Dr. HANS WERNER®
CHEMIKALIEN

'Solar Encapsulates, EVA, POE, EPE Films'

Products Catalog

Content

Leading
European Solar Encapsulate
Manufacturer

About Us

Aim to push technology advancing to reliable products:

Renewable energy comes from eco-friendly natural resources that never run out, but it takes modern technology to convert it into easy-to-use natural energy. Dr Hans Werner Chemicals is a solar EVA, POE and EPE film encapsulate manufacturer that was established in September, 2022 and located in Antalya Industrial Area. The company is a high-tech enterprise focusing on product development, Research & Development, production and sales of new EVA, POE and EPE film encapsulation materials for PV solar module manufacturing. The product performance is leading in Turkiye and reaching the international advanced level. Our products will make customer's reliable partner. We take science and technology as the guide.

Our Mission

DrHWC is dedicated to advancing the solar industry by providing most advanced solar encapsulate solutions.

We strive to empower our partners with innovative materials that optimize solar panel performance and ensure long-lasting reliability, contributing to a sustainable energy future.

Our Vision

DrHWC aspires to be the world's leading innovator in solar film technology, driving the widespread adoption of solar energy.

We envision a future powered by clean, reliable solar energy, where our advanced encapsulate solutions play a critical role in maximizing efficiency and ensuring the longevity of solar panels.

Quality Control

At Dr. HWC, we conduct quality inspections and tests from the acceptance of raw materials to the placement of product palettes on transport vehicles. All raw materials and packaging materials are stored in air-conditioned warehouses and undergo quality assurance procedures before use. In addition to focusing on innovation and R&D in solar encapsulation, EVA, POE, and EPE films, we aim for continuous improvement in quality. Our efforts encompass capsules that are not only economically and environmentally friendly but also feature more stable and longer-lasting encapsulation with reduced curing times, addressing concerns related to occupational health and safety.

To maintain our high product quality, all necessary quality measurements for solar capsules, such as visual controls, GSM, thickness, width, thermal shrinkage, thermal conductivity, gel content, adhesion strength to glass/backsheet, elongation percentage, tensile strength, optimum permeability, and UV cutoff levels, are routinely tested.

Your Reliable Partner for Solar Encapsulate **Solutions**

Advantanges

Quality Assurance

Gel Content
Decides PV panel durability

Adhesion (Peel bond) with Glass (Eva holding on to the glass can calculate the strength)

Adhesion (Peel bond) with Back sheets(Eva's backsheet clinging calculates the strength)

UV cut-off wavelength
(UV light impermeability of the bottom panel Percentage)

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Optical Transmittance

Elongation at Break

Volume Resistivity
PID resistant evaluation property

DSC
Curing energy and polymer melting behaviour

Company's Strengths

Factory established on **30,000** sqm area.

Annual Production capacity **5 GW.**

R&D center and state-of-art laboratory.

Adequate raw material stock.

Over **10 years** of rich in expertise experience.

The Future of Solar Encapsulation

Dr. HANS WERNER®
CHEMIKALIEN
'Solar Encapsulates EVA, POE, EPE Films'

Dr. HANS WERNER CHEMIKALIEN®

ACID FREE EVA FILMS
For Encapsulating Solar PV Panels
(EU408*C* & ET409*C* & ET410*C* FAST CURE)

This series of EVA films is a fast-curing product, especially suitable for encapsulating TOPCON and HJT solar cells

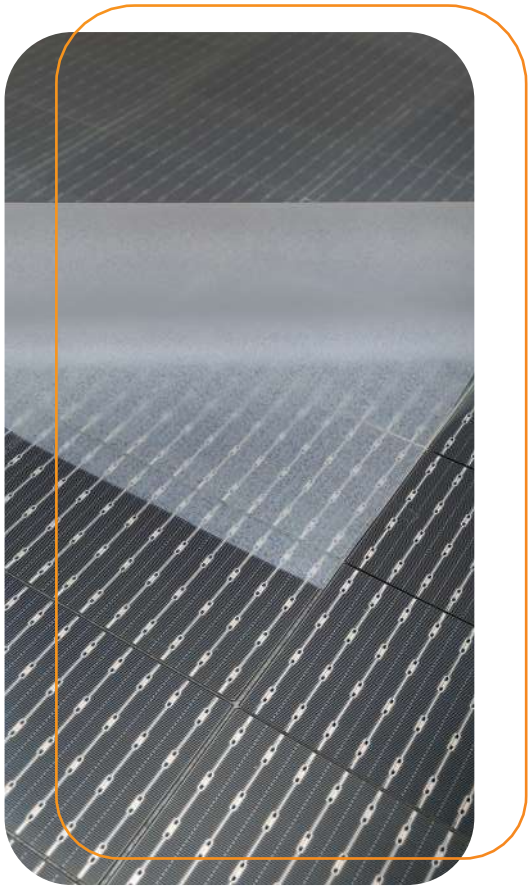
PRODUCT SPECIFICATION

01 **Low acid release**, active protection for metals, widely compatible with N-type solar cell pastes and HJT solar cells.

02 High volume resistivity, excellent anti-PID performance across various solar cells.

03 The products have good compatibility with different brands of glass, backsheets, solder tapes, silver pastes and positioning tapes, as well as equipment.

