Institute of Metallurgy and Materials Science

Polish Academy of Sciences

Accredited Laboratories Group

Based on the Institute's 50 years of experience, the main investigated areas of research are metallurgy and materials science.

In 1997, the Materials Testing Laboratories at the Institute of Metallurgy and Materials Science of the Polish Academy of Sciences (IMMS PAS) were granted the accreditation certificate No. AB 120 issued by the Polish Centre for Testing and Certification – Polish Centre for Accreditation (PCA).

In 2006, the Institute signed a sub-licence agreement with the PCA for the use of the ILAC-MRA mark.

Within the accreditation testing, IMMS PAS has also the possibility to introduce and modify our testing methods, use updated standardized methods, change the measurement range of a testing method and add a tested feature within the method.

IMMS PAS engages all research potential and many years of experience in the assessment of mechanical and plastic properties of materials, analytical electron microscopy, X-ray diffraction, analysis of composition and structure, physicochemical properties of materials and optoelectric properties in order to continuously improve the quality of the performed research.


POLSKIE CENTRUM AKREDYTACJI
POLISH CENTRE FOR ACCREDITATION

CERTYFIKAT AKREDYTACJI
LABORATORIUM BADAWCZEGO
ACCREDITATION CERTIFICATE OF TESTING LABORATORY
Nr AB 120

INSTYTUT METALURGII I INŻYNIERII MATERIAŁOWEJ
im. ALEKSANDRA KRUPKOWSKIEGO
POLSKIEJ AKADEMII NAUK
ZESPÓŁ LABORATORIÓW BADAWCZYCH

The strategic goal in terms of the quality policy at IMMS PAS is to achieve a high level and reliability of the performed research, in accordance with the requirements of the PN-EN ISO/IEC 17025:2018-02 standard, PCA documents, in particular the DA-10 document, as well as the European Accreditation EA-4/16 documents. The results obtained in this way will enable proper control of production processes, modernization of technologies, and, consequently, increasing the competitiveness of our industrial partners.

The confirmation of the success of our actions is the full commitment to the continuation and improvement of the quality policy, especially through the systematic improvement of the personnel's qualifications, securing financial resources for the purchase of new equipment, carrying out periodic reviews, upgrades and repairs of equipment failures, participation in European networks and research projects.

Our mission is to:

MAINTAIN A HIGH PROFESSIONAL LEVEL OF THE TESTS GAINING CLIENT TRUST AND CONSTANT DEVELOPMENT OF THE TECHNICAL COMPETENCES OF THE LABORATORIES AT IMMS PAS.

L-1 STRENGTH TESTING LABORATORY

AB 120

Range of research :

Static tensile test (R_m; $R_{p0,2}$; R_{eL}; R_{eH}; A)

- tests carried out in accordance with own investigation procedure based on the PN-EN ISO 6892-1, PN-EN ISO 6892-2 and PN-EN ISO 6892-3 standards or according to
- customers demands
- temperature range: from -150 °C up to 1200 °C
  measurement heads: 0-0.1 kN, 0-10 kN, 0-1200 kN (the 1200 kN head – investigations beyond the accredited range of PCA)

Static compression test (R_c; R_{plc}; $R_{c0,2}$; a)

- tests carried out in accordance with own procedure based on the withdrawn PN-57/H-04320 standard or according to customers demands
- temperature range: from -150 °C up to 600 °C
- measurement heads: 0-0.1 kN, 0-10 kN, 0-1200 kN

Hardness test (HV; HBW; HRA; HRBW; HRC)

- tests carried out in accordance with own investigation procedure based on the PN-EN ISO 6506-1, PN-EN ISO 6507-1, PN-EN ISO 6508-1 standards or according to customers demands

Toughness test (KV_2; KU_2)

- tests carried out in accordance to own procedure based on the PN-EN ISO 148-1 (not instrumented test) and the PN-EN ISO 14556 (instrumented test) standards or according to customers demands
- temperature range: from -40 °C up to room temperature
- hammers: 300 J, 450 J

