

DYESOL

EQUIPMENT CATALOGUE



DYESOL EQUIPMENT CATALOGUE

ABOUT DYESOL

About Dyesol	4
How to order	5
Materials	6
Equipment	9

EQUIPMENT

Glass Preparation	11
Materials Application	17
Electrode processing	22
Cell construction	26
Test Equipment	29
Light Soakers	30
Cell Characterisation	31
Solar Simulators	33

ABOUT DYESOL

Dyesol is a global leader in the development and commercialisation of Perovskite Solar Cell (PSC) technology – 3rd Generation photovoltaic technology that can be applied to glass, metal, polymers or cement.

Dyesol manufactures and supplies high performance materials and is focussed on the successful commercialisation of PSC photovoltaics.

Our team of highly skilled scientists and engineers focus on:

- Developing (and continuously advancing) a suite of thoroughly tested PSC chemicals, components and

equipment used in the manufacture of PSC cells, modules and panels to researchers and industrialists;

- Providing turn-key and custom fabrication facilities for research, development and production of PSC photovoltaic devices; and
- Providing specialist training, consulting and engineering solutions for the application of PSC photovoltaic technology.

Dyesol is a publicly listed company: Australian Securities Exchange ASX (DYE) and German Open Market (D5I).



HOW TO ORDER

Order Online

If you would like to purchase Dyesol materials, shop online at www.dyesol.com or email purchase@dyesol.com.

European Customers

To purchase or enquire email italy@dyesol.com.

For more information

For more information, custom orders or tailored material and equipment quotes email information@dyesol.com or call Dyesol's Headquarters +61 2 6299 1592.

Custom Orders

Dyesol welcomes the opportunity to tailor our products or product quantities to suit your needs. If you require a custom formulated order, it is worth discussing your project goals and requirements with Dyesol. Simply send your request by email to purchase@dyesol.com.

Bulk Orders

Dyesol receives requests for bulk orders. We can assist you with one-off or repeat orders for materials in specific quantities. Our operation is scalable, we are capable of fulfilling small orders for individual projects or large orders for production scale initiatives.

Customer Service

Our customer service and sales teams are located in both the northern and southern hemisphere's which means you have access to assistance around the clock.

Email information@dyesol.com if you would like to discuss special order quantities or require product advice.

If you have placed an order, and you have a query regarding its status, keep an eye on your emails for your order confirmation or email purchase@dyesol.com.

Shipping

Dyesol will ship your order within 10 days of receipt of payment

and aims to dispatch goods immediately upon receipt of your purchase order. If goods are not in stock, Dyesol will contact you with the expected shipment date.

Taxes

All purchases are subject to taxes or import duty as applicable to the order and location. Sales from and within Australia incur a 10% GST (goods and services tax) which is added to all orders sold within the country.

International orders (from Australia) are exempt from GST tax charges and are shipped Delivery Duties Unpaid. Orders received from the UK may be subject to a 20% VAT (value added tax) or exempt under EU law.

Payment

Credit card payments (Visa, Mastercard, AMEX) are accepted and encouraged for the prompt order processing.

Dyesol will also accept payment by cheque or direct deposit. All payments by direct deposit must include the reference number in the bank transfer. If payment is made by direct deposit, please forward the transaction receipt to purchase@dyesol.com.

Payment by cheque or direct deposit is slower to process and wherever possible, Dyesol encourages customers to use Dyesol's online eCommerce website to place orders. Please speak to Dyesol's Sales Team to arrange for an account or special payment terms as necessary.

Dyesol Head Office

3 Dominion Place, Queanbeyan NSW 2621, Australia
Post: PO Box 6212, Queanbeyan NSW 2621, Australia

Website: www.dyesol.com

Sales: purchase@dyesol.com

European customers: italy@dyesol.com

Information: information@dyesol.com

Newsletter: [Subscribe here](#)

Phone: +61 6299 1592



HIGHEST QUALITY MATERIALS

Dyesol has more than 800 customers located in 60 countries. Customers include leading universities, manufacturers and scientists. All demand a high quality and consistent product, which Dyesol has become renowned for internationally.

We provide our customers with the industry's highest quality perovskite precursors, sensitising dyes, ligands, dye additives, titania pastes, platinum pastes, electrolytes, conductive glass substrates, sealants and more!

Dyesol is also a pioneer Licensee of the Ecole Polytechnique

Federale de Lausanne (EPFL) and many of our products are sold under license from EPFL.

Our operation is scalable, and we are capable of fulfilling small orders for individual projects or large orders for production scale initiatives.

Our products go under the most rigorous quality testing in the market to provide the best performance and highest consistency. We already supply a range of producers with large quantities of several materials at very competitive prices.



PEROVSKITE PRECURSORS – AMMONIUM SALTS

Iodides

- Acetamidinium iodide
- Benzylammonium iodide
- iso-Butylammonium iodide
- n-Butylammonium iodide
- t-Butylammonium iodide
- Diethylammonium iodide
- Dimethylammonium iodide
- Ethylammonium iodide
- Formamidinium iodide
- Guanidinium iodide
- Imidazolium iodide
- Methylammonium iodide
- Phenethylammonium iodide
- Phenylammonium iodide
- iso-Propylammonium iodide
- n-Propylammonium iodide
- Pyrrolidinium iodide
- n-Octanylammonium iodide

Bromides

- Benzylammonium bromide
- iso-Butylammonium bromide
- n-Butylammonium bromide
- t-Butylammonium bromide
- Diethylammonium bromide
- Dimethylammonium bromide
- Ethylammonium bromide
- Formamidinium bromide
- Guanidinium bromide
- Imidazolium bromide

- Methylammonium bromide
- Phenethylammonium bromide
- Phenylammonium bromide
- iso-Propylammonium bromide
- n-Propylammonium bromide
- n-Octanylammonium bromide

Diammonium

- 1,4-Benzene diammonium iodide
- Ethane 1,2 diammonium bromide
- Ethane 1,2 diammonium iodide
- Propane 1,3 diammonium bromide
- Propane 1,3 diammonium iodide

Pseudohalides

- Formamidinium hexafluorophosphate
- Formamidinium tetrafluoroborate
- Formamidinium thiocyanate
- Methylammonium hexafluorophosphate
- Methylammonium tetrafluoroborate
- Methylammonium thiocyanate

Spiro - ammonium

- 5-Azaspiro(4.4)nonan-5-ium iodide
- 5-Azaspiro(4.4)nonan-5-ium chloride
- 5-Azaspiro(4.4)nonan-5-ium bromide

Chlorides

- n-Octanylammonium chloride

HOLE TRANSPORT MATERIAL, DOPANTS & COBALT COMPLEXES

- FK 102 Co(II) PF₆ Salt
- FK 102 Co(II) TFSI Salt
- FK 102 Co(III) PF₆ Salt
- FK 102 Co(III) TFSI Salt
- FK 209 Co(II) PF₆ salt
- FK 209 Co(II) TFSI salt
- FK 209 Co(III) PF₆ salt

- FK 209 Co(III) TFSI salt
- FK 269 Co(II) PF₆ salt
- FK 269 Co(II) TFSI salt
- FK 269 Co(III) PF₆ salt
- FK 269 Co(III) TFSI salt
- H101

TITANIA & PLATINUM PASTES

- BL-1 Blocking Layer
- MPT-20
- 18NR-AO Active Opaque Titania Paste
- CELS Counter Electrode Solution
- 30 NR-D