04 Wide adhesion adaptability, excellent adhesion with TOPCON/HJT solar cells.



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Dr. HANS WERNER®
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'Solar Encapsulates EVA, POE, EPE Films'

Technical Specification

Properties	Unit	EU408*C*	ET409*C*	ET410*C*
Product Use	/	PERC/TOPCON/HJT	PERC/TOPCON/HJT	HJT
Product Type	/	UV Cut-off	UV Through	UV to Blue light
Shrinkage	%	MD≤3.0; TD≤1.0		
Transmittance (380-1100nm)	%	≥91		
UV Cut-off Wavelength	nm	360nm/380nm(HJT)	UV Through	UV to (400-500)nm
Gel Content	%	≥80		
Volume Resitivity	Ω.cm	$\geq 1.0\times10^{15}$		
Dielectric Strength	KV/mm	≥28.0		
CTI (Comparative Tracking Index)	V	≥600		
Adhesion	N/cm	≥80		
Tensile Strength	MPa	≥16		
Elongation At Break	%	≥600		
DH1000h	%	≤4.0 (TOPCON:EPE+EVA, DH1000h, Double Glass) ≤5.0 (TOPCON:EPE+EVA, DH2000h, Double Glass)		
UV Aging	/	ΔYI≤4.0 (120KWh/m^2)		
PID Test	%	≤4.0 (TOPCON:EPE+EVA, PID 192h, Double glass)		

Films testing standard according to GB/T 29848-2018, PID test condition: 85°C, RH85%, -1500V, 192h

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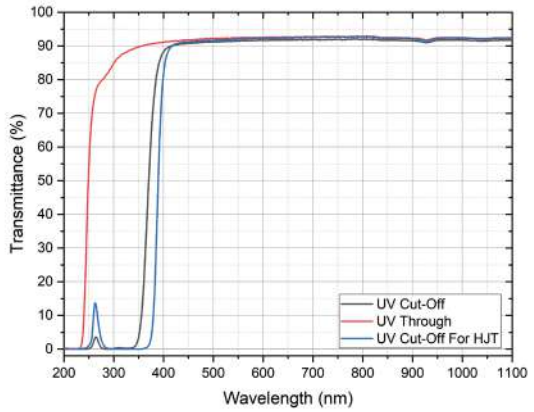
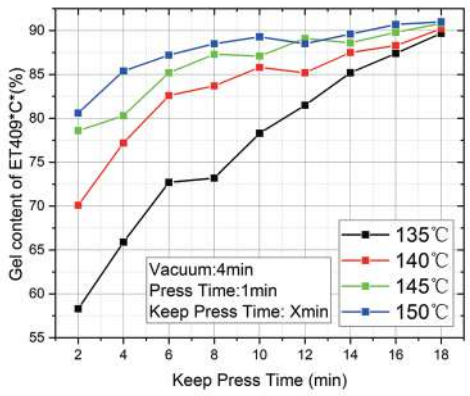
KEY PROPERTIES

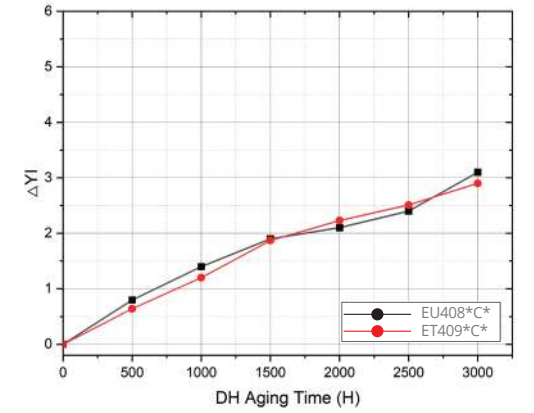
Transmittance



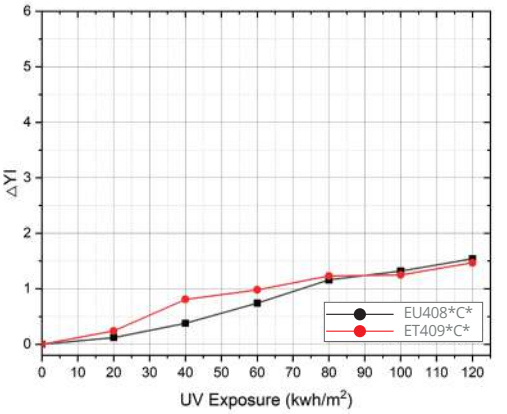
Crosslink Curve



DH YELLOW (85°C, RH85%)



UV Yellowing (340nm, 1.8 W/m^2)

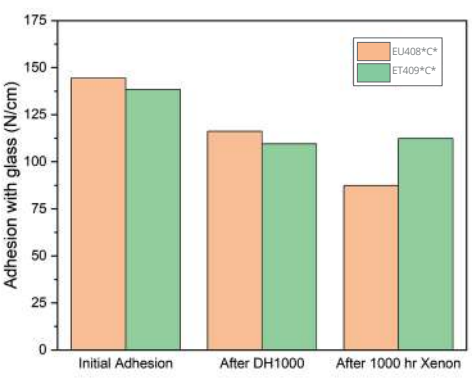


Anti Snail-track

85±2°C, RH85±5%, 8A
Structure: Glass / EVA / TOPCon Cells / EVA / Glass

Sample	0h	200h	400h	600h
EU408*C*/ET409*C*	OK	OK	OK	OK
Comp. A	OK	OK	NG	NG
Comp. B	OK	NG	NG	NG

Long-lasting adhesion



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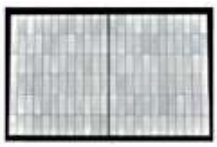
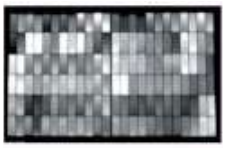
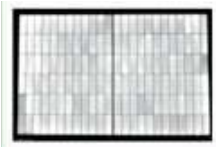
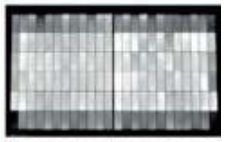
PV modules aging test

Structure: Glass / EVA / TOPCon Cells / EVA / Glass

Encapsulation Film Combination	(85°C, RH85%, -1500V, 192h)			
	Initial	192H	After UV	Power Loss (%)
EVA (EU408*C*)+EVA (ET409*C*)				Front: -3.32% Back: -2.67%

Structure: Glass / EVA / TOPCon Cells / EVA / Glass

Encapsulation Film Combination	DH (85°C, RH85%, -1000h)			
	Initial	1000H	Front Side Power Loss (%)	Back Side Power Loss (%)
EVA (EU408*C*)+EVA (ET409*C*)			-3.76%	-2.67%

Recommended Lamination Process

Laminate parameters	Single Chamber	Double Chamber	
		First Chamber	Second Chamber
Temperature (°C)	140~155	130~140	145~155
Vacuum (min)	6~3	4~7	0~3
Press (KPa)	-60/-30/-10	-30~0	-30~0
Keep Press (min)	15~10	2~6	8~15

In the actual lamination process, the cross-linking degree reaches the design value and the component yield is high as a guideline, which is adjusted according to the **actual working conditions on site.**

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ACID FREE EPE(EVA-POE-EVA) FILMS
For Encapsulating Solar PV Panels
(EPEU307*C* & EPET306*C* & EPET309*C* FAST CURE)

This series of EVA films is a fast-curing product, especially suitable for encapsulating TOPCON and HJT solar cells

PRODUCT SPECIFICATION

01 **Low acid release**, active protection for metals, widely compatible with N-type solar cell pastes and HJT solar cells.