Tensile testing machine INSTRON 3382, load capacity 100 kN

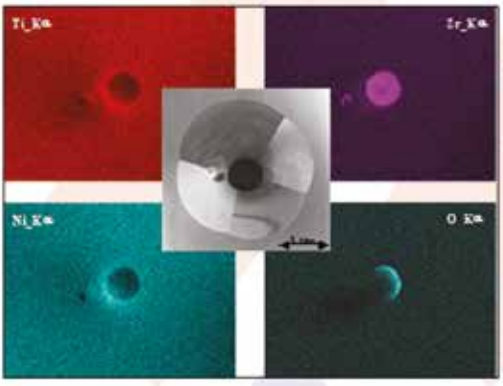
Tensile testing machine INSTRON 6025, improved by Zwick/Roell, load capacity 100 kN
1. macro-extensometer
2. high-temperature furnace
3. high-temperature extensometer

L-2 LABORATORY OF ANALYTICAL ELECTRON MICROSCOPY

AB 120

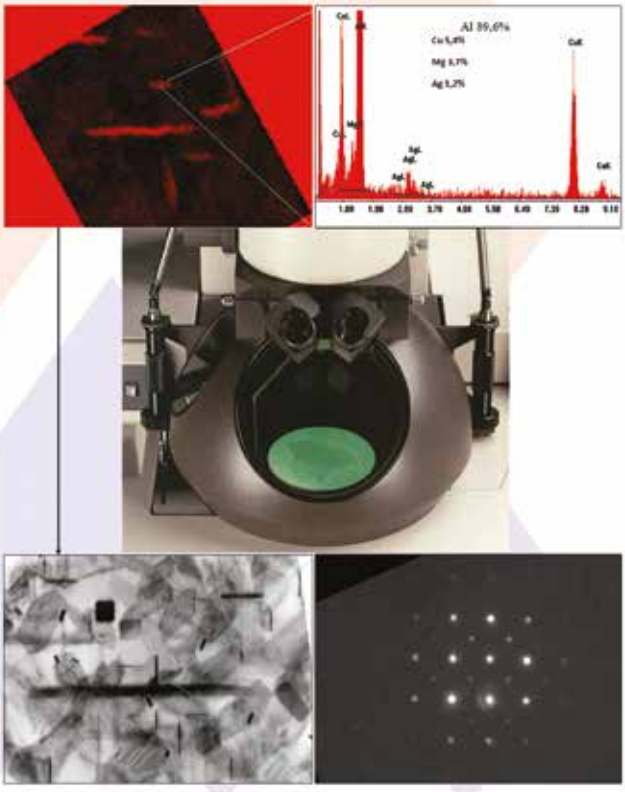
Research capabilities (covering metallic, ceramic and composite materials):

- microstructure observation in bright field (BF) and dark field (DF) including: distribution, size and shape of precipitates, antiphase boundaries;
- electron diffraction in parallel beam (SAEDP) aimed at identification of local phase composition, orientation, type of ordered antiphase domains;
- local chemical analysis (EDS), qualitative mode for Z>5 and quantitative mode for Z >10.



TEM BF microstructure and accompanying maps of local chemical composition

TEM BF microstructure and accompanying diffraction from AgCuSn



TEM BF microstructure and accompanying electron diffraction pattern from AlCuMgAg alloy

Research equipment:

- transmission electron microscope Tecnai G2 SuperTWIN F20 (200kV with field emission gun) with EDAX EDS attachment;
- FIB Dual Beam Quanta 200 3D.