- WER2-O Reflector Titania Paste
- PT1 Platinum Paste
- 90-T Transparent Titania Paste (Thin Use)
- 18NR-T Transparent Titania Paste

DYES & SENSITIZERS

- C106 Dye
- K19 Dye
- N3 Foundation Dye
- N719 Industry Standard Dye
- N749 Black Dye
- Z907 Hydrophobic Dye

ELECTROLYTES & COMPONENTS

- Ethyl Isopropyl Sulfone
- EL-HPE High Performance Electrolyte
- EL-HSE High Stability Electrolyte
- EL-HTE High Temperature Electrolyte
- Ultra High Stability Electrolyte

LIGANDS & INTERMEDIATES

- 4-Bromo-N,N-bis(4-iodophenyl)aniline
- C101 Ligand
- C106 Ligand
- 1-Chloro-2,4-bis(hexyloxy)benzene
- DCBP Anchoring Ligand
- DMBP Building Block Ligand
- DNBP Hydrophobic Ligand
- FK 102 Ligand
- FK 209 Ligand
- FK 269 Ligand
- K19 Ligand
- TCBA Black Dye Ligand
- 4-bromo-N,N-bis(4-methoxyphenyl)aniline
- 4-(tert-butyl)-2-chloropyridine
- 4-(tert-butyl)pyridine-N-oxide

ADDITIVES AND MODIFIERS

- 5-AVAI
- 5-AVAB
- 5-AVAC

GLASS SUBSTRATES

- TEC15 Glass Plates
- TEC7 Glass Plates
- TEC8 Glass Plates
- Platinum Coated Test Cell Counter Electrodes with Fill Hole
- TiO₂ Coated Test Cell Glass Electrodes (Opaque)
- TiO₂ Coated Test Cell Glass Electrodes (Transparent)

SEALANTS

- Two Part Thermal Cure Epoxy Compound - Clear
- Two Part Thermal Cure Epoxy Compound - Opaque
- Aluminium Thermoplastic Laminate
- High Temperature Thermoplastic Sealant
- Low Temperature Thermoplastic Sealant
- Two Part Hermetic Sealing Compound
- Two Part Interconnect Polymer
- Two Part Neutral Assembly Polymer

SPECIALIST EQUIPMENT

In addition to specialist materials, Dyesol offers a unique, proprietary DSC and Perovskite equipment set, and provides DSC and Perovskite researchers and manufacturers with a range of customisable and all-inclusive equipment, materials and training packages.

Dyesol's lab equipment enables you to develop research capability and master the fundamental processes involved with DSC and Perovskite construction. The Laboratory Solutions allow you to quickly produce high quality, consistent test cells so that you can focus on researching optimum DSC and Perovskite materials and processes.

Packages

Dyesol's Laboratory Solutions can be packaged to suit your needs, consider:

- Project Planning
- Equipment Commissioning
- Equipment Delivery and Installation
- Starter DSC and Perovskite Materials Set
- Facility requirements identified
- Technical training on equipment
- Ongoing technical assistance allowance
- Package tailored to your individual needs

If you are planning to refurbish your laboratory, talk to Dyesol about the lab packages available. Consider Dyesol's state-of-the-art machines, affordable prices, and technical know-how.

To view Dyesol's range of lab equipment visit www.dyesol.com/equipment



Glass Preparation

Dyesol sourced glass preparation equipment is used to process raw TEC glass substrates to individual or multiple plate electrodes prior to application of DSC and Perovskite materials.

These pieces of equipment can be used for preparing substrates for both Liquid and Solid State DSC research.

View this section to discover how to scribe your substrates and drill the holes for liquid DSC in the most effective way.



Materials Application

Dyesol sourced materials application equipment comes from Dyesol's extensive experience in developing DSC and Perovskite materials and ensuring optimised materials application.

These pieces of equipment can be used for the application of materials for both Liquid, Solid State DSC and Perovskite Solar Cells research.

In this section you will find the state of the art screen printing and spin coating equipment.



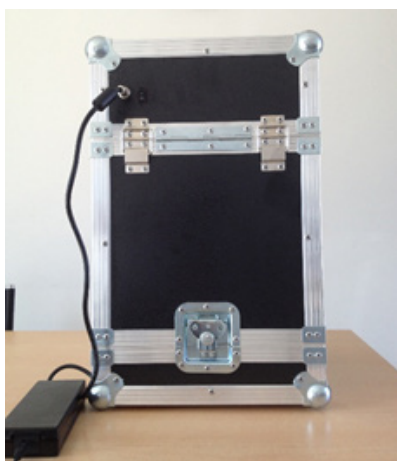
Electrode Processing

Dyesol sourced electrode processing equipment is used for the processing of DSC and Perovskite substrates for the application of; Dyes at a laboratory level, and for the sintering of DSC counter working electrode and Perovskite layers or other materials at elevated temperatures. These pieces of equipment can be used for the processing of electrodes for both Liquid and Solid State DSC research.



Cell construction

Dyesol developed and sourced cell construction equipment can be used for the construction of smaller laboratory DSC cells. These pieces of equipment can be used for both Liquid and Solid State DSC research. Give your manufacturing processes a full control



Test Equipment

Dyesol developed and sourced test equipment comes from Dyesol's extensive experience in testing of DSC, ssDSC and Perovskite devices. These pieces of equipment can be used for testing both Liquid and Solid State DSC. Try our solar simulators, enjoy the accuracy of our IPCE systems experiment the best UPTS available.

GLASS PREPARATION

Laser Scribing System Mini Desktop



Use

Use the Laser Scribing Machine to remove the conductive oxide layer from glass substrates so that a series connect tile can be produced and to laser scribe and identify test cells and other products.

Description & Benefits

The Laser Scribing Machine utilises a carbon dioxide laser, producing a continuous cut, which is used to remove the conductive oxide layer from glass substrates so that a series connect tile can be produced. The software allows the machine to be programmed for your specific tiles and designs.

The wavelength utilised renders the system suitable for plastics and glass. There is a slight etching of the substrate where the TCO is removed. Benefits of the Laser Scribing Machine include: precision scribing, use of your own CAD files, and high speed operation.

Specifications			
	Mini 1	Mini 2	
Features	Description		Benefit / Additional Information
Control Features	Computer control system allows user to define scribing design		High precision control system puts you in charge
CO2 Laser	Sealed 10.6 microns. Available in; 40Watts		Carbon dioxide lasers provide the highest power, continuous wave laser with high efficiency and is suitable for scribing glass and plastic
Repetition Rate	Repetition rate is dependent on the pattern that is being printed and the speed of the laser which is up to 100cm/sec		High speed operation for quick production times
Safety Features	Provided with Protective goggles		
Machine Requirements	<ul style="list-style-type: none"> Electricity: 110/220VAC \pm10%, 50/60Hz Exhaust system and ducting supplying 7 cubic metres per minute of air at 15cm of static pressure (water) Air-conditioning 		
Dimensions	Overall: L 930mm x W 760mm x H 450mm Weight: 110kg		Compact size fits well into most laboratories and workshops
Substrate Sizes Accomodated	L 62cm x W 30cm x H 10cm Max weight: 9kg	L 62cm x W 30cm x H 10cm Max weight: 9kg	Accommodates a range of DSC and Perovskite substrates
Working area	50 cm x 30 cm x 15 cm	60 cm x 50 cm x 15 cm	
Lens Options	Spot size is dependent on the lenses that are chosen when the laser is purchased. 2 Options available, the standard option is in bold: Focal length Spot Size Resolution 38.1mm 0.08mm 50.8mm 0.13mm		Changeable lenses enable you to specify the spot size as per your requirements. The smaller the beam size the faster the cutting
Cooling Type	Water Cooling		High efficiency cooling system
Engraving Speed	0-60000mm/min		
Cutting Speed	0-40000mm/min		

