Webinar
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Jinko Solar

29 April 2020

8 AM – 9 AM	| CDT, México
9 AM – 10 AM	| EDT, New York
3 PM – 4 PM	| CEST, Berlin
9 PM – 10 PM	| CST, Beijing

Marian Willuhn

Editor | pv magazine

pv magazine webinars

Integrating bifacial - New system design and bespoke products

Kaushik Roy Choudhury

DuPont Photovoltaics and Advanced Materials

Andrea Viaro

Jinko Solar EU

Corrine Lin

PV Info Link

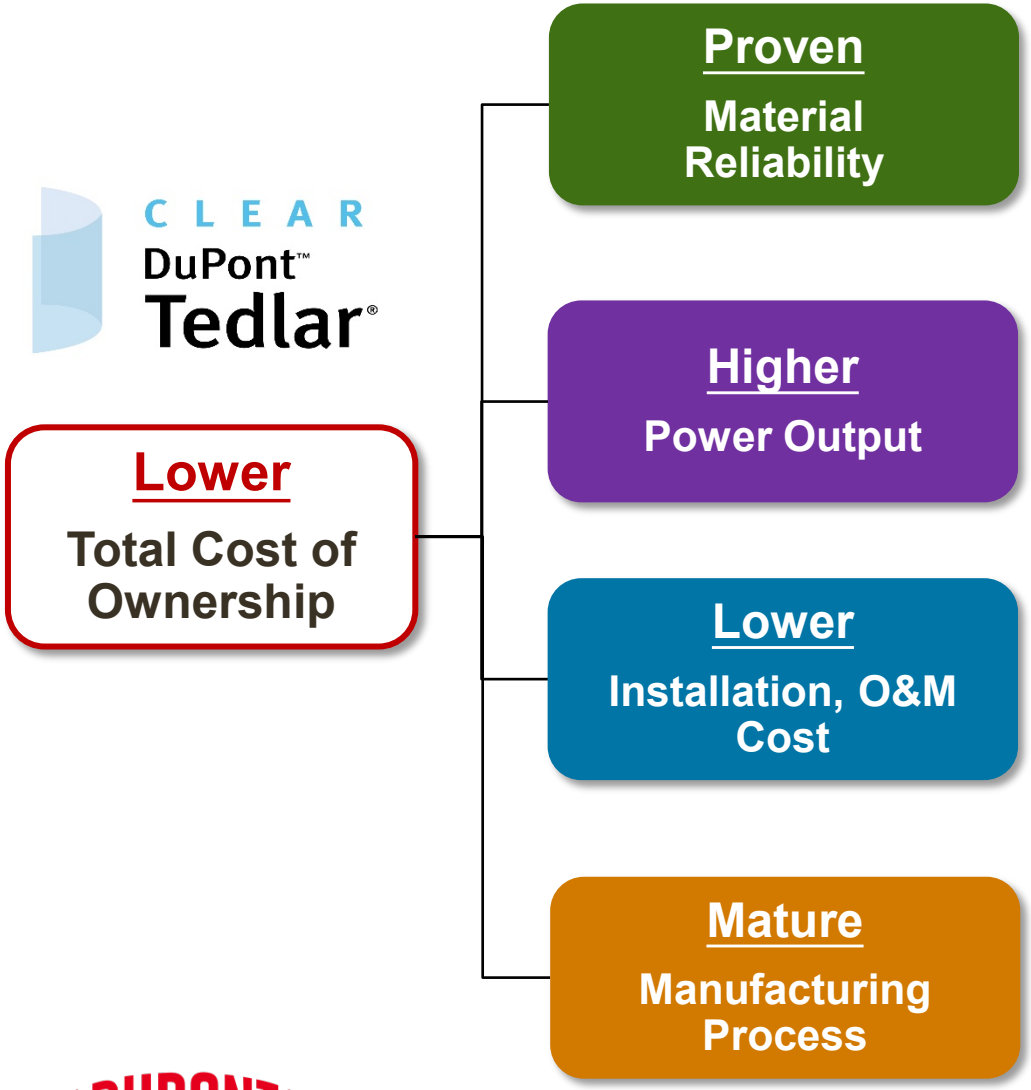
Eric Kuo

NEXTtracker

Lower Cost of Ownership with Clear Tedlar® Film Based Backsheet

DuPont Photovoltaic Solutions

Advantages of Bifacial Module with Tedlar® Based Transparent Backsheet



Advantages of Bifacial Module with Tedlar® Based Transparent Backsheet

CLEAR DuPont™ Tedlar®

Lower
Total Cost of Ownership

Proven
Material Reliability

- Glass/Backsheet structure has **35yrs+ field proven record**
- Robust **UV protection** and **stable mechanical properties**
- Excellent durability in **accelerated sequential test**

Higher
Power Output

- **Higher power output** due to lower cell operating temperature

Lower
Installation, O&M Cost

- **Same BOS design** on racking and tracking
- **Lighter weight**, easier installation, lower labor cost
- **Easy cleaning**, lower O&M cost