L-3 LABORATORY OF X-RAY DIFFRACTION

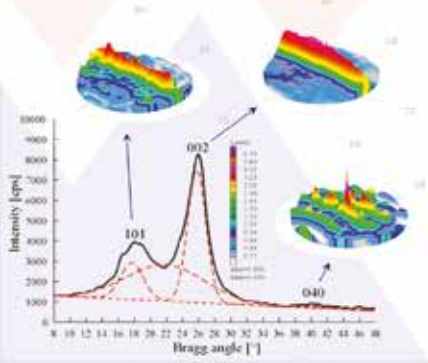
AB 120

Range of research:

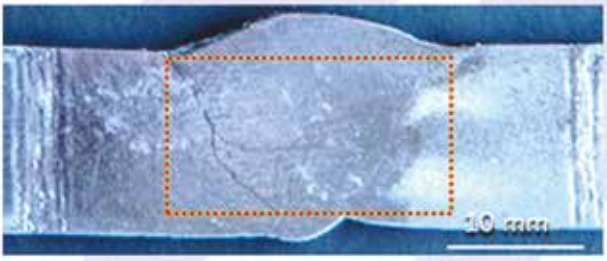
- XRD quantitative phase analysis of materials - relative weight fractions of phases, lattice parameters, crystallites size and strain, degree of crystallinity;
- XRD stress investigation in polycrystalline samples - non-destructive measurements of stress tensor in the near surface areas of materials, estimation of principal stresses magnitudes and directions, stress tensor mapping across selected zones in freely defined measurement grids;
- XRD texture analysis of polycrystalline samples - pole figures measurements and estimation of orientation distribution function (ODF) for all crystal symmetries.

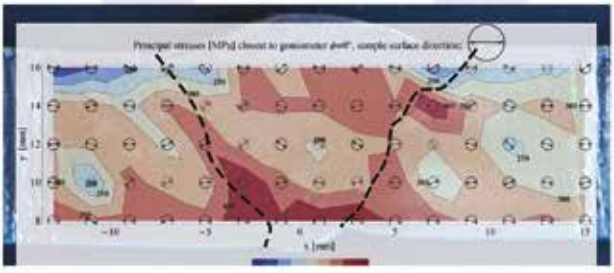
Research equipment:

- multifunction diffractometer Bruker D8 Discover;
  Eulerian cradle, X-Y-Z stages for sample positioning, polycapillary optics of primary X-ray beam, silicon strip 1D detector LynxEye, scintillation detector, traditional Bragg-Brentano and parallel beam configurations, proprietary control and analytical software;
- multifunction diffractometer Philips X'Pert;
  Eulerian cradle, Bragg-Brentano configuration, scintillation detectors, graphite monochromator, proprietary control and analytical software.

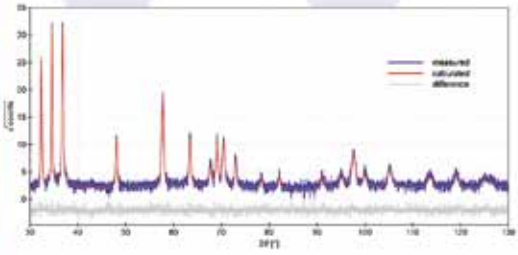


X-ray difraction spectrum of pine wood with complete pole figures





Topography of residual stresses (principal directions) on the cross-section of welded joint of the sheets made of ferritic-pearlitic steel P460NL1



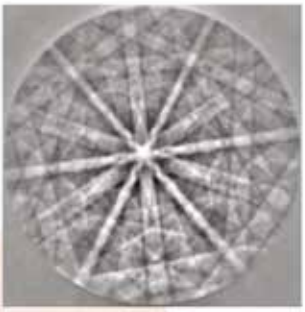
X-ray diffraction pattern of Mg-AZ31 alloy enables to identify the phases and their microstructural characteristics (size of crystallites, lattice deformation)

L-4 LABORATORY OF SCANNING ELECTRON MICROSCOPY

AB 120

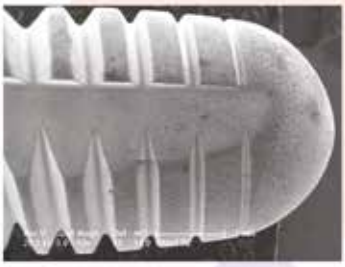
Range of research :