Features	Description	Benefit / Additional Information
Laser Output Control	(0-100% Set by Software)	
Min. Engraving Size	Chinese: 2.0mm*2.0mm, English Letter: 1.0mm*1.0mm	
Highest Scanning Precision	4000DPI	
Locating Precision	≤+0.01mm	
Controlling Software	DSP Control System	
Graphic Format Supported	DST PLT BMP DXF DWG AI LAS,etc	
Compatible Software	TAJIMA, CORELDRAW, PHOTOSHOP, AUTOCAD,etc	
Color Separation	Yes	
Drive System	High-precision 3-phase Stepper Motor	
Auxiliary Equipments	Exhaust Fan and Air Exhaust Pipe	
power Supply	AC110V/220V+10%,50HZ/60HZ	
Working Environment	Temperature: 0-45°C , Humidity 5-95% (No Condensate Water)	
Optional Spare Parts	Honeycomb Worktable, Rotary Device,Auto-focus Device	

Laser Scribing System - Medium and Large



Use

Use the Laser Scribing Machine to remove the conductive oxide layer from glass substrates so that a series connect tile can be produced and to laser scribe and identify test cells and other products.

Description & Benefits

The Laser Scribing Machine utilises a carbon dioxide laser, producing a continuous cut, which is used to remove the conductive oxide layer from glass substrates so that a series connect tile can be produced. The software allows the machine to be programmed for your specific tiles and designs.

The wavelength utilised renders the system suitable for plastics and glass. There is a slight etching of the substrate where the TCO is removed. Benefits of the Laser Scribing Machine include: precision scribing, use of your own CAD files, and high speed operation.

Specifications	Laser scriber medium	Laser scriber large
Features	Description	
Control Features	Computer control system allows user to define scribing design	
CO2 Laser	Sealed 10.6 microns. Available in 60 Watts	Sealed 10.6 microns. Available in RECI S2 80W
Repetition Rate	Repetition rate is dependent on the pattern that is being printed and the speed of the laser which is up to 100cm/sec	
Safety Features	Provided with Protective goggles	
Machine Requirements	<ul style="list-style-type: none"> Electricity: 110/220VAC \pm10%, 50/60Hz Exhaust system 	
Dimensions	L 1137 mm x W 1602 mm x H 1060 mm	L 1547 mm x W 1872 mm x H 1060 mm
Working area	100 cm x 60 cm	130 cm x 90 cm
Z axes control	Available on request	Available on request
Lens Options	Spot size is dependent on the lenses that are chosen when the laser is purchased. 2 Options available, the standard option is in bold: Focal length Spot Size Resolution 63.5mm 0.18mm 101.6mm 0.33mm	
Cooling Type	Water Cooling	
reflector mirrors	3pcs	
Focal lens	1 pc	
Engraving Speed	0-60000mm/min	
Cutting Speed	0-40000mm/min	
Laser Output Control	(0-100% Set by Software)	
Min. Engraving Size	Chinese: 2.0mm*2.0mm, English Letter: 1.0mm*1.0mm	
Highest Scanning Precision	4000DPI	
Locating Precision	\leq +0.01mm	
Controlling Software	DSP Control System	
Graphic Format Supported	DST PLT BMP DXF DWG AI LAS,etc	
Compatible Software	TAJIMA, CORELDRAW, PHOTOSHOP, AUTOCAD, etc	
Colour Separation	Yes	
Drive System	High-precision 3-phase Stepper Motor	
Auxiliary Equipments	Exhaust Fan and Air Exhaust Pipe	
power Supply	AC110V/220V+10%,50HZ/60HZ	
Working Environment	Temperature: 0-45°C, Humidity 5-95% (No Condensate Water)	
Optional Spare Parts	Honeycomb Worktable, Rotary Device,Auto-focus Device	

Manual Hole Drilling System



Use

Use the Manual Hole-Drilling Machine to create electrolyte fill holes in your glass DSC substrate.

Description & Benefits

The Manual Hole Drilling Machine uses a fast, dry process which avoids use of water and avoids constant replacement of high-cost drill-bits. Manual operation of this machine includes the holding of the work piece and the nozzle during blasting. A foot switch is used to control the length of time for blasting.

The Manual Hole Drilling Machine is used for creating electrolyte fill holes in glass substrates during the initial stage of glass electrode preparation. Accurate holes are produced by application of fine, high-pressure blasting media onto the substrate.

The system includes a double filtration system for capturing dust that is formed during the blasting process. A clear safety window allows for viewing inside the blasting chamber during the blasting process.

Specifications

Features	Description	Benefit / Additional Information
Grit Media	Grit sizes from ultra fine 10 micron to larger 300 micron media	Can accommodate most common grades of grit media
Control Grit Dosage	Manual control of grit dosage	Allows user to control speed and pressure delivery of grit media to substrate
Safety Features	Safety glass window – protects user during operation while providing excellent view. Dust Absorber to collect harmful dust particles produced during the blasting process	
Physical Dimensions	Blasting Unit: Length 320mm, Width 220mm, Height 350mm Blasting Chamber: Length 460mm, Width 300mm Height 200mm	
Machine Requirements	<ul style="list-style-type: none"> Electricity: 230V AC, 50Hz Air Supply: 8bar maximum Clean, Dry, Compressed Air or Nitrogen 	
Substrate Sizes Accomodated	Max Size: Length 430mm x Width 270mm	Accommodates a range of DSC substrates

YAG Laser Scribing System



Use

Use the YAG Laser Scribing Machine to remove the conductive oxide layer from glass substrates so that a series connect tile can be produced and to laser scribe and identify test cells and other products.

Description & Benefits

The YAG Laser Scribing Machine utilises a YAG laser, producing a continuous cut or scribing, which is used to remove the conductive oxide layer from glass substrates so that a series connect tile can be produced. The software allows the machine to be programmed for your specific tiles and designs.

The wavelength utilised renders the system suitable for plastics and glass. YAG laser ablates the TCO without damaging the underlying glass; this leads to isolations without residual material piled up at the edges. This is important for perovskites due to the small thickness of the active layers (compared to DSC), as the piled up material can form shorting pathways. Machine include: precision scribing, use of your own CAD files, and high speed operation.