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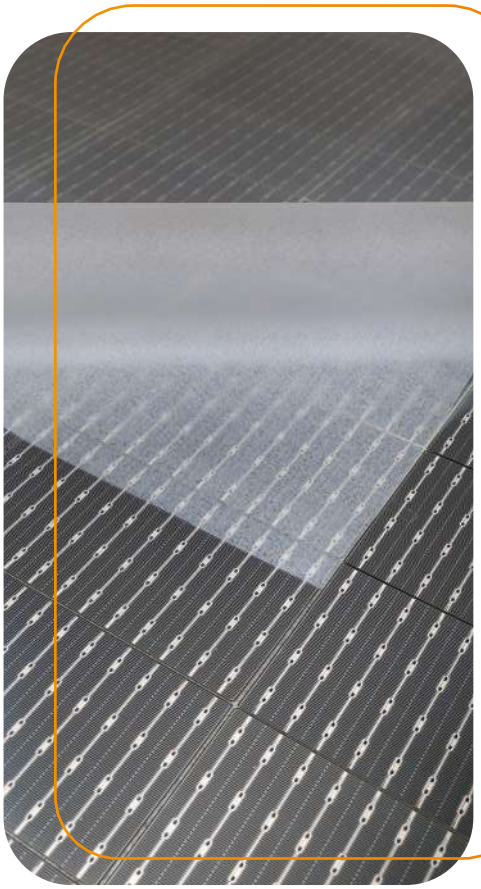

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Technical Specification

Properties	Unit	EPEU307*C*	EPET306*C*	EPET309*C*
Product Use	/	TOPCON/HJT		HJT
Product Type	/	UV Cut-off	UV Through	UV to Blue light
Shrinkage	%	MD≤3.0; TD≤1.0		
Transmittance (380-1100nm)	%	≥91		
UV Cut-off Wavelength	nm	360nm/380nm(HJT)	UV Through	UV to (400-500)nm
Gel Content	%	≥75		
Volume Resitivity	Ω.cm	$\geq 1.0\times10^{15}$		
Dielectric Strength	KV/mm	≥28.0		
CTI (Comparative Tracking Index)	V	≥600		
Adhesion	N/cm	≥65		
Tensile Strength	MPa	≥10		
Elongation At Break	%	≥600		
UV Aging	/	ΔYI≤4.0 (120KWh/m^2)		
Component Power Loss	%	≤5 (IEC G2804)		
Humidity and Heat Resistance	/	ΔYI≤4.0		

Films testing standard according to GB/T 29848-2018, PID test condition: 85°C, RH85%, -1500V, 192h

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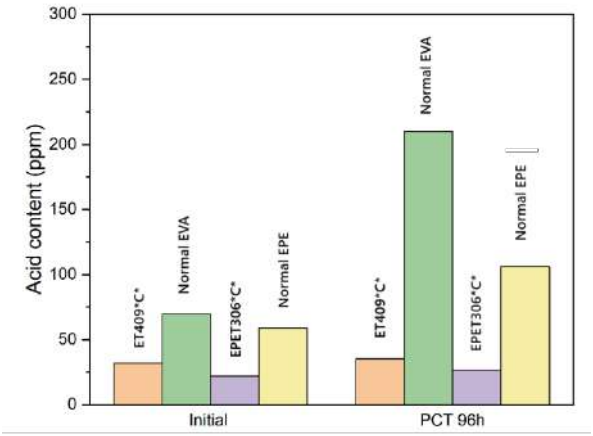
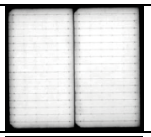
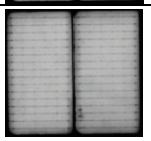
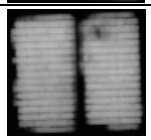
Acid-free Technology of Encapsulating Films

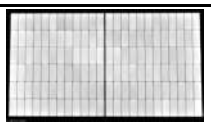
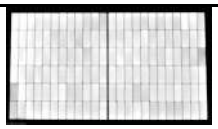
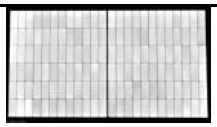
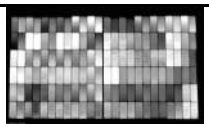


Acid content of different films

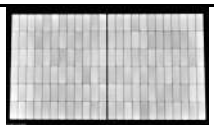
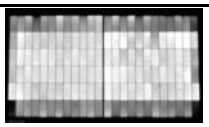
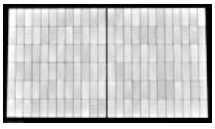
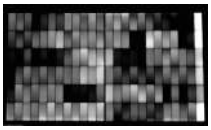
Solar Cell Type	Sample	PCT Test (121 °C, 100%RH)	
		Initial	96h
TOPCON Solar Cells (G/G)	EPET306*C*+EPET*306C（Acid-free）		
	EPE+EPE (Normal type)		

Moisture and Heat Resistance of Low-Acid Film

Anti-PID Performance of Acid-free Films

Encapsulation Film TOPCON Solar Cells		PID Test Results (85°C, 85%RH, -1500V, 192h)		
		Initial	192h	Power Loss (%)
1	EPET306*C*+EPET306*C*（Acid-Free) (G/G)			1.24%
2	EPE+EPE (Normal type) (G/G)			8.48%