Mature
Manufacturing Process

- Be able to use current manufacturing equipment, **no additional capital investment**
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Long-term Field Proven Record of Tedlar® Based Transparent Backsheet

System Information

Age at Inspection	18 years
Location	Amsterdam, Netherlands Overhang of a building
Number of Modules	51 full-size
System Size	6.228 kWp
Backsheet ID	Tedlar® based transparent backsheet
Status	• No back-sheet yellowing • No back-sheet delamination • Slight ARC delamination • Slight EVA yellowing • Slight yellowing of insert used on junction box connection

New Clear Tedlar® Film Enables Transparent Backsheet for Bifacial Modules

Backsheet

cell side (inner layer)
core (middle layer)
air side (outer layer)

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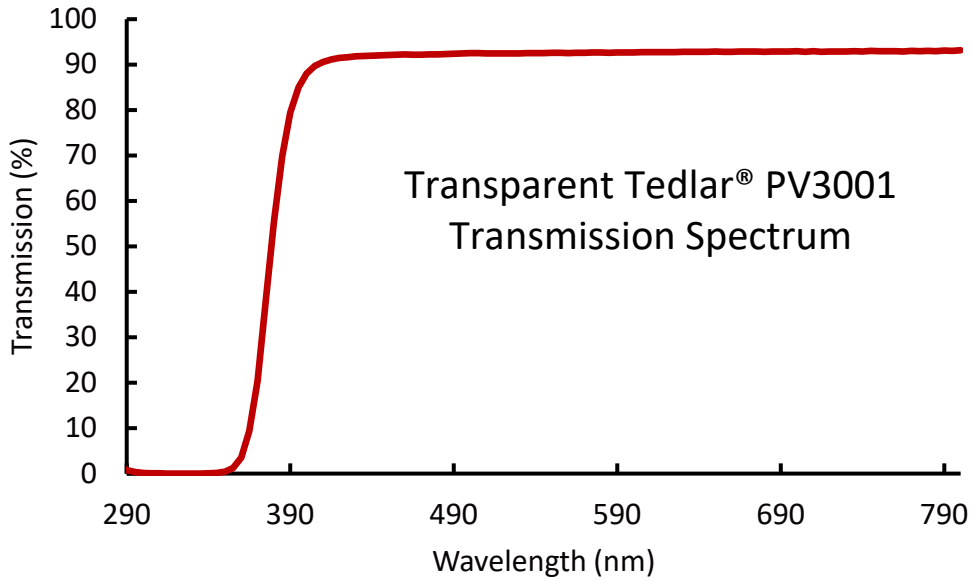
Clear Tedlar® PVF Film - PV3001

High transparency

Robust mechanical properties

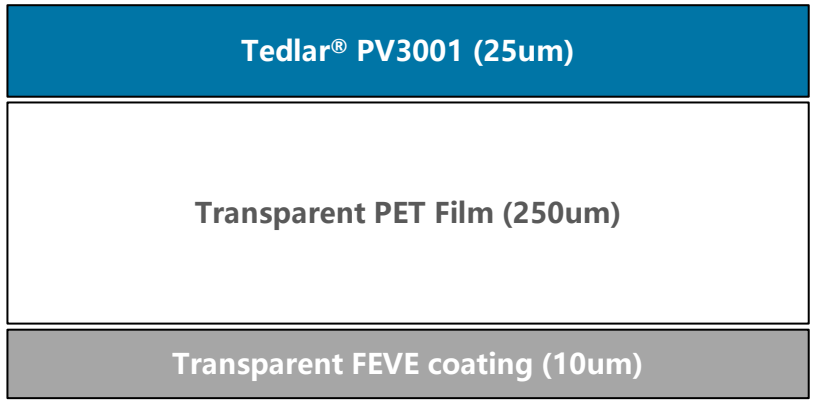
Excellent UV protection for PET core layer