Specifications		
Features	Description	Benefit / Additional Information
Laser output power	75W	Use the advanced diode side-pumped laser technology, with high optical conversion efficiency and stable performance
Laser wavelength	1064nm	
Standard marking scope	110 mm*110mm	Fast speed & no touch processing, the heat exchange is little, the material is not easy to distirt.
Selective Marking scope	70mm*70mm / 150mm*150mm / 200mm*200mm	
Beam quality	M2 <3	With precise beam mode than YAG lamp-pump laser machine, the high precision is what the YAG Lamp-pump laser machine can not reach.
Marking depth	0.01~0.2mm	
Marking speed	7000mm/s	No need to change the consumables (such as laser lamp), free of maintenance, very low operation cost.
Repeated accuracy	±0.01mm	
Minimum character	0.1mm	All the core optical components used such as laser diode, Q-switch crystal, are famous brands with top quality, therefore the whole machine is with very stable performance and long life time.
Minimum line width	0.015mm	
Electric power requirement	220V/50-60Hz	
Machine power	3KW	
Gross weight	120KG	
Dimensions :(L*W*H)	Mainframe: 240mm*1280mm*1200mm	
	Control Cabinet: 590mm*560mm*800mm	
	Water Cooling Machine: 540mm*700mm*900mm	

MATERIALS APPLICATION

Screen Printer



Use

Use one of the Screen Printers (compact, medium or large) to apply the wide range of screen printable DSC & Perovskite materials onto your conductive rigid and/or flexible substrates in a precise, controllable manner.

Description & Benefits

The Screen Printer is typically used for the application of an electrical conductor to form a busbar, a catalyst paste to form the counter electrode and a semiconductor paste to form the working electrode. The flexible nature of this piece of equipment allows users to experiment with the application of other cell components such as electrolytes and sealants.

Controllable squeegee speed and controllable pressure allow for precise and repeatable prints for both small and large production runs. Operation is semi-automatic or manual. The chemically inert flood blade ensures no contamination of your Dye Solar Cells & Perovskite solar cells.

These screen printers are the best choice for DSC & Perovskite research because they are optimised for use with DSC & Perovskite material sets by the inclusion of Dyesol engineered jigs and flood-blades. The electropneumatics of this machine provide infinite control of flood & squeegee blades which is essential for controlling layer thickness

Specifications			
Features	Compact Model	Medium Model	Large Model
Max Print Area	Length 250mm Width 200mm	Length 450mm Width 300mm	Length 600mm Width 400mm
Working table size	Length 400mm Width 250mm	Length 600mm Width 400mm	Length 700mm Width 500mm
Max outer dimensions of screen frame	Length 530mm Width 380mm Frame height 20-30mm	Length 750mm Width 500mm Frame height 20-30mm	Length 900mm Width 700mm Frame height 25-45mm
Capacity at full speed	990 P/H	800 P/H	600 P/H
Substrate thickness	0mm to 50mm	0mm to 50mm	0mm to 120mm
Weight	180kg	245kg	485kg
Dimensions	Length 720mm Width 680mm Height 1710mm	Length 920mm Width 750mm Height 1710mm	Length 1300mm Width 1050mm Height 1600mm
Air Source	5Bar to 7Bar Clean, Dry, Compressed Air	5Bar to 7Bar Clean, Dry, Compressed Air	5Bar to 6Bar Clean, Dry, Compressed Air
Power Requirements	Single phase 220V 50/60Hz	Single phase 220V 50/60Hz	Three phase 220V/380V 50/60Hz
Power consumption	0.83kW	0.83kW	1.54kW
Safety Features	Emergency stop features protect machine user		
Dyesol Engineered Jigs	Dyesol alignment jigs allow for repeatability in batch printing		

Spin Coater



Use

Use Dyesol Screen Printer basic to apply the wide range of DSC & Perovskite materials onto your DSC and Perovskite glass substrate in a precise & controllable manner

Description & Benefits

The Spin Coater is typically used for the application of a thin layer. The flexible nature of this piece of equipment allows users to experiment with the application of other cell components varying the spinning parameters in a very precise controllable manner.

Controllable acceleration time, spin speed and deceleration time allow for precise and repeatable depositions. The chemically inert materials of the internal chamber ensures no contamination of your Dye & Perovskite solar cells.

This Spin coater is the best choice for Perovskite research because it is optimised for use with Perovskite material sets. Different models available with different spin parameters and substrates thicknesses, for specific request contact directly our sale office.

Specifications	
Features	Basic model
Bowl-shaped process chamber	9.5 inc (241 mm)
Substrate capability	Up to ø 6inc (150 mm) wafer Up to ø 5inc (125 mm) square
Program controller	Digital
speed	To 12K RPM
Acceleration with standard chuck	To 13K RPM/sec
Acceleration increment	1 RPM
calibration	No calibration needed
Time	1 sec to 99 min and 59.9 sec
Time increment	0.1 sec
programs	Twenty 51-steps
Pc interface	Via dedicated software
Safety door interlock	Disable rotation when door is open
Safety door latch	Requires deliberate action to open process chamber
Safety door lock	Prevents chamber opening while programme is running
Glovebox ready configuration	May be installed in a nitrogen or argon filled enclosure without modification
Power	95 to 240 VAC , 47/63 Hz 300W
Clear ECTFE lid	ø ¾ inc (19 mm) centre opening
Exhausted drain reservoir	250 ml removable polypropylene drain container for coating application

ELECTRODE PROCESSING

Programmable Hotplate - Covered



Use

Use the Programmable Hotplate to fire working and counter electrodes on Dye and Perovskite Solar cells

Description & Benefits

The Programmable Hotplate provides a consistent, controllable and reliable heat source for the firing of small working and counter electrodes for the production of test cells.

The Programmable Hotplate includes ramp timing and temperature controls.

The Programmable Hotplate includes ramp timing and temperature controls. The key benefit to users of the Programmable Hotplate is that it can be programmed to precisely control the machine – an essential factor for achieving consistent, reliable results. Up to 5 temperature steps can be programmed and each temperature step can incorporate a ramp time or constant temperature time.

The Programmable Hotplate surface is high quality nickel plating; it is also highly robust and durable for use in any busy lab.

Specifications		
Features	Description	Benefit / Additional Information
Temperature Range	Up to 600°C	Allows a full range of temperatures for firing DSC materials
Substrate Sizes	230mm x 160mm	Accommodates from test cells up to tile size electrodes
Temperature Uniformity	Due to the large thermal capacity of the Programmable Hotplate, the temperature uniformity, once stabilised is $\pm 5\%$ except within 10mm of the edge	Temperature uniformity ensures precise user control of the firing temperatures, essential for achieving consistent results
Programmable Timing	<ul style="list-style-type: none"> Up to 5 temperature steps Temperature steps incorporate a ramp time and constant temperature time Time range: both ramp and constant time up to 9 hours 59 minutes in 1 minute intervals. 	The programmable timing function with 5 temperature steps allows for multi-stage firing processes of different ssDSC and Perovskite material sets.
Safety Features	Protective lid. Automatic off timing	Protective lid protects user during operation. Programmable timing feature means the hotplate will turn off at a specific time.
Physical Dimensions	Overall: L 350mm x w 300mm x H 180mm Hotplate: L 280mm x W 200mm Weight: 10kg	Compact design fits well in most laboratories and workshops.
Machine Requirements	220-240VAC 50-60Hz	

Programmable Hotplate - Uncovered



Use

Dyesol's Programmable Hotplate to fire working and counter electrodes on Dye Solar Cells and Perovskite Solar Cels.

Description & Benefits

Dyesol's Programmable Hotplate provides a consistent, controllable and reliable heat source for the firing of small working and counter electrodes for the production of test cells.

Dyesol's Programmable Hotplate include ramp timing and temperature controls.

