7	500	76.50
3	385-395	12.6	500	76.80
4	400-410	13.0	700	100.09
5	420-430	19.0	700	64.00
6	450-460	18.0	700	92.00
7	520-530	28.5	700	33.50
8	590-600	14.7	700	29.50
9	630-640	15.3	700	44.50
10	730-740	18.7	700	46.40
11	850-860	16.6	700	44.60
12	white (420-700)	280.0	700	60.00

Xenon Lamp 150 W

unique intensity stabilization

INSTYTUT FOTONOWY

High performance stability, wide range of applications in research.

DESCRIPTION

The Xenon lamp is an extensively used light source in areas of research. Often used with an elliptic reflector which shapes a white light beam into a beam a with single focal point from the lamp output window or with parabolic reflector.The lamp can be used with various filters. With an Air Mass filter it can serve as a solar simulator. Due to reflector engulfing the lamp, up to 70% of emitted radiation is captured by the reflector and directed to the illuminated point.

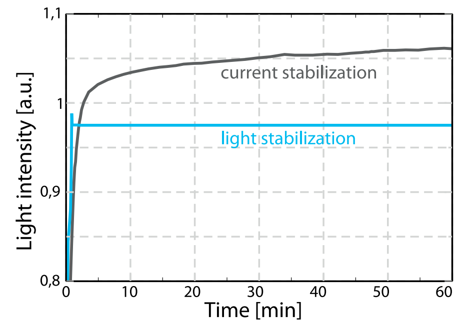
The unit also provides three types of stabilization: electric current, electric power and light intensity stabilization. The light intensity stabilization mode helps the long term (order of hours) stability of the output beam. It also reduces the warm up time to about 3 minutes as compared with 30 minutes or longer with current stabilization.

SPECIFICATIONS

- Nominal electric power: 150 W,
- Output beam: horizontal or vertical,
- Reflector type: elliptical (for convergent beam)/ parabolic (for collimated beam),
- Reflecting system efficie-ncy: up to 70 %,
- Maximal electric current: 8.5 A,
- Nominal working current: 7.5 A,
- Current resolution: 0.1 A,
- Stabilization of current: 0.1 %,
- Stabilization of light intensity,
- Warm up time: less than 180 sec (in light stabilization mode),
- Current/photodiode monitor output: BNC,
- Low electromagnetic emissivity of lamp starter,
- Quiet water cooling system.

PERFORMANCE

The plot shows the difference in light intensity evolution in two available stabilization modes (current and light). Despite the current stabilization, the light intensity changes significantly over time (black line) due to temperature and pressure changes within the xenon bulb. The light intensity stabilization eliminates the long-term drift in the light output and makes it stable just 3 minutes after the lamp is switched on.



Xenon Lamp Pulser

for xenon lamp

Adds strong pulses to the continuous light.

DESCRIPTION

The device is designed to add pulses to the continuous white light from xenon lamp (typically 150 W). It enables adjustments of the flash energy. The pulse triggering may be controlled via internal electronics or via external trigger input (e.g. from oscilloscope).

SPECIFICATIONS

- Pulse duration: 2 μs – 2 ms
- Peak pulse current: 8.5 – 595 A

Monochromator

adjustable, monochromatic light

INSTYTUT FOTONOWY

For wide range of research applications where monochromatic, adjustable light is required (photovoltaics, photochemistry, etc).

DESCRIPTION

A monochromator is an optical device that transmits only a narrow, selectable band chosen from a wider range of wavelengths available at the input. Our monochromators use a Czerny-Turner configuration with two aluminum coated mirrors.
The spectral range and resolution are determined by diffraction grating. The more grooves per millimeter the narrower spectral range and better resolution. Monochromators is equipped with 4 gratings placed on motorized turret.

The entrance and exit slit are manually adjusted. Their number and placement can be customized.
The wavelength and position of an internal shutter can be set from a PC software.

SPECIFICATIONS

- Spectral range: 200 nm – 24 μm (grating dependent!),
- Focal length: 200 mm,
- Aperture ratio: f/4,
- Number and configuration of slits: customizable,
- Slit adjustment: motorized,
- Maximum slit width: 5 mm,
- Maximum number of gratings: 4,
- Grating selection mechanism: motorized,
- Dispersion: 4 nm/mm for 1200 gr/mm grating,
- Wavelength setup: digital,
- Internal shutter setup: digital,
- External connectivity: serial port RS485,
- Power supply: 230 V / 50 Hz or 120 V / 60 Hz,
- Size: 260 x 273 x 120 mm (l. x w. x h.),
- Weight: about 8 kg.