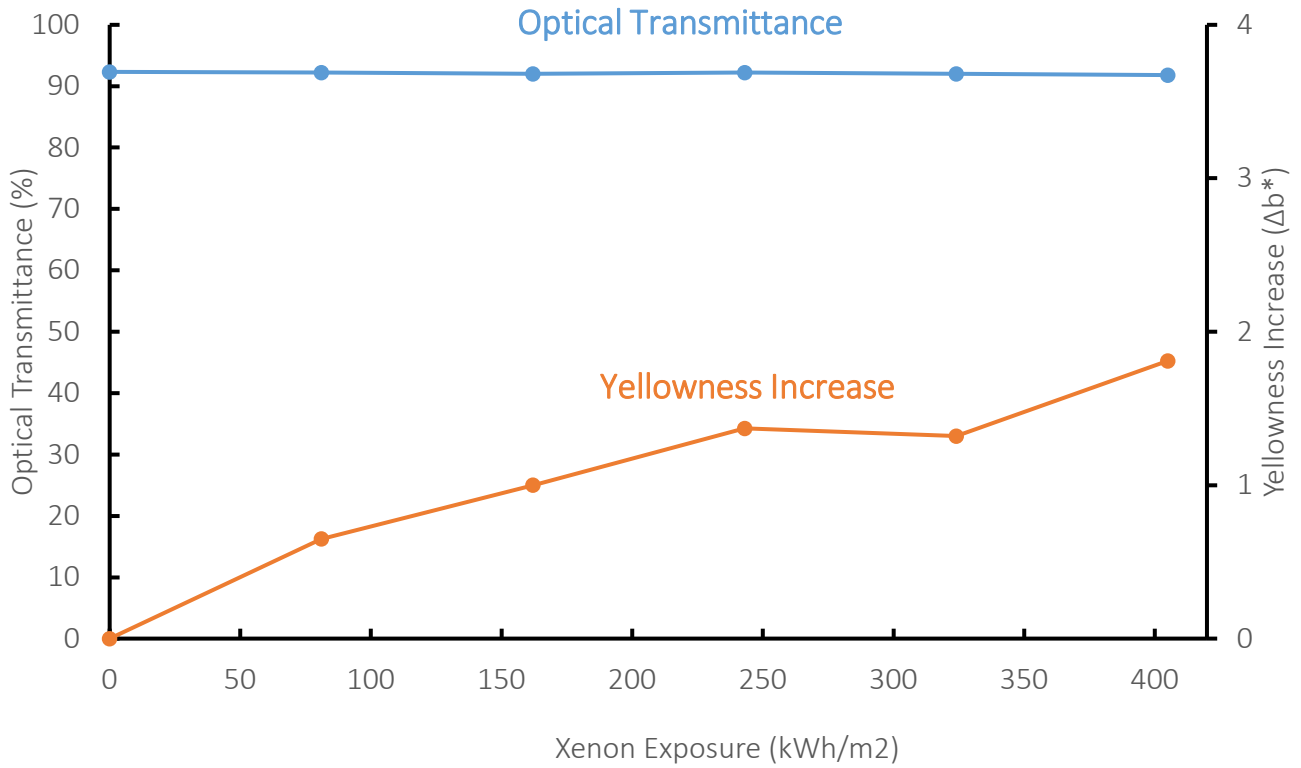
Property	Value	Method
Thickness	25 µm	Micrometer
Optical Transmission	94 %	ASTM D1003
MD Elongation at Break	150 %	ASTM D882
TD Elongation at Break	140 %	ASTM D882