- surface morphology examination of the samples in the solid state with Scanning Electron Microscopy (observation of the morphology and size of the inclusions, analysis of defects such as cracks or the composition inhomogeneities etc.);
- analysis of the chemical composition in micro-regions with Energy Dispersive X-ray Spectroscopy (X-ray microanalysis EDXS): qualitative and quantitative chemical composition in micro-regions, the elements' concentration distribution obtained with the scanning electron beam along the line (linescan) or the surface (mapping).

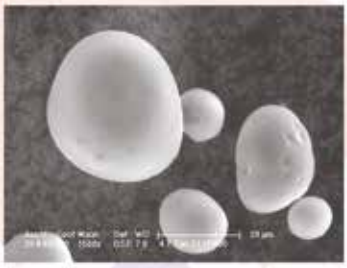


Electron backscatter diffraction acquired from Ni monocrystal

Microstructure of natural hydroxyapatite, E-SEM mode, GSE image, mag 100 000x



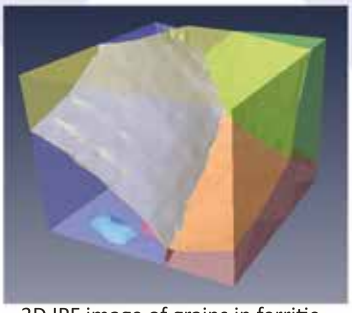
Surface of Ti screw used in implantology, SE image, mag 50x



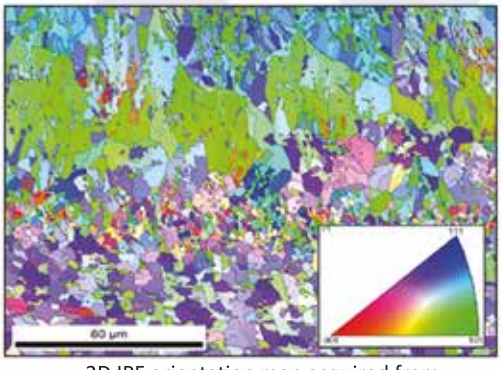
Starch grains, E-SEM mode, GSE image, mag 1500x

Furthermore:

- analysis of orientation topography of crystalline materials with complete phase identification,
- analysis of chemical composition with WDXS spectrometer,
- analysis of crystallographic orientation with application of EBSD technique,
- three-dimensional analysis of chemical composition and crystallographic orientation,
- in-situ investigations of phase transitions (using GATAN 950 °C Murano 525 heating stage).



3D IPF image of grains in ferritic Crofer 22 APU steel



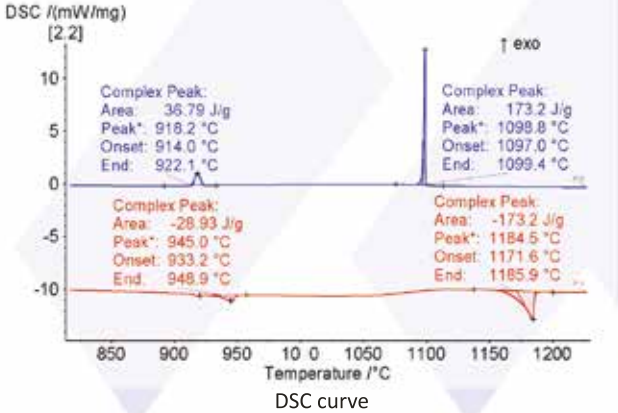
2D IPF orientation map acquired from bioceramics (shell of Neotrigonia)

