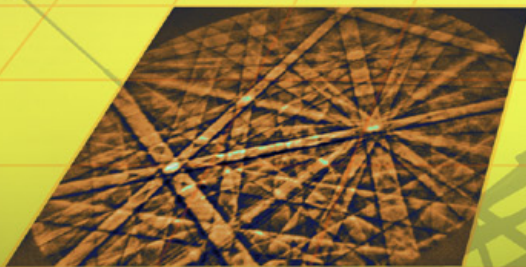


SOLUTIONS

FOR THE PHOTOVOLTAIC INDUSTRY



AMETEK[®]
ametekphotovoltaic.com

CAMECA . EDAX . HAMILTON PRECISION METALS . HCC INDUSTRIES
HDR POWER SYSTEMS . LAND INSTRUMENTS . PRECITECH
PRINCETON APPLIED RESEARCH . PROCESS INSTRUMENTS . PROGRAMMABLE POWER
SOLARTRON ANALYTICAL . SOLIDSTATE CONTROLS
SPECTRO ANALYTICAL INSTRUMENTS . TAYLOR HOBSON

Solutions for the Photovoltaic Industry

AMETEK manufactures a wide variety of products for the photovoltaic industry under many brand names. For R&D applications, Secondary Ion Mass Spectrometry (SIMS) from CAMECA are used for material science and thin film analysis. X-ray spectroscopy (EDS) instruments available from EDAX and Spectro are also used in materials analysis applications. Scanning White Light Interferometry (SWLI) instruments from Taylor Hobson are used for thin film metrology and surface topography.

For electrical property testing, potentiostats are available from our Princeton Applied Research business, while PV array and grid simulators are made by our Programmable Power business. AC and DC power supplies and inverters are available from HDR Power Systems and Solidstate Controls, while CIGS structural

■ PV Research & Development Solutions		■ PV Cell Fab and Thin Film Solutions	
AMETEK PV SOLUTION	AMETEK BUSINESS	AMETEK PV SOLUTION	AMETEK BUSINESS
Substrate and Structural Materials		Thermal Imaging and Infrared Thermometers	
Precision rolled and finished metal alloys and wires	www.hpmetals.com	Fixed spot Infrared thermometers for crystal growth reactors	www.ametek-land.com
Sealing materials and connectors for PV module assembly	www.hccindustries.com	Infrared linescanners for thermal imaging and temperature profiles of continuous processes for monitoring and quality control	www.ametek-land.com
Vacuum Quality and Residual Gas Analysis		Elemental Analysis and Chemical Characterization Instruments	
Quadrupole mass spectrometers for vacuum residual gas analysis and gas compositional analysis	www.ametekpi.com	Optical emission spectrometers with inductively coupled plasma (ICP) for thin layer purity analysis	www.spectro.com
Thermal Imaging for Crystal Growth Reactors		Spark spectrometers for monitoring the compositional contents of solders, wires and other metal components	www.spectro.com
Fixed spot Infrared thermometers for polysilicon refraction control	www.ametek-land.com	Handheld XRF instruments for non-destructive, at-line analyses of production PV panels that measure relevant elements such as gallium, selenium, indium, cadmium, tellurium, zinc or iron	www.spectro.com
Elemental Analysis and Chemical Characterization Instruments		Energy dispersive X-ray spectroscopy (EDXRF) for in-situ post processing QC of layer thickness	www.edax.com
X-ray spectroscopy (EDS, EDXRF, WDS, and μ -XRF) detectors for SEM and TEM systems	www.edax.com	X-ray spectroscopy (EDS, EDXRF, WDS, and μ -XRF) for the chemical characterization of PV materials	www.edax.com
Optical emission spectroscopy with inductively coupled plasma for thin layer purity analysis	www.spectro.com	XRF spectrometers for determining elemental metal (Na to U) content of CIS, CIGS or CdTe layers samples	www.spectro.com
Spark spectrometers for monitoring the compositional contents of solders, wires and other metal components	www.spectro.com	Dopant Depth Profiling and Thin Layer Analysis of PV Cells	
XRF spectrometers for determining elemental metal (Na to U) content of CIS, CIGS or CdTe layers samples	www.spectro.com	Secondary Ion Mass Spectrometers (SIMS) for element detection, metal contamination, dopant and impurity detection	www.cameca.com
Dopant Depth Profiling and Thin Layer Analysis of PV Cells		Morphology	
Secondary Ion Mass Spectrometers (SIMS) for element detection, metal contamination, dopant and impurity detection	www.cameca.com	Orientation imaging microscopy using electron backscattered diffraction (EBSD)	www.edax.com
Morphology		Dimensional Analysis of 1st Gen, 2nd Gen and Next Gen PV Cells	
Orientation imaging microscopy using electron backscattered diffraction (EBSD)	www.edax.com	Surface Topography and Thin Film Metrology by Scanning White Light Interferometry (SWLI)	www.taylor-hobson.com
Dimensional Analysis of 1st Gen, 2nd Gen and Next Gen PV Cells		Electrical Performance Characterization of PV Cells	
Surface Topography and Thin Film Metrology by Scanning White Light Interferometry (SWLI)	www.taylor-hobson.com	Potentiostats for I-V characterization (Power, Rs, Rsh, FF, efficiency, Voc, Vsc, Ioc, Isc)	www.solartronanalytical.com www.princetonappliedresearch.com
Electrical Performance Characterization of PV Cells		Potentiostats for C-V characterization (Mott-Schottky, Nc, Ndrive level)	www.solartronanalytical.com www.princetonappliedresearch.com
Potentiostats for I-V characterization (Power, Rs, Rsh, FF, efficiency, Voc, Vsc, Ioc, Isc)	www.solartronanalytical.com www.princetonappliedresearch.com	Wide bandwidth impedance/admittance spectroscopy for electrical performance characterization	www.solartronanalytical.com www.princetonappliedresearch.com
Potentiostats for C-V characterization (Mott-Schottky, Nc, Ndrive level)	www.solartronanalytical.com www.princetonappliedresearch.com	AC impedance spectroscopy for electrical performance characterization	www.solartronanalytical.com www.princetonappliedresearch.com
Wide bandwidth impedance/admittance spectroscopy for electrical performance characterization	www.solartronanalytical.com www.princetonappliedresearch.com	AC and DC Power Supply and Control Systems for Reactors and Furnaces	
AC impedance spectroscopy for electrical performance characterization	www.solartronanalytical.com www.princetonappliedresearch.com	Power supplies and power control systems for silicon refining, directional solidification system (DSS) furnaces, and other crystal melt chambers	www.hdrpower.com
AC and DC Power Supply and Control Systems for Reactors and Furnaces		Power supplies and power control systems for chemical vapor deposition (CVD) reactors	www.hdrpower.com
Power supplies and power control systems for directional solidification system (DSS) furnaces and other crystal melt chambers	www.hdrpower.com	Bulk Gas Purity Monitoring	
Power supplies and power control systems for chemical vapor deposition (CVD) reactors	www.hdrpower.com	UHP gas chromatographs for the analysis of H ₂ , CO, CO ₂ , and hydrocarbons in ultra high purity gases	www.ametekpi.com
AC and DC Power Supply and Control Systems for Reactors and Furnaces		UHP moisture analyzers for ultra high purity gases	www.ametekpi.com
Power supplies and power control systems for directional solidification system (DSS) furnaces and other crystal melt chambers	www.hdrpower.com	AC and DC Power Supply and Control Systems for Reactors and Furnaces	
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materials and hermetic and specialty seals and connectors are made by our HCC Industries businesses. Our Process Instruments business supplies residual gas analyzers, gas chromatographs and moisture analyzers.