UV Performance of Tedlar® Based Transparent Backsheet

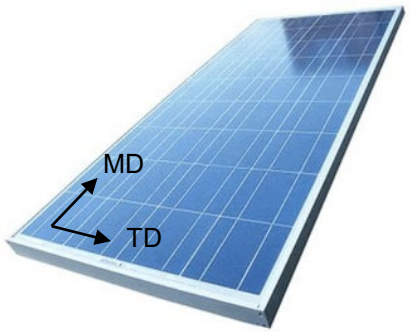
Tedlar® based transparent backsheet

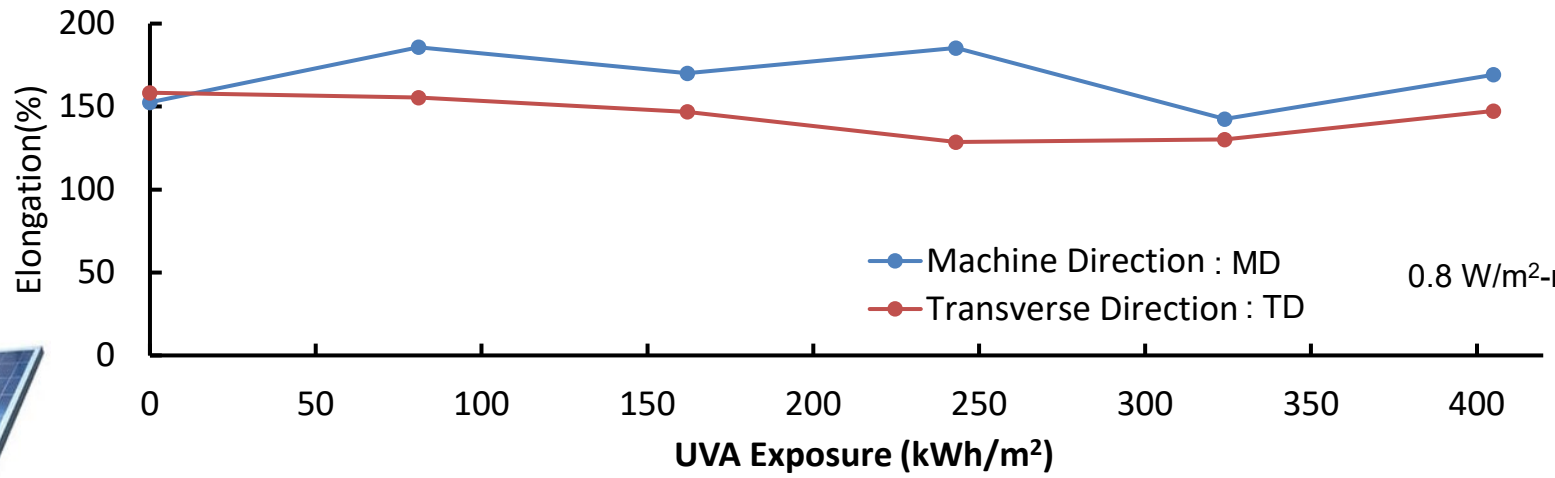


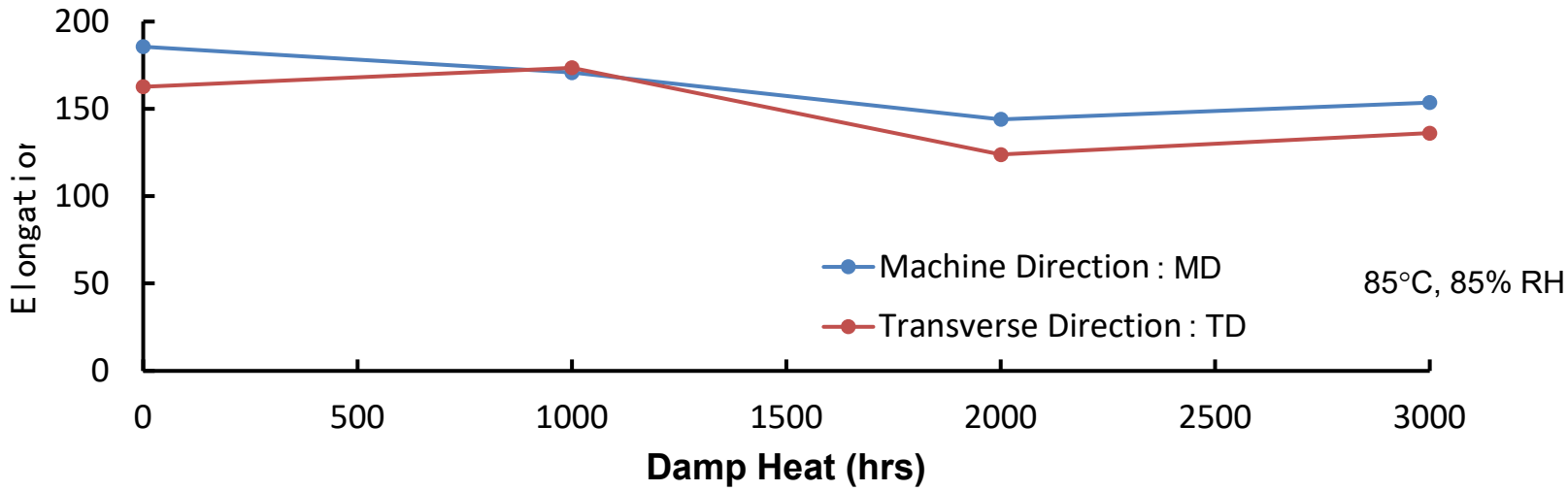


Xenon Exposure: 0.8 W/m^2-nm @ 340 nm, 90 °C BPT

Tedlar® Based Transparent Backsheet Keeps Stable Mechanical Property after UV and Damp Heat Aging Tests