L-5 LABORATORY OF CALORIMETRY

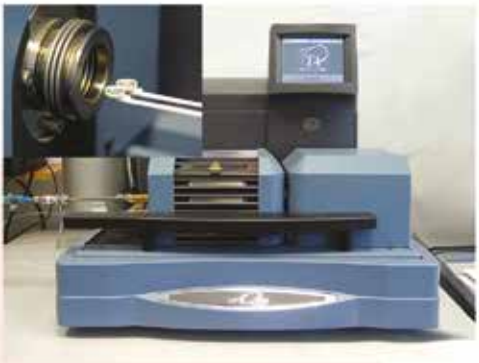
AB 120

Range of research:

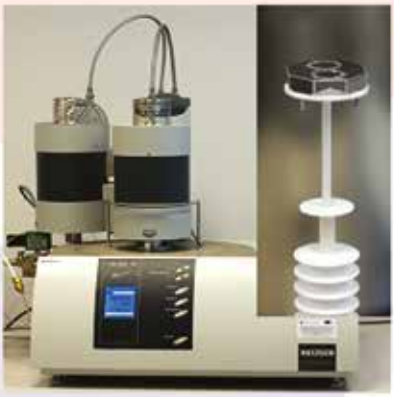
- temperature range and kinetics of decomposition, oxidation or other chemical reactions proceeding with mass changes, also combustion processes;
- thermal stability of materials: non-diffusion and diffusion phase transformations, e.g. martensitic, crystallization, glass transition, recrystallization, melting;
- phase diagrams determination;
- heat capacity of the material;
- enthalpy of mixing and formation;
- temperature range covers -175 to 1650 °C;
- changes of mechanical properties of materials under the constant or variable load versus programmed temperature: elasticity, thermal expansion, deformability, strength, softening, phase transitions;
- range of: temperature from -150 to 1550 °C, strength from -3N to 3N and frequency up to 1 Hz.



DSC curve



Thermo-Gravimetric Analyzer and Differential Scanning Calorimeter SDT (DSC+TGA) Q600 TA Instruments



Differential Scanning Calorimeter DSC 404 F1 Netzsch

Thermo-Mechanical Analyzer TMA 402 F1 Netzsch

Typical materials:

metal alloys, high-temperature phases, glasses, polymers, emulsions, soaps, ferroelectrics, explosives materials.

Laboratory carries out research for the research centers, manufacturing plants and other institutions engaged in a commercial activity.

Laboratory provides trainings and internships for students, academics and workers of industrial laboratories.

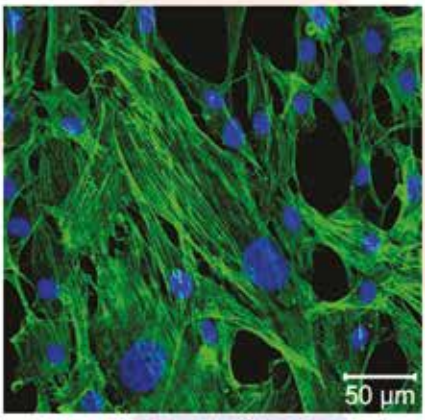
L-7 LABORATORY OF LASER AND ACOUSTIC SCANNING MICROSCOPY

AB 120

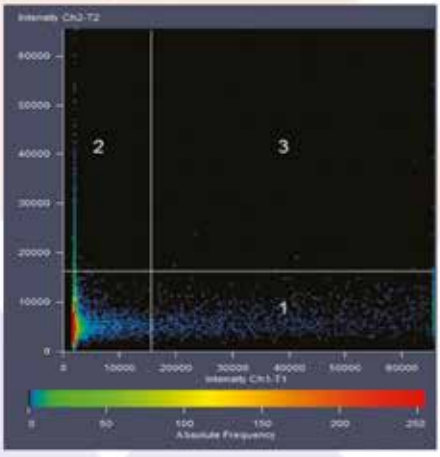
Range of research:

Confocal laser scanning microscopy LSM Exciter 5 with incubation chamber:

- measurement of the fluorescence intensity
- analysis of the cell morphology and cell number
- fluorescent analysis of the surface morphology
- 2D and 3D imaging of fluorescent objects
- fluorescence analysis of objects using six lengths of laser light excitation
- cellular processes *in situ* study using the incubation chamber and the heating stage
- data analysis using computational software AxioVision 4.8



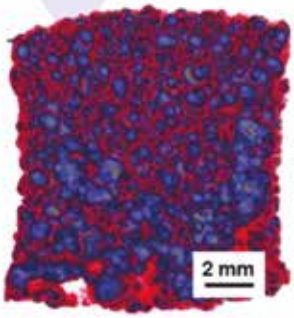
Analysis of the morphology of vascular endothelial cells on the investigated substrate; blue- nuclei (DAPI), green - actin cytoskeleton (phalloidin - AlexaFluor 488)



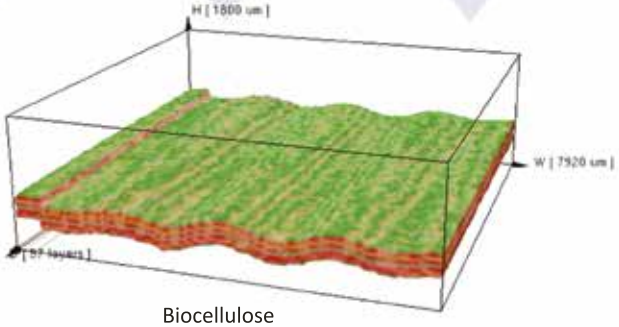
Analysis of biomaterial interaction with human blood. Location analysis of the fluorescence intensity of the fluorochrome-conjugated antibodies; anti-CD45 - immune response, anti-CD62P - blood platelet activation

Scanning Acoustic Microscope:

- material examination in real time
- surface defects and surface topography
- analysis using 4 ultrasound transducers (15MHz, 75MHz, 110 MHz 180 MHz)
- heterogeneity of the structure in the surface area (size 1 mm to several cm)
- delamination of coatings
- 2D and 3D imaging of structural changes with a range around 30 mm



Porous hydroxyapatite



Biocellulose

L-8 THE PHYSICOCHEMICAL TEST LABORATORY

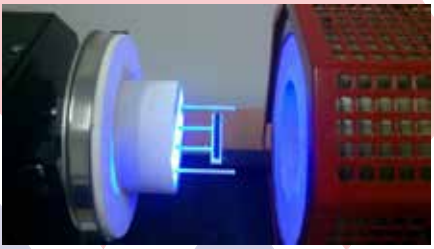
AB 120

The Laboratory specializes in dilatometric studies of solids and sintered materials, using for this purpose Misura® 3 FLEX-ODLT optical dilatometer, which allows for non-contact analysis, and also in hydrogen absorption and desorption measurements in solids using a Sievert apparatus (IMI HTP Hiden Isochema) connected to a mass spectrometer.

Dilatometric measurements

Range of research:

- Dilatometric analysis of the kinetics of phase transformations.
- Study of phase transformations occurring in the solid-state.
- Measurement of the change in length of the test sample under the influence of temperature change during the heating and cooling process.
- Observing changes in the geometry of samples during sintering.
- Performing non-contact bending measurements of materials.

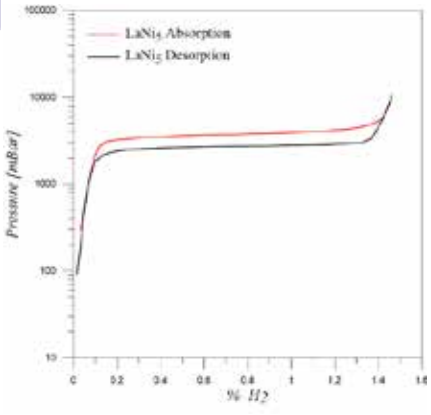


Optical dilatometer (Misura® 3 FLEX-ODLT 1600).