Anti Damp Heat Performance of Acid-free Films

Encapsulation Film TOPCON Solar Cells		Damp Heat Test Results (85°C, 85%RH, 2000h)		
		Initial	2000h	Power Loss (%)
1	EPET306*C*+EPET306*C*（Acid-Free) (G/G)			3.47%
2	EPE+EPE (Normal type) (G/G)			13.41%

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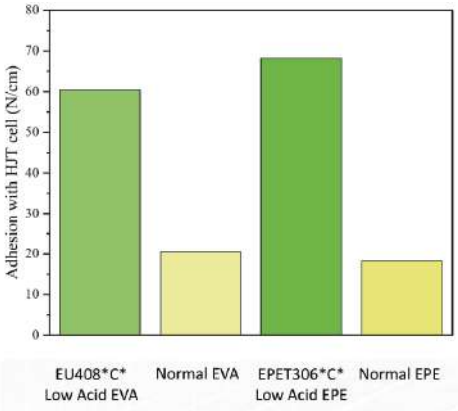
Encapsulating Solutions For HJT G/G Modules

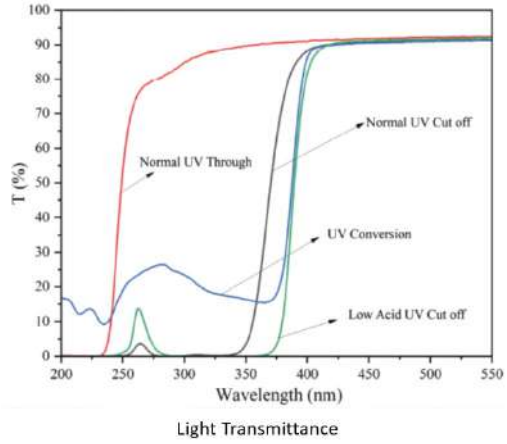
Front Glasss
EPET309*C* (UV conversion)
HJT Solar Cells
EPEU307*C* (UV Cut-off)
Rear Glass

	Front Glasss	
P	ET410*C* (UV conversion)	P
I	HJT Solar Cells	I
B	EU408*C* (UV Cut-off)	B
	Rear Glass	

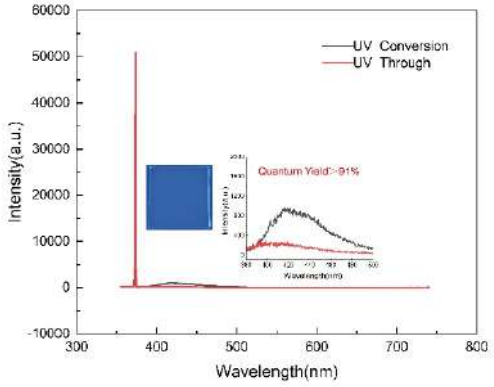
Good Adhesion with HJT Solar Cells



UV Conversion for HJT Solar Cells

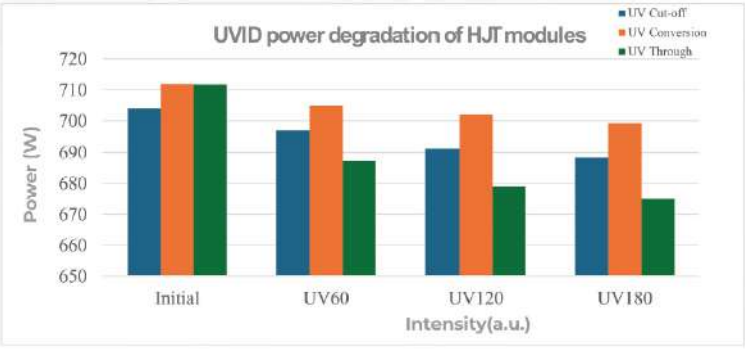


Light Transmittance



UVID Testing Results with UV Light Conversion Film

Structure: Glass / EPE / HJT Solar Cells / EPE / Glass



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Recommended Lamination Process

Laminate parameters	Single Chamber	Double Chamber	
		First Chamber	Second Chamber
Temperature (℃)	140~155	130~140	145~155
Vacuum (min)	6~3	4~7	0~3
Press (KPa)	-60/-30/-10	-30~0	-30~0
Keep Press (min)	15~10	2~6	8~15

In the actual lamination process, the cross-linking degree reaches the design value and the component yield is high as a guideline, which is adjusted according to the **actual working conditions on site.**

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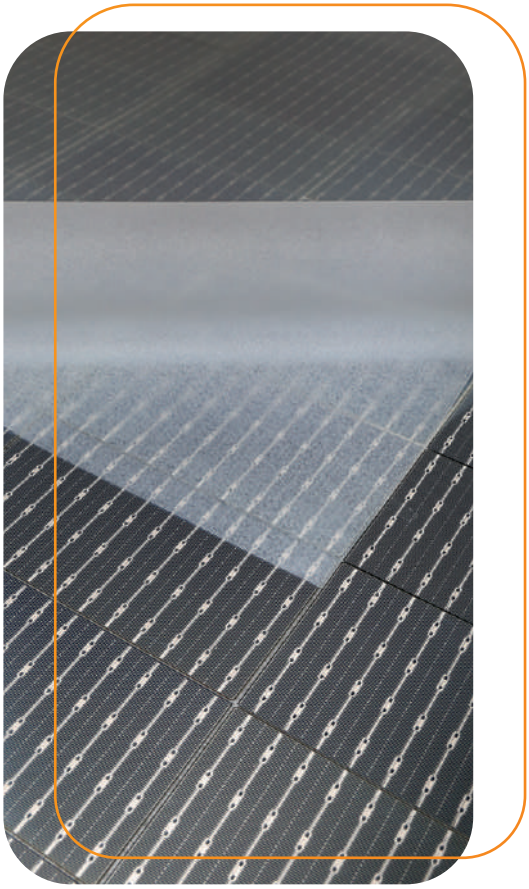
POE (Polyolefin Elastomers) FILM
For Encapsulating Solar PV Panels