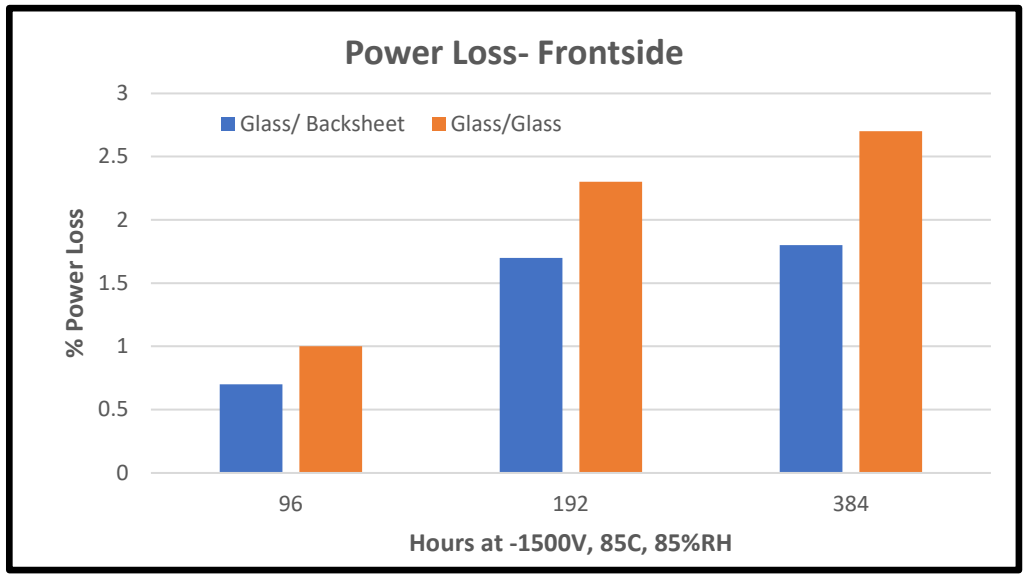


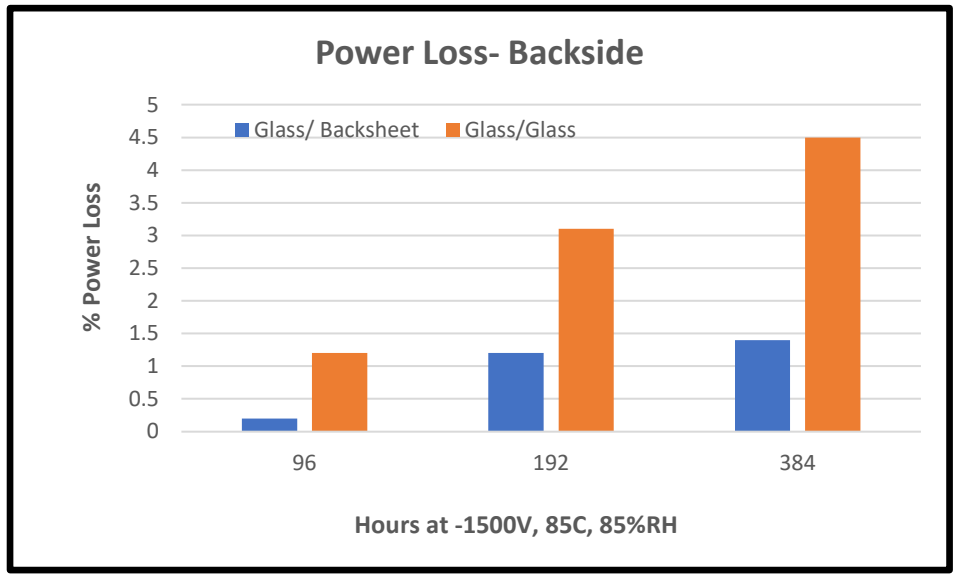




Tedlar® Based Transparent Backsheet – Less PID Risk

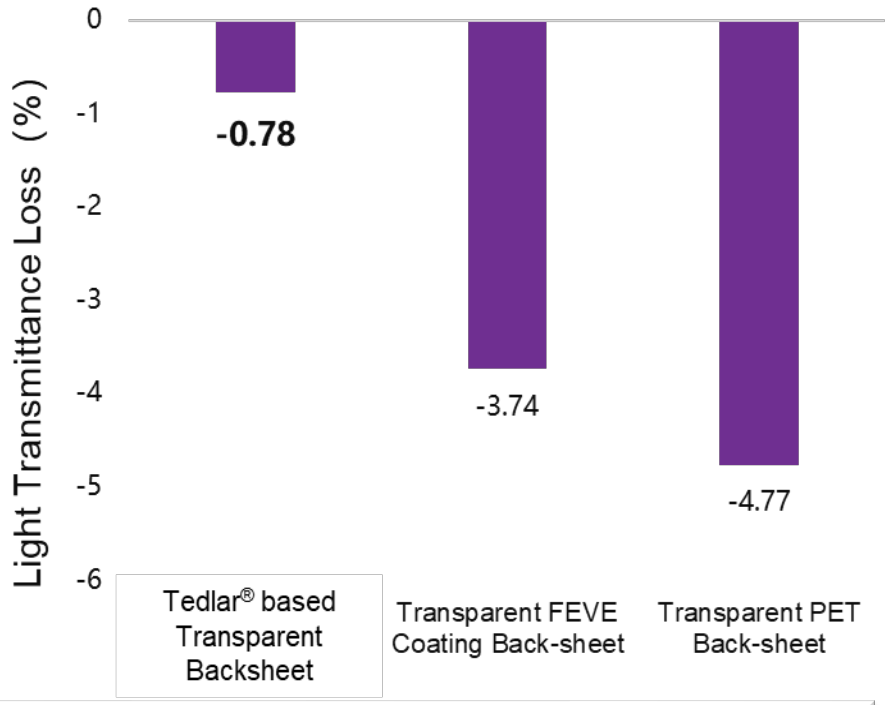
- Bifacial p-PERC can have less robust back surface passivation. Sodium ion migration from rear glass can result in significant rear-side ion mediated PID and power loss
- Tedlar® based transparent backsheet does not contain sodium ions and bifacial modules with the backsheet is more resistant to rear PID*.