Diffraction gratings:

Spectral range	Resolution	Blaze wavelength	gr / mm
200-1200 nm	0.1 nm	250 nm	1200
200-1200 nm	0.1 nm	300 nm	1200
200-1200 nm	0.1 nm	500 nm	1200
200-1200 nm	0.1 nm	750 nm	1200
200-1200 nm	0.1 nm	1200 nm	1200
200-2400 nm	0.2 nm	250 nm	600
200-2400 nm	0.2 nm	300 nm	600
200-2400 nm	0.2 nm	500 nm	600
200-2400 nm	0.2 nm	750 nm	600
200-2400 nm	0.2 nm	1200 nm	600
200-2400 nm	0.2 nm	1600 nm	600

Motorized Multi-Axis Vacuum Table

precise sample positioning

Precise sample movement, wide range of application in research.

DESCRIPTION

Multi-axis sliding table is a compact solution which may be used in wide range of research where the precision of sample placement is especially crucial.

Table is equipped with vacuum system of placing the sample which provides an extraordinary stability of the sample position.

It is possible to make a special hole in the table surface where an additional sensor may be placed (e.g transmission measurement). An additional metallic coating may be deposited on the table surface in to provide an appropriate electrical connection with the sample.

SPECIFICATIONS

- Motorized regulation in two axis (X,Y),
- Manual movement in X, Y axis,
- Manual regulation of table height (Z axis),
- Adjustable vacuum system of sample placement on table surface,
- Additional metallic coating available: golden/chromium,
- Contact electrodes manually placed on any point of the sample,
- Movement range for X, Y axis: 20 x 20 cm,
- Movement precision: 0.01 mm,
- Movement range for Z axis: 12 mm,
- Work surface of table (max sample dimensions): 20 x 20 cm.

Spectrometer CCD

for visible light

INSTYTUT FOTONOWY

Universal, portable, compact appliance for visible light measurements.

DESCRIPTION

CCD Spectrometer is a universal, compact, portable instrument dedicated to measure visible light in 340 – 800 nm range. It may be used in a wide range of research as an independent instrument or as a component of the more complex measurement system. The device is equipped with factory calibration of the measured wavelengths range and may be applied as photometer or radiometer.

SPECIFICATIONS

- Detector type: CCD array,
- Number of pixels: 3600,
- Wavelength range : 340 – 800 nm,
- Input slit: 20 – 200 μm,
- Wavelength resolution: 1 – 3 nm (depending on the input slit),
- Light beam input type: slit + optical fiber with SMA connector,
- Optical fiber: silicone / glass,
- Standard optical fiber length: 80 cm (custom length available),
- Integration time: 1 ms – 1s,
- Maximum number of averages: 100,
- Dimensions: 100 mm x 40 mm x 67 mm,
- Weight: 300 g,
- Power supply & communication: USB C 1.1 / USB A 1.1 5V, 500 mA.

Adaptive Dynamic Range (ADR)

Extended version of the instrument is equipped with algorithm of auto – adjust of time integration and advanced processing of obtained signals. Designed algorithm enables simultaneous detection of intensive and very weak signals in examined spectrum.

Potentiostat

P-IF 4.0

INSTYTUT FOTONOWY

Device that measures characteristics of the chrono-volt-amperometric signal in electrochemical systems.

DESCRIPTION

Potentiostat 4.0 allows to measure current at a set voltage or Open Circuit Potential (OCP) of the electrochemical systems. It is used in both two and three-electrode setups. The instrument is fully software driven.

It employs the following measurement techniques:

- Current-voltage (IV) characteristics,
- Cyclic voltammetry (CV),
- Chronoamperometry (CA),
- Open circuit potential (OCP).

The potential control range is ±5V and the current ranges are from 10 nA to 10 mA. The instrument is capable of measuring current down to 1 pA.