PU307 & PT306 GRADES

PRODUCT SPECIFICATION

- High Adhesion with Solar Glass
- Excellent Transparency
- Strong Anti PID Ability
- Excellent UV Protection
- Low Water Vapor Rate
- Excellent Weatherability and Long Term Reliability



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Technical Specification (Dr. HWC-PU307 - PT306 Grades)

Properties	Unit	Test Method	Value	
			PU307	PT306
Total Thickness (Tolerance: ±0.05%)	mm	DR. HWC method	0.40 ~ 0.90	
Total Width	mm	Scale	Up to 1300	
Thermal Shrinkage (MD)	%	On solar glass (3 min, 125°C)	≤ 3	≤ 3
Thermal Shrinkage (TD)	%	On solar glass (3 min, 125°C)	≤ 1	≤ 1
Thermal Creep	mm	90°C, 250hrs	≤ 1	≤ 1
Shore Hardness	Shore A	ASTM D 2240	70 ± 5	70 ± 5
Melting Point	°C	ASTM D3417	70 ± 2	70 ± 2
Degree of Cross-linking (Gel Content)	%	Soxhlet Method Lamination (10 min,145°C)	≥ 70	≥ 70
Adhesion to Glass (With Backsheet)	N/cm	ASTM D 903	≥ 80	≥ 80
Adhesion to Backsheet	N/cm	ASTM D 903	≥80	≥ 80
Ultimate Elongation (Cured)	%	ASTM D 638	≥ 600	≥ 600
Tensile Strength (Cured)	MPa	ASTM D 638	12 ± 3	12 ± 3
Optical Transmittance (380nm-1100nm)	%	ASTM E424	≥ 91	≥ 91
UV Cut-off Wave Length	nm	DR. HWC method	340-360	UV transparent
Heat / Humidity Resistance (80°C, 85%RH, 2000hrs)	ΔYI	ASTM E 313	≤ 5	≤ 5
Water Absorption (Cured)	%	ISO 62-200805	≤ 0.1	≤ 0.1
Volume Resistivity (Cured)	Ω*cm	ASTM D 257	≥ $1*10^{15}$	≥ $1*10^{15}$

Lamination Recipe

Lamination Parameters	Unit	First Chamber	Second Chamber
Temperature	°C	120 - 130	145 - 150
Vaccum Time	min	5 - 7	5 - 7
Lamination Time	min	9 - 14	9 - 14
Pressure	kPa	-70 I -50 I -25	-70 I -50 I -25

Note 1: Customers can adjust to appropriate lamination parameters according to different equipment or process.
Note 2: It is recommended to use it up within 48 hours after opening of the original packing.
Note 3: These are typical laboratory values that may change depending on the cure conditions as well as the test conditions and methods.

UL Certification File Number: E531674

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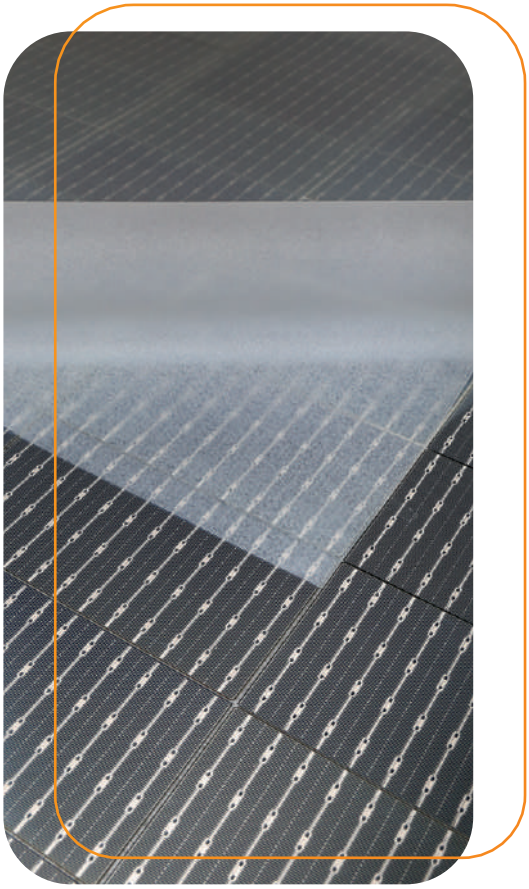
Dr. HANS WERNER CHEMIKALIEN®

EVA (Ethylene Vinyl Acetate) FILM
For Encapsulating Solar PV Panels

EU307 & ET306
ULTRA FAST CURE

PRODUCT SPECIFICATION

- High Tensile Strength
- Excellent Transparency
- Outstanding Adhesion
- UV Protection
- Snail Trail Protection
- Excellent Weatherability and Long Term Reliability



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Dr. HANS WERNER®
CHEMIKALIEN
'Solar Encapsulates EVA, POE, EPE Films'

Technical Specification (Dr. HWC-EU307 - ET306 Ultra Fast Cure)

Properties	Unit	Test Method	Value	
			ET306	EU307
Total Thickness (Tolerance: ±0.05%)	mm	DR. HWC method	0.40 ~ 0.90	
Total Width	mm	Scale	Up to 1300	
VA Content	%	DR. HWC method	28	28
Thermal Shrinkage (MD)	%	On solar glass (3 min, 125°C)	≤ 3	≤ 3
Thermal Shrinkage (TD)	%	On solar glass (3 min, 125°C)	≤ 1	≤ 1
Water Vapor Transmission	g/m²/24h	ASTM F1249	≤ 5	≤ 5
UV Resistance (300 kWh/m²)	ΔYI	ASTM G154	≤ 4	≤ 4
Humidity and Heat Resistance	ΔYI	ASTM E313	≤ 2	≤ 2
Thermal Conductivity	W/(m.K)	ISO 2207-4	0.27	0.27
Shore Hardness	Shore A	ASTM D 2240	70 ± 5	70 ± 5
Melting Point	°C	ASTM D3417	70 ± 2	70 ± 2
Degree of Cross-linking (Gel Content)	%	Soxhlet Method Lamination (10 min,145°C)	≥ 80	≥ 80
Adhesion to Glass (With Backsheet)	N/cm	ASTM D 903	≥ 80	≥ 80
Adhesion to Backsheet	N/cm	ASTM D 903	≥ 80	≥ 80
Ultimate Elongation (Cured)	%	ASTM D 638	≥ 600	≥ 600
Tensile Strength (Cured)	MPa	ASTM D 638	≥ 10	≥ 10
Optical Transmittance (380nm-1100nm)	%	ASTM E424	≥ 91	≥ 91
UV Cut-off Wave Length	nm	DR. HWC method	UV transparent	340-360
Dielectric Strength	kV/mm	ASTM D 149	≥ 25	≥ 25
Refractive Index	-	ISO 489	1.48	1.48
Water Absorption (Cured)	%	ISO 62-200805	≤ 0.1	≤ 0.1
Volume Resistivity (Cured)	Ω*cm	ASTM D 257	≥ 1*10¹⁵	≥ 1*10¹⁵