The key benefit to users of the Programmable Hotplate is that it can be programmed to precisely control the machine – an essential factor for achieving consistent, reliable results. Up to 31 temperature steps can be programmed and each temperature step incorporates a ramp time and constant temperature time. An Advanced Software interface (optional) allows users to program the desired profile curve directly via Laptop.

The Programmable Hotplate is made of high quality Copper alloy, heat-resistant alloy plating which decreases the possibility of contamination of substrates, it is also highly robust and durable for use in any lab.

Specifications		
Features	Description	Benefit / Additional Information
Temperature Range	Up to 650°C	Allows a full range of temperatures for firing DSC materials.
Substrate Sizes	230 mm X 160 mm	Accommodates from test cells up to tile size electrodes.
Temperature Uniformity	±2%	The temperature uniformity ensures precise user control of firing temperatures, essential for achieving consistent results.
Physical Dimensions	300 mm X 300 mm	Compact design fits well in most laboratories and workshops.
Hot plate material	Copper alloy, heat-resistant alloy plating	
Programmable Timing	Up to 31 temperature steps Temperature steps incorporate a ramp time and constant temperature time Time range: both ramp and constant time up to 99 hours 59 minutes in 1 minute intervals.	The programmable timing function with multiple temperature steps allows for multi-stage firing processes of different DSC and Perovskite material sets.

Belt Furnace



Use

Belt Furnaces are used to dry printed layers, activate and fire busbars, working electrode, and counter electrode pastes

Description & Benefits

Dyesol Belt Furnaces have been sourced to allow for optimisation of firing profiles suitable for sintering DSC & Perovskite materials.

Dyesol Belt Furnaces are available as a lower temperature 4 zone drying furnace for printed DSC & Perovskite materials, a shorter 4 zone furnace for firing catalyst materials for counter electrodes, and a 6 zone furnace for firing Titania dioxide for the working electrodes.

Temperature zones can be individually programmed to optimise firing profiles for DSC & Perovskite materials in conjunction with controllable air flow throughout the furnace.

Custom models available under request.

Specifications			
Feature	4 Zones Drying Furnace	4 Zones CE Furnace	6 Zones WE Furnace
Heating Mode	Infrared Quartz	FEC ceramic heating board	Infrared short wave heating tube
Maximum Temperature	200°C	650°C	700°C
Long Term Operating Temperature	Room Temperature - 110°C	600°C	650°C
Belt Width	300mm	300mm	300mm
Belt Material	Stainless Steel grade 304	Nichrome (Cr20Ni80)	Stainless Steel grade 316
Maximum Part Height	30mm	30mm	30mm
Heating Zones	4	4	6
Total Length	2830mm	3960mm	4460mm
Load Table	600mm	350mm	600mm
Heating Zone Length	1200mm	1800mm	1800mm
Cooling Zone Length	300mm	910mm	870mm
Unload Table	600mm	350mm	600mm
Working Voltage	AC220V/380V ±10%, 3 φ 4 line, 50Hz	AC220V/380V ±10%, 3 φ 4 line, 50Hz	AC220V/380V ±10%, 3 φ 4 line, 50Hz
Power Rating	>20KVA	>30KVA	>40KVA
Overall Dimensions	Length 2830mm x Width 1000mm x Height 1350	Length 3960mm x Width 1200mm x Height 1350	Length 2830mm x Width 1000mm x Height 1350
Weight	~500Kg	~800kg	~700kg

CELL CONSTRUCTION

Test Cell Assembly Machine



Use

Use Dyesol's custom designed Test Cell Assembly Machine to quickly and easily assemble multiple DSC & Perovskite test cells.

Description & Benefits

Dyesol's Test Cell Assembly Machine (TCAM) provides the user with a rapid, reliable and repeatable method for the assembly and permanent sealing of DSC & perovskite test cells.

The TCAM applies flat, equal pressure across the cell for even sealing. A combination of light mechanical pressure and resistive heating is used in sealing. An electrical current is passed through the conductive layer on the glass substrate of the counter electrode to melt a thermoplastic gasket between the counter and working electrodes.

The temperature which the counter electrode reaches can be controlled by adjusting the voltage which controls the current allowed to flow through the conductive layer. This is important because excessive temperatures will damage dyes. The mechanical pressure applied to the cell during construction and the time of application can be varied by a user-adjustable pressure regulator and a timing unit. This is important because it ensures consistent, repeatable cell construction.

Dyesol's Test Cell Assembly Machine is designed to accommodate DSC & perovskite test cells of the dimensions listed below.

Specifications		
Features	Description	Benefit / Additional Information
Variable Voltage Application	Voltage range from 0V DC to 40V DC Maximum current 3 Amps	Allows you to control voltage and current application for test cell sealing.
Timing Control	Variable timing of pressure application set by a user controlled timing unit: Timing range from 0.1 to 999 seconds	Allows users to specifically control and program the time for pressure application
Pressure Control	Variable pressure application, controlled by pressure regulator: up to 700kPA, indicated by front panel gauge	Allows users to specifically determine the amount of pressure to apply to the cell via the sealing mechanism.
Safety Features	<ul style="list-style-type: none"> Safety shield with interlock Emergency stop button Mains power cut out at less than 200kPa 	Protects user during TCAM operation from potential manufacturing and assembly hazards
Physical Dimensions	Length 570mm x Width 310mm x Height 400mm Weight: 7kg	Compact design fits easily into your facility.
Machine Requirements	<ul style="list-style-type: none"> Electricity: 230V AC, 50Hz Air Supply: 7bar maximum Clean, Dry, Compressed Air or Nitrogen 	
Substrate Size	Substrate thickness maybe varied providing total cell thickness pre-compression is between 2 & 6mm: Working Electrode: Min = 20mm x 20mm, Max = 20 x 25mm Counter Electrode: Min = 30mm x 20mm, Max = 50mm x 20mm	

Ultrasonic Soldering Station



Use

Dyesol ultrasonic solderer is your best choice for flux free, high quality ultrasonic soldering.

Description & Benefits

In the past, flux and heating were the typical method to be used for soldering, but special new generation solderers, as Dyesol ultrasonic one, introduce a new type of soldering, based on heat and ultrasonic vibrations. The induced cavitation effect replaces usage of flux as well as the cleaning process, since there is no exhaust fumes and pollution.

By combining this device with peculiar solder alloys (purchasable from Dyesol), the customer can solder on almost of all the materials, for example glass, ceramics, aluminium, molybdenum etc. (except for organic substances) On the Dyesol ultrasonic solderer can be mounted tips from 1 mm to 4 mm adjustable by 0.5 mm unit, with a 45° tapered cut or straight one.

Characteristics

- User-friendly interface
- By combining Dyesol ultrasonic solderer with peculiar solderer alloys, the customer can solder directly on glass/ceramics/unsolderable materials.
- New feed-back method developed from careful research of oscillator frequency settings enables stable, reliable work.
- Output adjustable by stepless control
- Temperature can be set within 200°C 500°C by 10°C unit
- Temperature ascend time: 1 min to 400 min
- Frequency, power output and temperature can read out from a display and easily replicated when necessary.
- Small, compact design enables easy changes of working station.
- Suitable for use abroad, with AC ranging from 100V to 240V.
- CE mark compatible

Applications

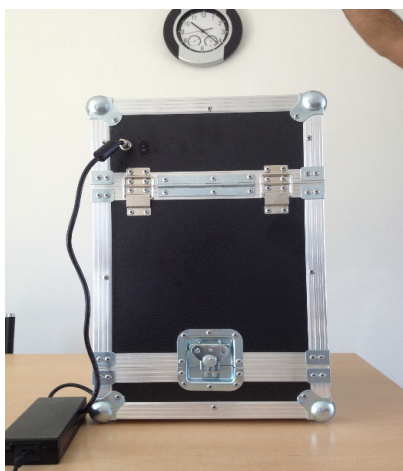
- Small scale production.
- For use in laboratory conditions, while preparing data before mass production and for inspection purposes.
- Soldering electrodes for display goods.
- Soldering electrodes for solar cells.
- Soldering electrodes on highly conductive ceramic substrates. Bonding electronic parts.
- EL lighting.