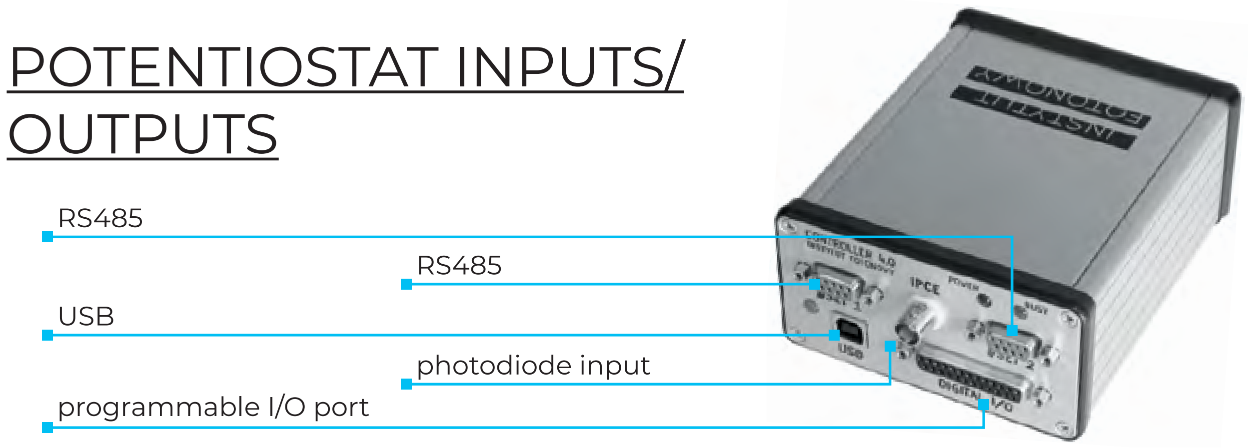
SPECIFICATIONS

- Current ranges: 10 nA, 100 nA, 1 µA, 10 µA, 100 µA, 1 mA, 10 mA,
- Probe frequency: 1 kHz,
- Current resolution from 1 pA to 100 nA (range dependent),
- Potential range from -5V to 5V.

The potentiostat can use three electrode measuring method:

- Working Electrode (WE) - red,
- Reference Electrode (RE) - black,
- Counter (auxiliary) Electrode (CE) - blue.

POTENTIOSTAT INPUTS/ OUTPUTS



Picosecond Laser

laser diode for short pulses

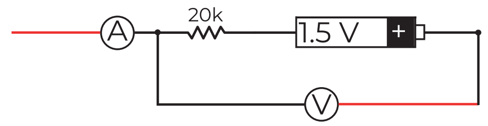
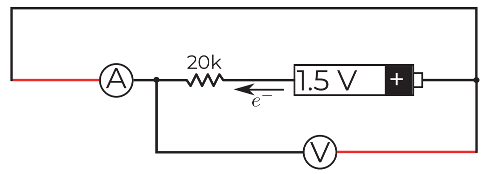
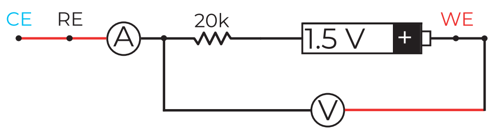
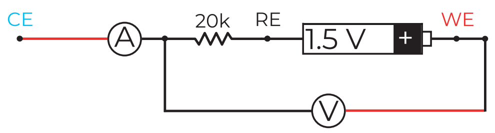
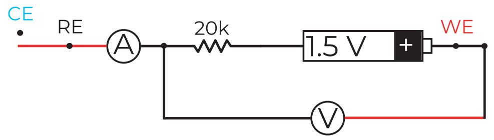
SPECIFICATIONS

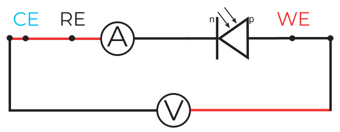
The pulse laser diode for short pulses can use any laser diode with capacitance bellow 3 nF. In the following, parameters for 405 nm laser diode are listed.

- wavelength: 405 nm,
- temporal pulse span: 150-200 ps,
- pulse frequency: up to 1 MHz,
- power in a pulse: 60 mW for free beam, 48 mW for 100 µm fiber,
- trigger type: TTL up to 1 MHz,
- output:
  - free space output,
  - SMA fiber coupling.

INSTYTUT FOTONOWY

HOW DOES THE POTENTIOSTAT WORK?

		Experiment setup	Potential	Current	V	A
No potentiostat	a)		--	--	1.5 V	0 uA
	b)		--	--	0 V	75 uA
CHRONO-AMPEROMETRY	c)		0 V	-75 uA	0 V	75 uA
			1 V	-25 uA	1 V	25 uA
			-1 V	-125 uA	-1 V	125 uA
	d)		0 V	-336 uA	-5.1 V	336 uA
OCP	e)		1.5 V	0 uA	1.5 V	0 uA

	Experiment setup	OCP	Current	V	A
Photodiode		340 mV	-60 uA @ E=0	340 mV	60 uA

In the experimetal setups above there are external voltmeter and ammeter, V and A. Positive terminals are denoted by red lines. Can you predict readings of current from the potentiostat for set bias potentials? If you can, you know how the potentiostat works. If you also can explain weird readings from experimental setup (d) you are an expert.