Lamination Recipe

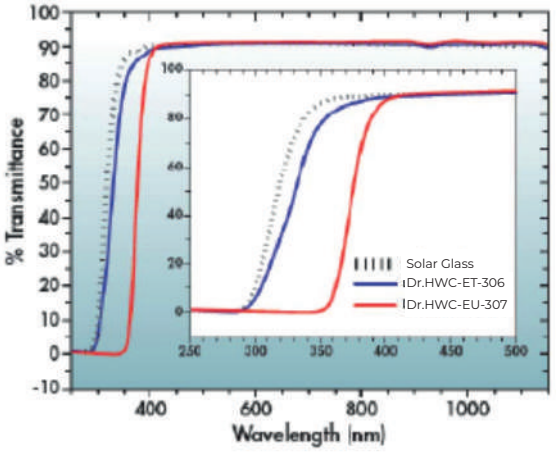
Lamination Parameters	Unit	First Chamber	Second Chamber
Temperature	°C	120 - 130	140 - 145
Vaccum Time	min	3 - 4	3 - 4
Lamination Time	min	6 - 8	6 - 8
Pressure	kPa	-70 I -50 I -25	-70 I -50 I -25

Note 1: Customers can adjust to appropriate lamination parameters according to different equipment or process.

Note 2: It is recommended to use it up within 48 hours after opening of the original packing.

Note 3: These are typical laboratory values that may change depending on the cure conditions as well as the test conditions and methods.

Light Transmittance Curve



UL Certification File Number: E531674

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Dr. HANS WERNER CHEMIKALIEN®

EVA (Ethylene Vinyl Acetate) INTERLAYER FILM

For Glass Lamination

ETG 306

PRODUCT SPECIFICATION

- High Tensile Strength
- Ultra Clear Transparency
- Outstanding Adhesion
- UV Protection
- High Cross-linking Degree
- Moisture Resistant (Open Edges)

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Technical Specification (Dr. HWC-ETG306 - EVA Film Interlayer for Glass Lamination)

Properties	Unit	Test Method	Value ETG306
Total Thickness (Tolerance: ±0.05%)	mm	DR. HWC method	0.40 ~ 0.90
Total Width	mm	Scale	Custom
VA Content	%	DR. HWC method	28
Thermal Shrinkage (MD)	%	On Glass (3 min, 125 °C)	≤ 3
Thermal Shrinkage (TD)	%	On Glass (3 min, 125 °C)	≤ 1
Water Vapor Transmission	$g/m^2/24h$	ASTM F1249	≤ 5
UV Resistance (300 kWh/m^2)	ΔYI	ASTM G154	≤ 4
Humidity and Heat Resistance	ΔYI	ASTM E313	≤ 2
Thermal Conductivity	W/(m.K)	ISO 2207-4	0.27
Shore Hardness	Shore A	ASTM D 2240	70 ± 5
Melting Point	°C	ASTM D3417	70 ± 2
Degree of cross-linking (Gel Content)	%	Soxhlet Method Lamination (10 min, 145°C)	≥80
Adhesion to Glass	N/cm	ASTM D 903	≥ 100
Ultimate Elongation (Cured)	%	ASTM D 638	≥ 600
Tensile Strength (Cured)	MPa	ASTM D 638	≥ 10
Optical Transmittance (380nm-1100nm)	%	ASTM E424	≥ 92
UV Cut-off Wave Length	nm	DR. HWC method	340-360
Dielectric Strength	kV/mm	ASTM D 149	≥ 25
Refractive Index	-	ISO 489	1.48
Water Absorption (Cured)	%	ISO 62-200805	≤ 0.1

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Your Reliable
Partner for Solar Encapsulate **Solutions**