Our LAND Instruments business makes infrared thermometers and scanners for polysilicon refraction control and crystal growth reactors, and Princeton Applied Research supplies potentiostats for electrical performance characterization of PV cells.

With so much to offer the PV industry, AMETEK is well positioned to serve your needs, from R&D and material testing to production and installation. Visit www.ametekphotovoltaic.com to learn more about how AMETEK can provide solutions for your PV applications.

PV Material Solutions	
AMETEK PV SOLUTION	AMETEK BUSINESS
Substrate and Structural Materials	
Precision rolled and finished metal alloys and wires	www.ametekmetals.com
Sealing materials and connectors for PV module assemblies	www.hccindustries.com
Elemental Analysis and Chemical Characterization	
Spark spectrometers for monitoring the compositional contents of solders, wires and other metal components	www.spectro.com
Handheld XRF instruments for non-destructive analysis of solar glass, material purity, and PV panels that measure relevant elements such as gallium, selenium, indium, cadmium, tellurium, zinc or iron	www.spectro.com
X-ray spectroscopy (EDS, EDXRF, WDS, and μ -XRF) for the chemical characterization of PV materials	www.edax.com
Bulk Gas Purity Monitoring	
UHP gas chromatographs for the analysis of H ₂ , CO, CO ₂ , and hydrocarbons in ultra high purity gases	www.ametekpi.com
UHP moisture analyzers for ultra high purity gases	www.ametekpi.com
Vacuum Quality and Residual Gas Analysis	
Quadrupole mass spectrometers for vacuum residual gas analysis and gas compositional analysis	www.ametekpi.com
Precision Machining Systems	
Ultra-precision multi-axis diamond turning, grinding, grooving and milling machines for both rotationally symmetric and freeform applications in single crystal, non-ferrous and ferrous materials	www.precitech.com

PV Module Assembly Solutions	
AMETEK PV SOLUTION	AMETEK BUSINESS
Hermetically Sealed Connectors	
Sealing materials and connectors for PV module assembly	www.hccindustries.com
Precision Machining Systems	
Ultra-precision multi-axis diamond turning, grinding, grooving and milling machines for both rotationally symmetric and freeform applications in single crystal, non-ferrous and ferrous materials	www.precitech.com
System Simulation Testers	
Instruments and systems for inverter, battery, and electrical component testing (simulators of PV arrays, utility supplies, battery strings and AC loads for IEC compliance testing)	www.programmablepower.com
Elemental Analysis of Materials and PV Panels	
Handheld XRF instruments for non-destructive analysis of solar glass, material purity, and PV panels that measure relevant elements such as gallium, selenium, indium, cadmium, tellurium, zinc or iron	www.spectro.com