Oscillator	
Ultrasounds frequency	Frequency adjustment 60KHz±5KHz
Ultrasonic oscillations output	1 - 12W, adjustable by 0.1W unit
Heater temperature setting	220 °C – 500 °C
Temperature adj	By 10°C
Power supply	AC100V/240V 50/60Hz 200W
Size	210×235×90(mm)
Weight	About 5 kg

Soldering Iron	
Oscillator	(P.Z.T)60KHz
Iron base	Special stainless steel
Tip shape	Straight cut or taper cut (please choose one)
Tip diameter	Dia 1.0 - 4.0mm, adjustable by 0.5mm
Heater	High-performance sheathed heater 65W
Size	Dia 136 (max) × 250 (mm)
Weight	About 210g (with cord)

TEST EQUIPMENT

LED Light Soaker chamber - available soon



Use

Use new LED Dyesol's Light Soaking Chamber to illuminate Solar Cells with emulated sunlight, accelerate cell aging, and conduct long term performance and stability testing of solar cells or tiles.

Description & Benefits

Dyesol's LED Light Soaking Chamber will enable you to soak your Solar cells with emulated sunlight Class ABA on 90% and control light soaking experiments through a number of specific control features.

The LED Light Soaking Chamber was developed to facilitate long term performance and stability testing of Solar cells or tiles.

The chamber is fitted with a multy LED matrix which provides about 1 SUN incident power. The standard interior irradiation chambers have a footprint of 40 cm x 40 cm. The Dyesol LED light soaker guarantees a stable spectral distribution over temperature.

The LED Light Soaking Chamber has a system of integrated cooling fans and vents in order to maintain thermal stability of devices being tested. For optimal thermal stability the Light Soaking Chamber should be placed in an air conditioned room. An open frame configuration is also available.

Specifications	
Features	Description
Interior chamber	40 cm X 40 cm
Spot dimensions	15 cm X 15 cm
Incident power	About 1000 W/m ²
Lamp	Multy high quality LED matrix
Power consumption	200 W
Lamp lifetime	> 12.000 h
Lamp cooling	Air cooling with fan
Spectral match	Class A
Temporal stability	Class A
Spatial uniformity	Class B

Electrochemical Impedance Instrument



Use

Use the Electrochemical Impedance Instrumentation to measure the impedance characteristics of your dye solar cells or modules

Description & Benefits

The Electrochemical Impedance Instrumentation is a state-of-the-art tool that will help you with quality control and enable you to characterise resistive, recombination, electron transport and diffusional power losses, ageing mechanisms for cells or modules, counter electrode performance, corrosion processes and even seal quality.

Also known as AC Impedance Spectroscopy, the technique involves the application of AC voltage signals over a wide frequency spectrum at present DC bias voltage while analysing the current amplitude and phase shift. Alternatively, the instrument can be used in galvanostatic mode, i.e. modulating the current while monitoring the voltage. In addition, the equipment can be used for a range of electrochemical techniques, such as potentiometry, cyclic voltammetry, etc. for determining redox potentials, elucidating electrochemical reaction mechanisms, determining concentrations, kinetic rate and diffusion constants, etc.

Purchase of the Electrochemical Impedance Instrumentation includes tooling, techniques and technical assistance to set up a robust Electrochemical Impedance and general electrochemistry operating system.

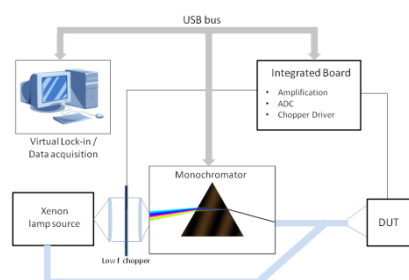
The output is $\pm 1A$ at $\pm 12V$ with $\pm 20V$ compliance voltage. The system is an excellent compromise between current capability up to 1A for measuring devices under illumination and very low current sensitivity, e.g. for measuring impedance of high quality coatings, such as for corrosion protection.

The instrument has 9 current ranges and post gain offset capability which allow for a maximum resolution of 3.3fA. 16-bit D/A and A/D converters provide accurate results down to $1\mu V$ resolution.

On-board electronics allow EIS scans from $10\mu Hz$ to 1MHz without the need for an external FRA or lock-in amplifier. Extensive voltage and current channel filtering provides low noise levels of $<20\mu V_{rms}$

Specifications		
Features	Description	Benefit / Additional Information
Potentiostat / Galvanostat / ZRA		Portable EIS system consisting of a notebook in conjunction with all hardware and software as outlined
Notebook	High performance Notebook matched to requirements: <ul style="list-style-type: none"> • 450MHz processor or faster • Two 25cm (10") PCI slots for each Potentiostat • 512MB RAM • 80MB free hard disk space 	
Software	PHE200 Physical Electrochemistry Software	
EIS Test Jigging & Light Exclusion fixture	EIS for DSC – analysis tools (an educational tool for technologies)	
Cyclic Voltammetry	Yes (option)	

IPCE open system



Use

Use Dyesol's Incident Photon-to-Current Efficiency (IPCE) Measurement Apparatus to ascertain device spectral response to incident light of different wavelengths.

Description & Benefits

Dyesol's IPCE Measurement Apparatus is an indispensable tool for DSC research and performance measurement and is highly complementary to IV characterisation. It shows the spectral response of the device to incident light with different wavelengths, ranging from UV to the Infrared region and provides insights into the operation of the device.

The equipment assists with the design of new and efficient dyes in DSC research, rendering an understanding of the correlation between the chemical modification of the sensitiser and the resulted change in the absorption spectrum to enable a better match to the solar spectrum.

It is also of particular interest to researchers investigating new photoanodes and electrolytes, since any interaction between the photoanode, the sensitiser and the electrolyte would manifest itself as a spectral shift of a change in the IPCE spectrum but might not be reflected in the photovoltaic parameters.

This system is based on design and technical solutions that are optimized for the organic and hybrid photovoltaic technologies. The deep use of integrated electronics reduces the size and the complexity of the system, resulting in a smart and easy-to-use instrument. The Dyesol experience in setting up and optimization of measurement systems allows for a wide tuning of performances and parameters and a full customization of the apparatus, meeting all your requirements.