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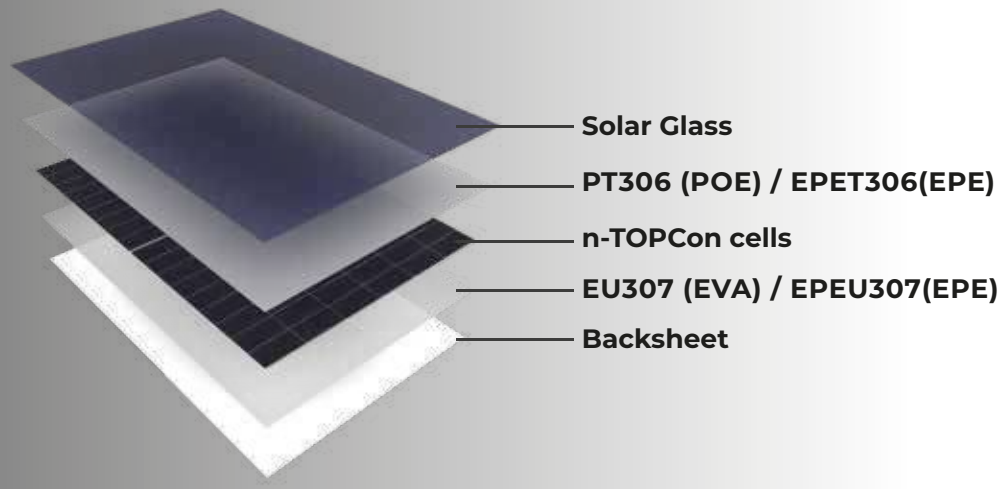
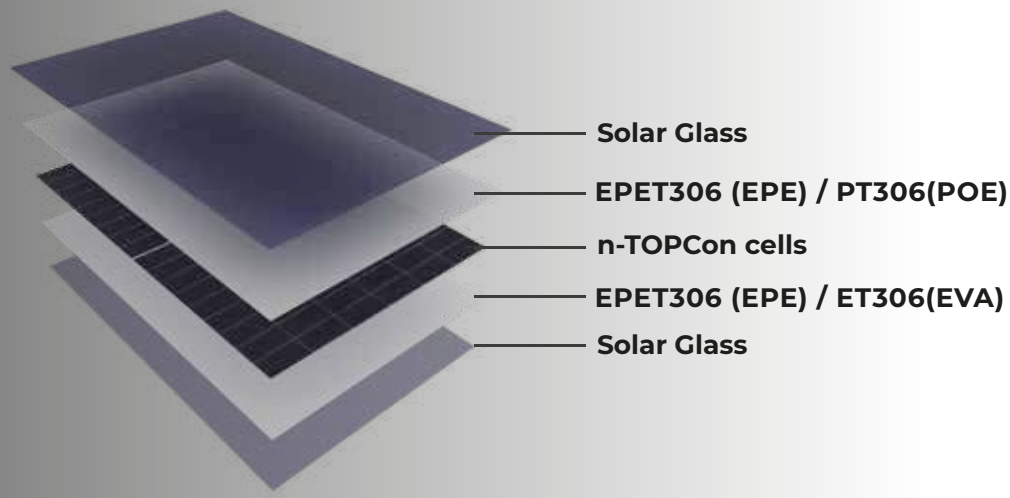
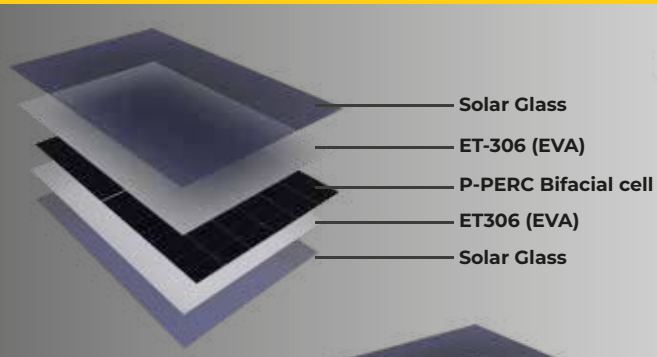
ENCAPSULATION SOLUTIONS