PV Power Generation Solutions	
AMETEK PV SOLUTION	AMETEK BUSINESS
Off Grid Inverters	
Solid state off-grid, single and three phase renewable energy systems	www.solidstatecontrolsinc.com
System Simulation Testers	
Instruments and systems for inverter, battery, and electrical component testing (simulators of PV arrays, utility supplies, battery strings and AC loads for IEC compliance testing)	www.programmablepower.com
PV Array and Grid Simulators for Power Compliance Testing	
Programmable AC and DC power supplies for PV array and battery simulation and balance of system testing	www.programmablepower.com
AC and DC Power Supply and Control Systems for Reactors and Furnaces	
Power supplies and power control systems for silicon refining, directional solidification system (DSS) furnaces, and other crystal melt chambers	www.hdrpower.com
Power supplies and power control systems for chemical vapor deposition (CVD) reactors	www.hdrpower.com

PV Installation Solutions	
AMETEK PV SOLUTION	AMETEK BUSINESS
Off Grid Inverters	
Solid state off-grid, single phase renewable energy systems	www.solidstatecontrolsinc.com
Solid state off-grid, three phase renewable energy systems	www.solidstatecontrolsinc.com
System Simulation Testers	
Instruments and systems for inverter, battery, and electrical component testing (simulators of PV arrays, utility supplies, battery strings and AC loads for IEC compliance testing)	www.programmablepower.com
PV Array and Grid Simulators for Power Compliance Testing	
Programmable AC and DC power supplies for PV array and battery simulation and balance of system testing	www.programmablepower.com

Balance of PV System Solutions	
AMETEK PV SOLUTION	AMETEK BUSINESS
Power Conversion and Control Systems	
Pulse Width Modulation (PWM) energy systems, single and three phase	www.solidstatecontrolsinc.com
Pulse Width Modulation (PWM) energy systems, single phase	www.solidstatecontrolsinc.com
PV Array and Grid Simulators for Power Compliance Testing	
Programmable AC and DC power supplies for PV array and battery simulation and balance of system testing	www.programmablepower.com

Installation

- > Off Grid Inverters
- > System Simulation Testers
- > PV Array and Grid Simulators for Power Compliance Testing

Balance of PV System

- > Power Conversion and Control Systems
- > PV Array and Grid Simulators for Power Compliance Testing

Power Generation

- > Off Grid Inverters
- > System Simulation Testers
- > PV Array and Grid Simulators for Power Compliance Testing
- > AC and DC Power Supply and Control Systems for Reactors and Furnaces

Research & Development

- > Substrate and Structural Materials
- > Vacuum Quality and Residual Gas Analysis
- > Thermal Imaging for Crystal Growth Reactors
- > Elemental Analysis and Chemical Characterization Instruments
- > Dopant Depth Profiling and Thin Layer Analysis of PV Cells
- > Morphology
- > Dimensional Analysis of 1st Gen, 2nd Gen and Next Gen PV Cells
- > Electrical Performance Characterization of PV Cells
- > AC and DC Power Supply and Control Systems for Reactors and Furnaces

Materials

- > Substrate and Structural Materials
- > Elemental Analysis and Chemical Characterization
- > Bulk Gas Purity Monitoring
- > Vacuum Quality and Residual Gas Analysis
- > Precision Machining Systems

Module Assembly

- > Hermetically Sealed Connectors
- > Precision Machining Systems
- > System Simulation Testers
- > Elemental Analysis of Materials and PV Panels

Cell Fab and Thin Film Processing

- > Thermal Imaging and Infrared Thermometers
- > Elemental Analysis and Chemical Characterization
- > Dopant Depth Profiling and Thin Layer Analysis of PV Cells
- > Morphology
- > Dimensional Analysis of 1st Gen, 2nd Gen and Next Gen PV Cells
- > Bulk Gas Purity Monitoring
- > AC and DC Power Supply and Control Systems for Reactors and Furnaces

AMETEK – THE GLOBAL PICTURE

AMETEK is a global leader in electronic instruments and electromechanical devices with 2009 sales of \$2.1 billion. It employs approximately 10,000 people at more than 80 manufacturing locations around the world. Supporting those operations are more than 100 sales and service locations in the United States and 37 other countries.

AMETEK consists of two business groups: Electronic Instruments and Electromechanical. Electronic Instruments is a leader in advanced instruments for process, aerospace, power and industrial markets. Electromechanical is a differentiated supplier of electrical interconnects, specialty metals, technical motors and systems, and floor care and specialty motors.

AMETEK has put together a coordinated presence in the photovoltaic industry. The vast experience, technology offerings and products we make for the PV marketplace enable us to offer solutions now and when future advancements are made in photovoltaics.

Please visit ametekphotovoltaic.com to help you better understand how AMETEK can come through for you in PV.



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