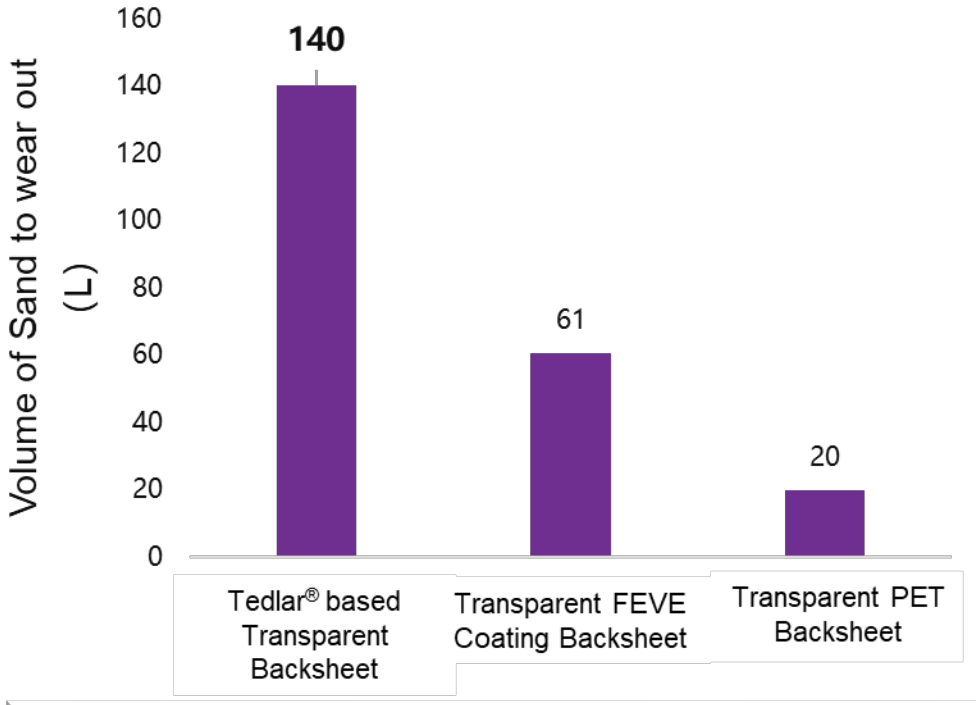
* Comparison of Glass/Backsheet and Glass/Glass 60-cell bifacial modules, with identical POE encapsulant and bifacial p-PERC cells. 1500V, 85°C, 85%RH

Excellent Abrasion Resistance of Tedlar® Based Transparent Backsheet



Tedlar® based transparent backsheet showed little change in light transmission after sand abrasion test

ASTM E424, Standard Test Methods for Solar Energy Transmittance and Reflectance (Terrestrial) of Sheet Materials
Wavelength: 400nm~760nm.
Backsheet samples after 100 liters of sand and surface cleaning



Tedlar® based transparent backsheet has high resistance to falling sand and is suitable for use in a high wind-sand area

GB/T 23988-2009, Determination for abrasion resistance of - Coatings by falling abrasive
SGS report
The amount of sand refers to the amount required to wear through this layer
The outer layer of transparent PET back-sheet has 2um UV resistant coating

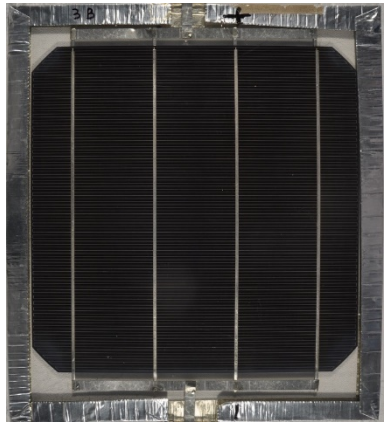
Tedlar® Based Transparent Backsheet Passed PVEL Sequential Test

PV MODULE PRODUCT QUALIFICATION PROGRAM

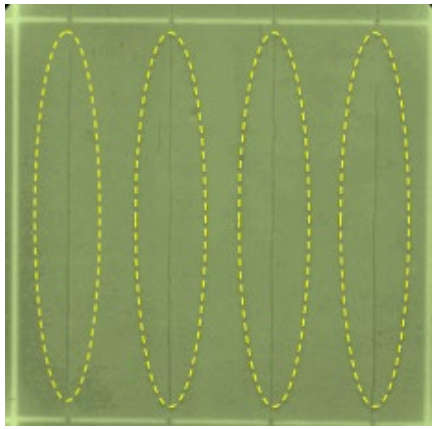
BACKSHEET DURABILITY SEQUENCE

When the backsheets of PV modules are made with substandard materials or poor-quality construction methods, they are likely to degrade – and ultimately cause solar asset underperformance. PV Evolution Labs (PVEL) provides buyers with the data they need to evaluate this critical component with the Backsheet Durability Sequence. This new backsheet test is now included with PVEL's updated PV Module Product Qualification Program.