Specifications	
Features	Description
Light source	<ul style="list-style-type: none"> 100 W Xenon arc lamp for probe integrated white bias option for 0.1 sun – 1 sun power density (adjustable) Probe light beam size: 10 mm Monochromatic light modulation: 0.5 Hz - 100 Hz
Monochromators	<ul style="list-style-type: none"> Monochromatic light wavelength range: 350 nm – 850 nm (standard), 300 nm - 2000 nm (extended) Motorized control monochromator with up to three gratings Selectable wavelength updating step (5 nm as default step) Motorized filter wheel with order-sorting filters Calibrated reference Si photodiode Spectral bandwidth of the monochromatic light: 1 nm (standard), 5 nm , 10 nm Wavelength accuracy: <ol style="list-style-type: none"> $\pm 0.3\text{nm}@1200\text{ l/mm}$, blaze 300nm (1st grating) $\pm 0.6\text{nm}@600\text{ l/mm}$, blaze 500nm (2nd grating) $\pm 0.8\text{nm}@300\text{ l/mm}$, blaze 1250nm (3rd grating)
Software	Software control routine based on National Instruments Lab View, allowing integration with common software routines
Dimensions	D 400 mm x W 600 mm x H 300 mm
Temperature control	Optional

Solar Simulator Xenon



Use

Use Solar Simulators to test your Dye Solar Cells across the solar spectrum from 400-1100 nm (basic configuration) for performance, durability and stability.

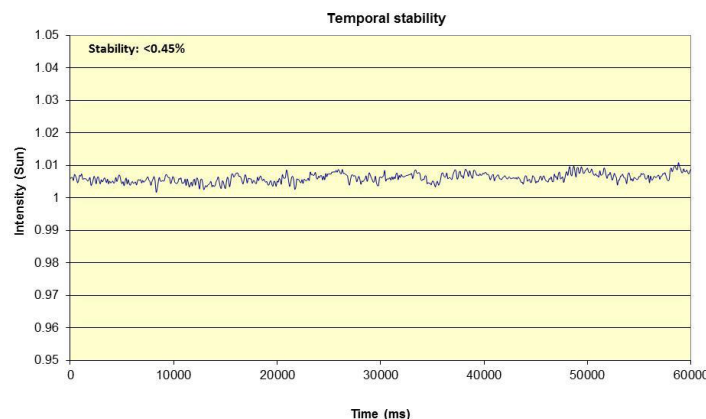
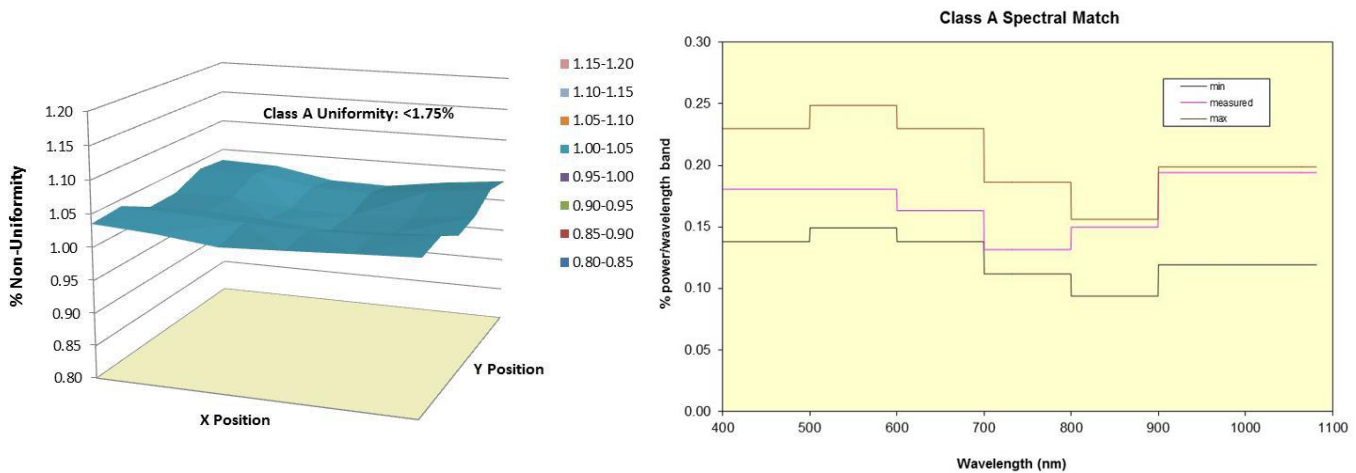
Description & Benefits

The sun simulators provided by Dyesol are all Class AAA and are available in a variety of models and aperture size (52 x 52mm, 156 x 156mm, 208 x 208mm, and 300 x 300mm).

With the use of advanced uniform beam optics, which includes special coated mirrors, filters, and a beam uniformity integrator, Dyesol solar simulator delivers highly accurate, collimated beams with the longest working distances.

All of DYESOL's Solar Simulators are certified to ASTM E927-05, IEC 60904-9 2007, and JIS C 8912 standards for Class AAA performance (Spectral Match 400 – 1100nm wavelength in 100nm bandwidth increments, Non-Uniformity, and Temporal Instability).

Available options include upgrades in the spectral match using special filters for performance testing Dye Sensitized (DSSC), Perovskite (PS), Organic (OPV), Concentrated Photovoltaic (CPV) and Multi-junction GaAs based solar cells. DYESOL's simulator filters are designed to Air Mass 1.5 Global (AM 1.5G) specifications but other air mass filters are also available. Without compromising Class A spectral match, the beam intensity can be adjusted from 0.8 – 1.1 Suns by using the one-touch button. DYESOL's Solar Simulators come in standard configurations with the adjustable power mode, but can be upgraded to include both constant power or constant intensity operations. A variable power supply allows the beam intensity range to be from 0 suns to 1.1 suns. In the constant intensity mode, lamp power automatically adjusts to maintain a constant 1 Sun Intensity as lamp power starts to degrade over time.



System specification		Sun simulator Features
Special	DYESOL 52	Constant current*
	DYESOL 156	Constant current*
	DYESOL 208	Constant current*
	DYESOL 300	Constant intensity
		Advanced Uniform Beam Optics
Spectral range **	400 – 1100 nm	
Illumination area	DYESOL 52	2 in X 2 in (52 mm X 52 mm)
	DYESOL 156	6 in X 6 in (156 mm X 156 mm)
	DYESOL 208	8 in X 8 in (208 mm X 208 mm)
	DYESOL 300	12 in X 12 in (300 mm X 300 mm)
		Meets JIS, IEC, ASTM Standards
Collimated angle	DYESOL 52	Half angle $< \pm 2.5$
	Others	Half angle $< \pm 2$
		Longest working distance
Typical power output	100 mW/cm ² (1 SUN)	
		Perfect for R&D and Production
Spatial uniformity	$\leq 2\%$ (CLASS A)	
		Ideal for IV Testing & Light Soaking
Temporal (ST)	$< 0.5\%$ ST & $< 2.0\%$ LTI (CLASS A)	
		3 year Class AAA Performance Warranty
Spectral Match 400 – 1100 nm	+ 25% (CLASS A)	
		Options
Working distance	DYESOL 52	12 \pm 0.5 in
	DYESOL 156	22 \pm 0.5 in
	DYESOL 208	25 \pm 0.5 in
	DYESOL 300	30 \pm 0.5 in
		Upgradable to 350nm-1800nm range
Lamp Power	DYESOL 52	300 W
	DYESOL 156	1000 W
	DYESOL 208	1600 W
	DYESOL 300	4000 W
		Configurable for DSSC, Organic, Multi-junction & CPV solar cells
Power Requirements	DYESOL 52	120 VAC/8A 230 VAC ^{***} /5A 50-60 HZ
	DYESOL 156	120 VAC/15A 230 VAC ^{***} /10A 50-60 HZ
	DYESOL 208	240 VAC/10A 230 VAC ^{***} /10A 50-60 HZ
	DYESOL 300	208 VAC/3Phase/30A 400 VAC ^{***} /3Phase/25A 50-60 HZ
		Available with Automated Constant Intensity

Solar Simulator Hyperion



The Hyperion Solar Simulator is a unique piece of equipment in the solar light emulation environment. It is the perfect joint between the best qualities of a standard high performing solar simulator and a long life light soaker with the addition of peculiar characteristics that only LED technology can give.