Hydrogen absorption and desorption measurements

Range of research:

- Performing hydrogen absorption and desorption isotherms in solid and powder samples.
- Performing tests of samples in the temperature range from -196°C to 500°C.
- Determination of the enthalpies of formation and decomposition of studied materials.
- Performing temperature-programmable desorption (TPD) runs.



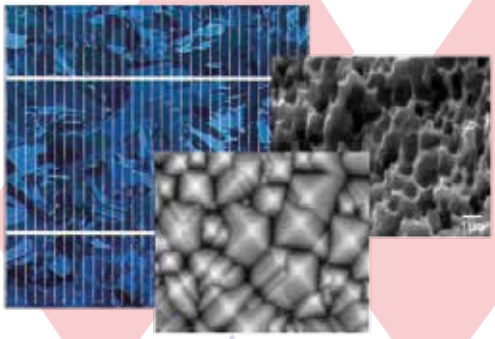
Sievert's apparatus (IMI HTP Hiden Isochema) connected to a mass spectrometer.

L-9 PHOTOVOLTAIC LABORATORY

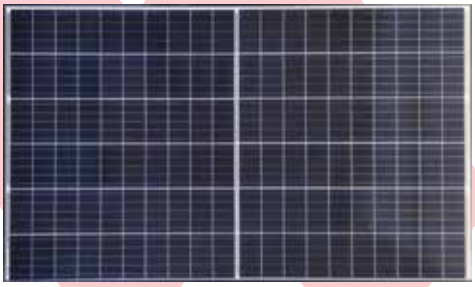
AB 120

Range of research:

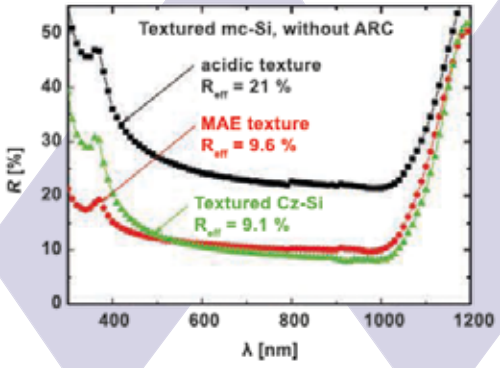
- measurement of reflection and transmission coefficients, light absorbance in the wavelength range from 250 to 2500 nm by using spectrophotometer - solid samples - (reflection and transmission coefficients, absorbance)
- measurements of I-V characteristics and electrical parameters of solar cells and photovoltaic modules based on mono- and multicrystalline silicon solar cells, in STC conditions (Standard Test Conditions: irradiance 1000 W/m^2, temperature 25°C, the spectrum of AM 1.5G).



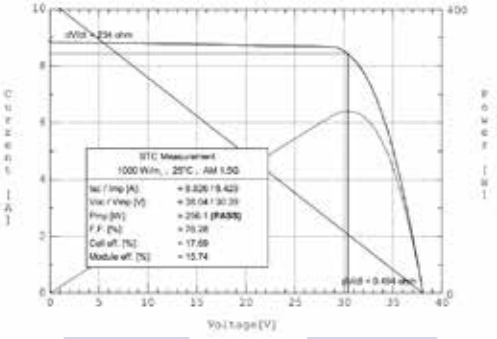
Various texture of silicon solar cells



Photovoltaic module



Reflectance from solar cells surface with different texture



I-V characteristic of photovoltaic module

Research equipment:

- Sunlight simulator for electrical parameters of photovoltaic modules measurement - Quick Sun 820A Endeas, AAA class;
- Sunlight simulator with I-V characteristic determination system for solar cells characterization - SS 200AAA, Photo Emission Tech Inc. AAA - class;
- UV-VIS-NIR Spectrofotometer with Integral sphere 150 mm, Lambda 950S, Perkin Elmer.

ACCREDITED LABORATORIES GROUP

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