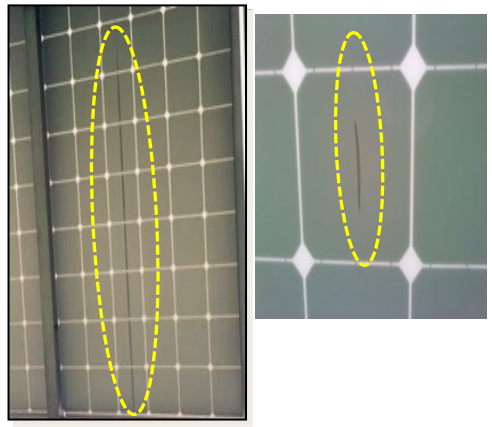
Tedlar® based transparent backsheet



No cracking, yellowing, or delamination observed in PVEL (UVA) and internal (UVX and UVMH) MAST testing



PVDF cracking in MAST testing of 60-cell commercial module by third party (DNV-GL)



PVDF cracking
Large MD crack 4 years in field

PVEL PQP BDS: DH1000+3x(UVA65 kwh/m2+TC50+HF10)+UVA6.5 kwh/m^2

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Total Cost of Ownership

Proven
Module Structure

- Glass/Backsheet structure has **35yrs+ field proven record**
- Stronger module with **fully tempered glass** and **thicker aluminum frame**
- **Lower PID risk**

Higher
Power Output

- **Higher power output** due to lower cell operating temperature
  - **Outlined in the Jinko presentation**

Lower
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- **Same BOS design** on racking and tracking
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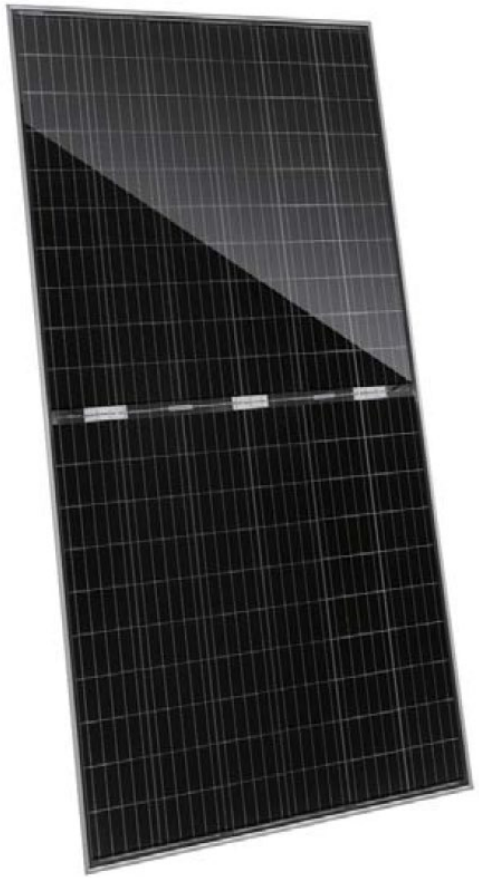
Lighter Weight with Tedlar® Based Transparent Backsheet



400W module
Area: 2m²

Glass/Trans. Backsheet: 22 kg
2.5mm Double Glass: 32 kg
2.0mm Double Glass: 26 kg

450W module
Area: 2.3m²

Glass/Trans. Backsheet: 26 kg
2.5mm Double Glass: 36 kg
2.0mm Double Glass: 30 kg

500W module
Area: 2.4m²

Glass/Trans. Backsheet: 28 kg
2.5mm Double Glass: 38 kg
2.0mm Double Glass: 32 kg

- Less prone to breakage during transportation and handling
- No extra cost for handling during installation