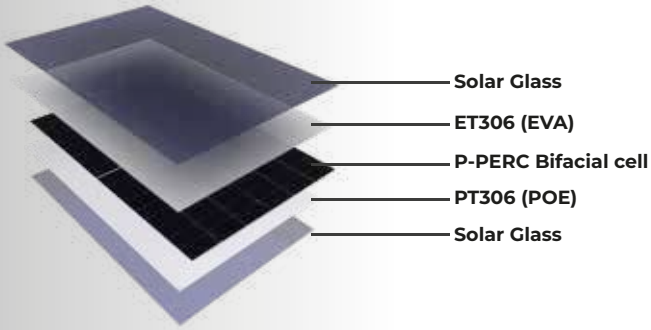
N-Topcon Modules

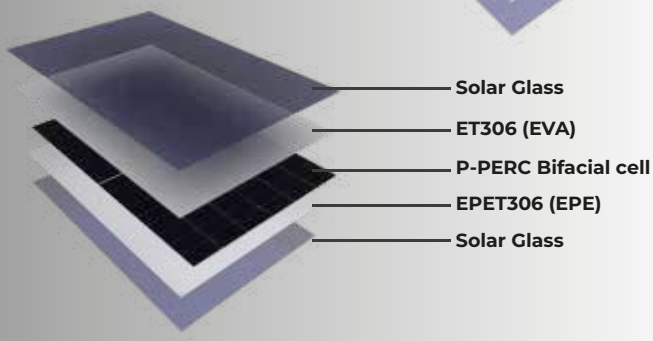




P-PERC Bifacial Glass-Glass Modules

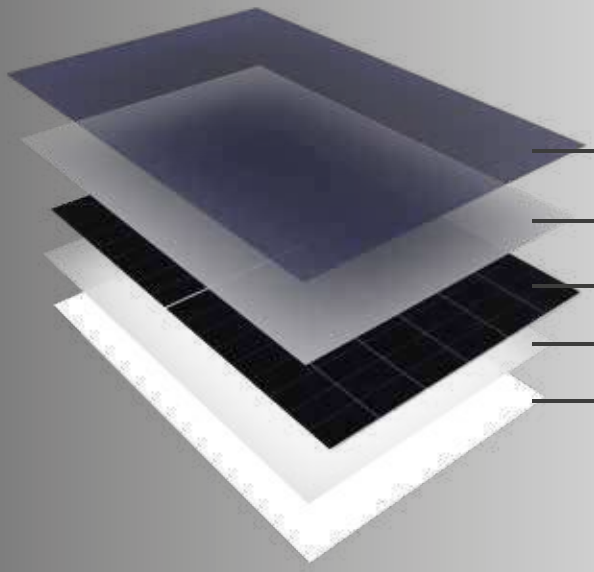




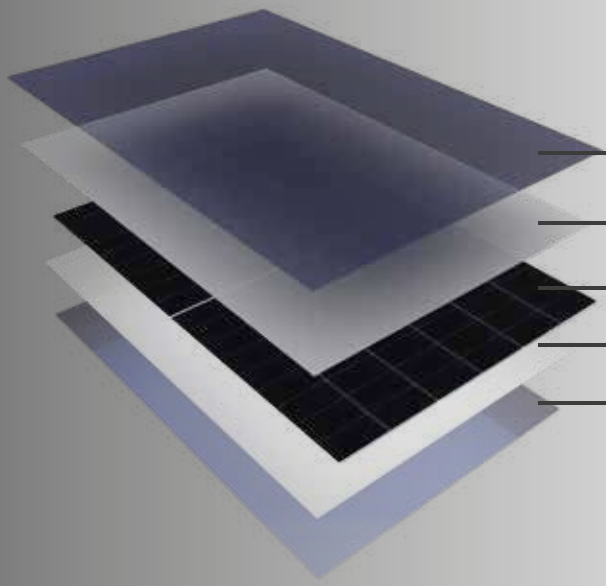


ENCAPSULATION SOLUTIONS

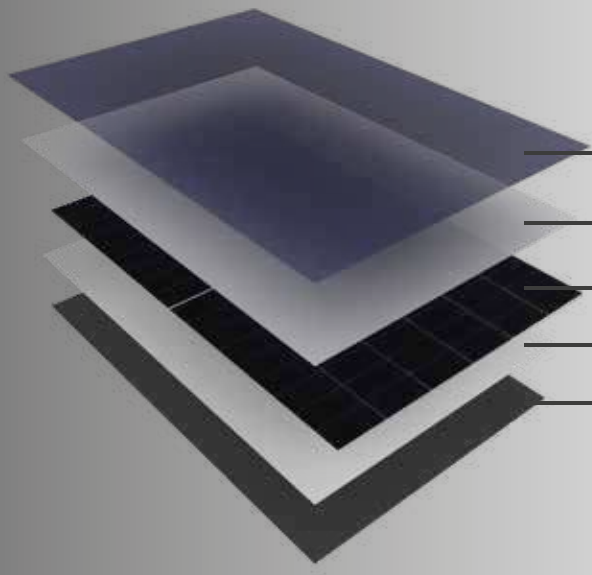
P-PERC Bifacial Glass-Backsheet Modules



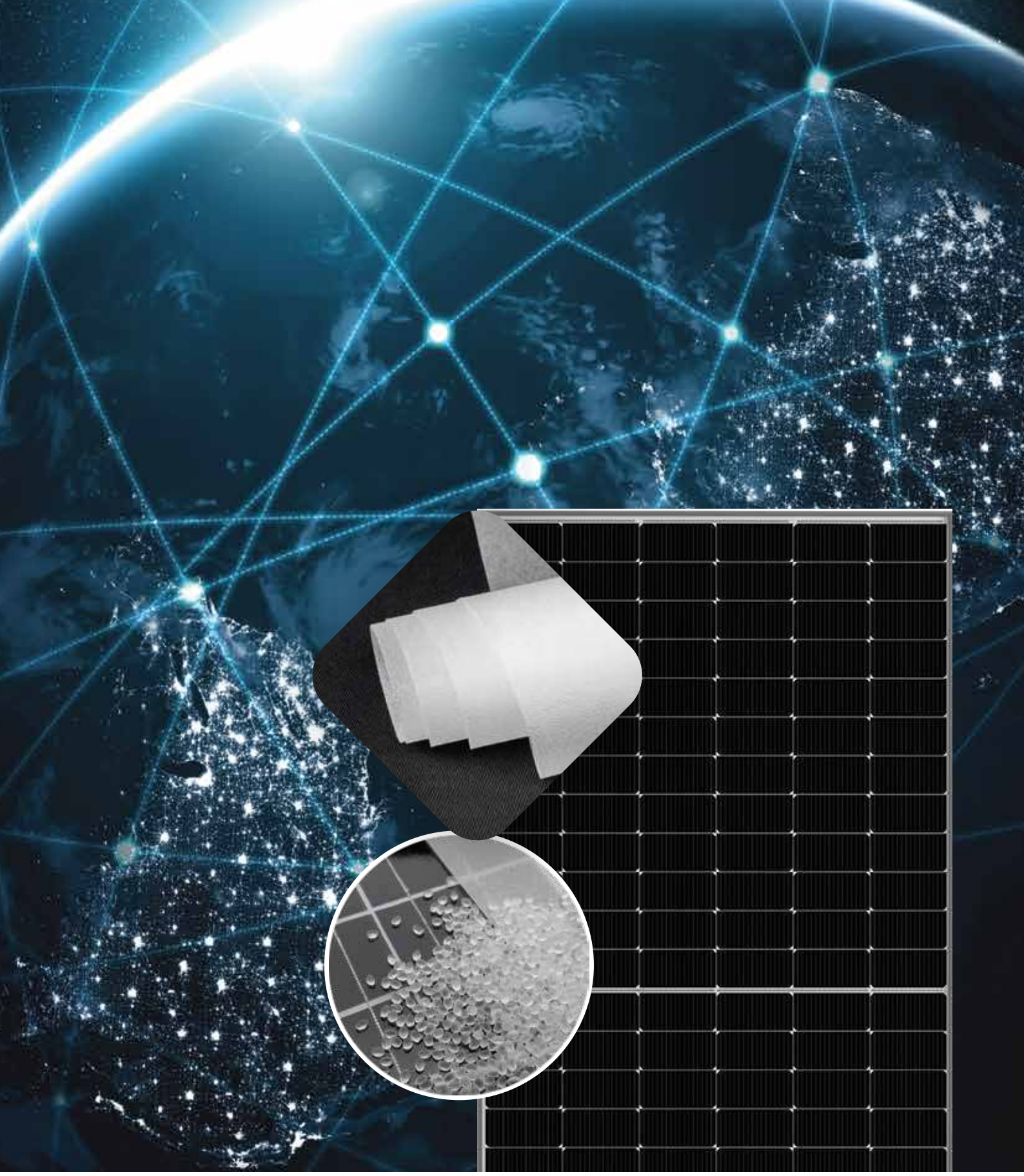
- Solar Glass
- ET306 (EVA)
- P-PERC Bifacial cell
- EU307 (EVA)
- White Backsheet



- Solar Glass
- ET306 (EVA)
- P-PERC Bifacial cell
- EPEU307 (EPE) / EU307 (EVA)
- Transparent Backsheet



- Solar Glass
- ET306 (EVA)
- P-PERC Bifacial cell
- EPEU307 (EPE) / EU307 (EVA)
- Black Backsheet



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