It allows the user to test the device under the most stringent standards and at the same time to light soak the samples in a way that was possible before only by using different machines or very expensive filters (ie. illuminate the DUT with just UV & IR frequencies or with customised spectrum).

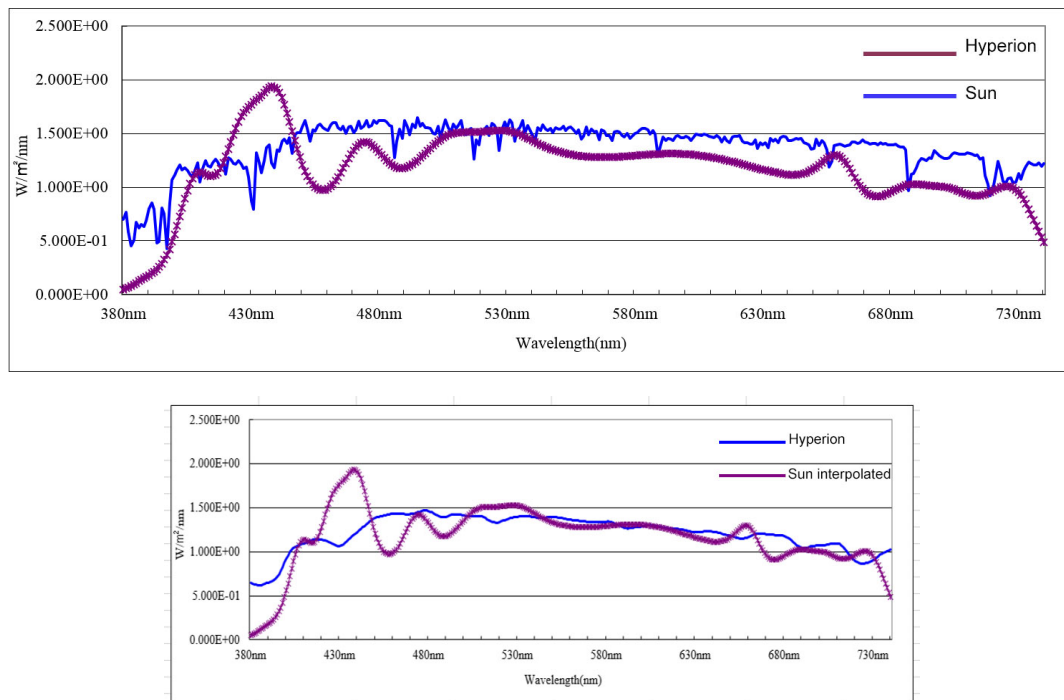
All this joint with a very reduced running cost make the Hyperion Solar Simulator the perfect choice as a light source to test your devices.

Specifications	
Features	Description
Internal chamber dimensions	40 cm X 40 cm
Spot dimensions (AAA class)	15 cm X 15 cm
Incident power	About 1000 W/m ² for extended emission version
USB controller	Customize spectral distribution profile (sunset, sunrise, cut specific band emission, ...)
Spectral profile	AM1.5G
Custom Spectral profile (optional)	Upon request
Lamp	Multy high quality LED matrix
Emission bandwidth	400 nm – 1100 nm
Power consumption	200 W
Lamp lifetime	> 12.000 h
Lamp cooling	Air cooling with fan
Spectral match	Class A
Temporal stability	Class A
Spatial uniformity	Class A
Flycase	Open frame
Electrical class	2
Power supplies	SELV 2

Dyesol developed an innovative AAA modular solar simulator utilizing LED matrixes as light sources. The system has an innovative Controller (included in Premium model) and the revolutionary LED Matrix Source Head.

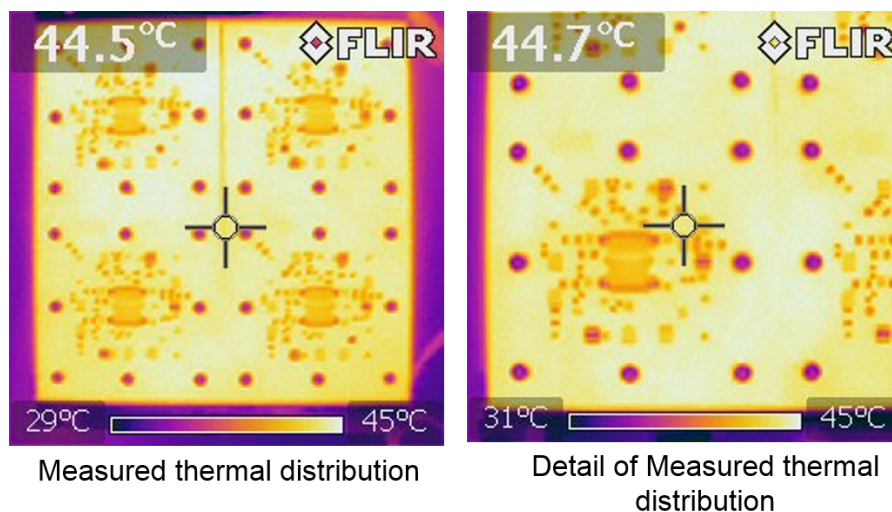
The system provides variable output that enables the user to choose an incident power that goes from 0.2 Sun up to 1.0 Sun over all the illumination area. LEDs peculiar physical characteristics allow end user to perform measurements at incident power even lower to 0.2 Sun, this simply moving DUT farther away from the light source (spectral uniformity remains constant with the distance).

The Hyperion Solar Simulator is a AAA class rated to IEC 60904-9 for Spectral Match, Non-Uniformity of Irradiance, and Temporal Stability. The LEDs geometry on the LED matrix has been undergoing rigorous testing for all the standards to ensure full compliance.



Hyperion drives independently multiple LEDs wavelengths spaced over the spectrum from 400 nm up to 1,100 nm to ensure a spectral match meeting Class A certification. The independent control of each LED allows the user to tune the output and create its own emission spectra. This adjustment can be done easily via software, directly from a common laptop through a T port and then be saved as a pre-set value in the controller section. The software is a very useful and essential tool that allows the customer also to program illumination cycles, like standard night and day, or even customised cycles to simulate, for example, cloudy days, shadows and so on.

The typical lifetime of LEDs is over 12000 hours, reducing the total cost of ownership of the simulator to a fraction of the xenon ones. The LEDs come up to a stable operating power within about 100 msec. This allows the unit to be shut off between tests without having to wait for the lamp to stabilize, in order to guarantee the integrity of the test results and shortening the LEDs lifetime. Hence, the effective lamp usage time is several times more efficient than a conventional lamp and eliminates the need for shutters on the output.





WWW.DYESOL.COM - PURCHASE@DYESOL.COM