Better Fit for Higher Power, Bigger Size modules

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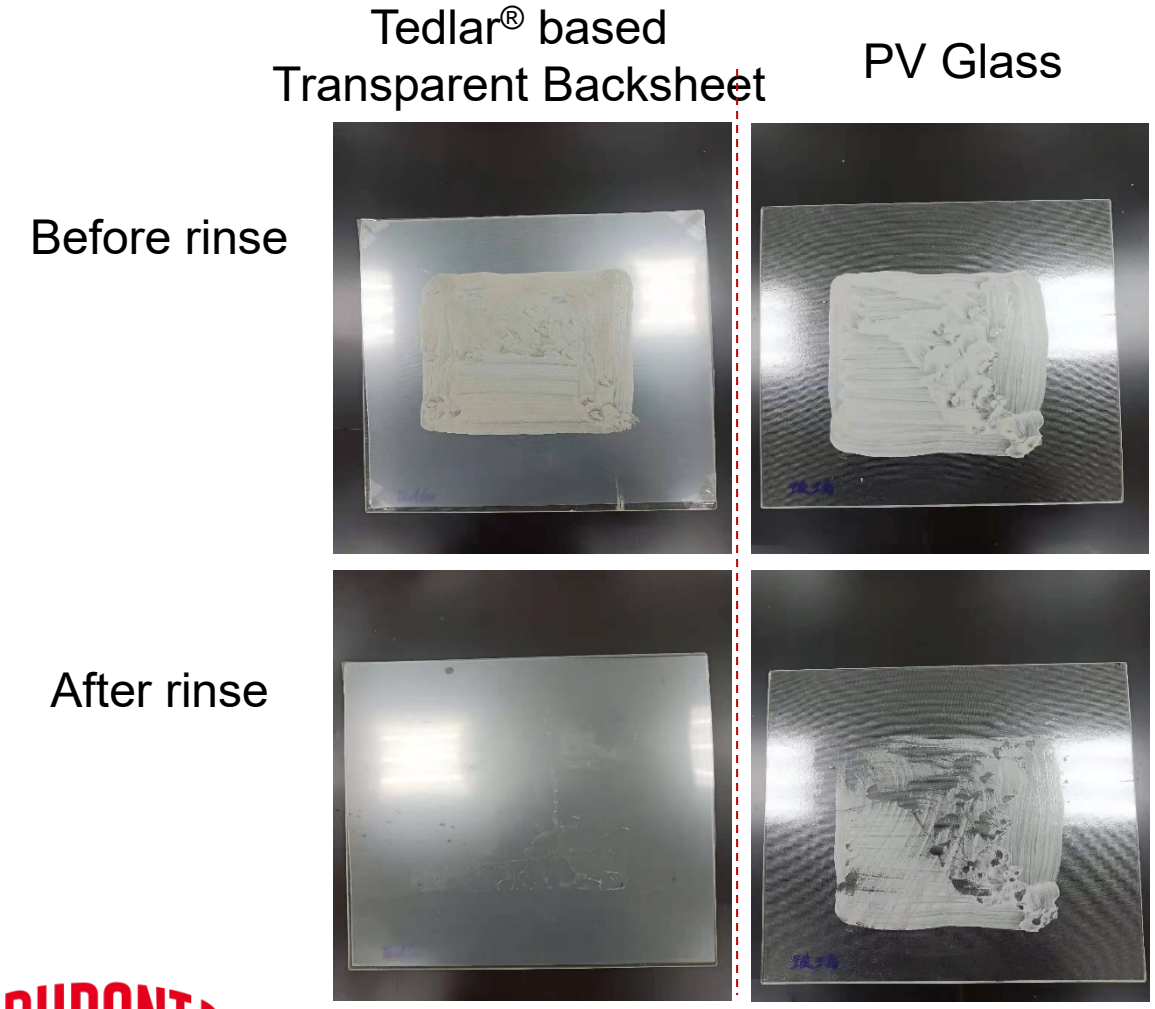
Less O&M Cost – Easy-cleaning for Tedlar® Based Transparent Backsheet

Soiling Resistance Test

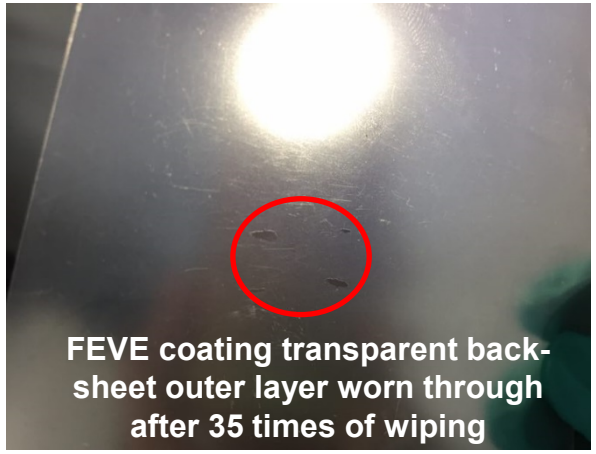


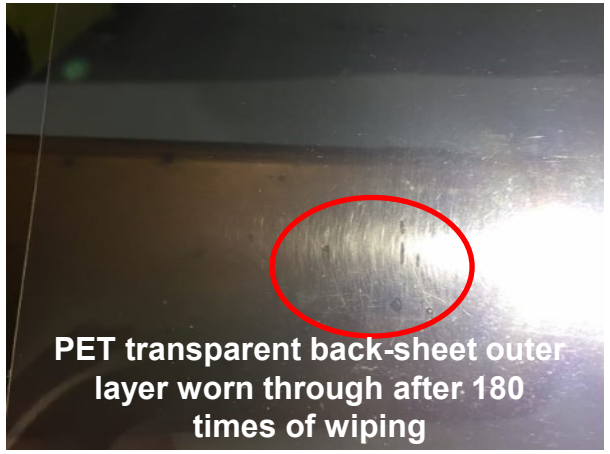
Test Standard： GB/T 9780-2005 Test method for dirt pickup resistance of architectural coatings and paints
Dirt fineness： 0. 045 mm square hole sieve (5.0±2.0)%
Suspension liquid：dirt：water = 1:0.9（by weight)
Suspension liquid amount： ~2 g
Stain surface：10 cmX10 cm
Dry time：10 min
Water flush speed：0.3-0.5 m/s
Water flush time：~10 s

Excellent Solvent Resistance of Tedlar® Based Transparent Backsheet

Solvent Resistance Test

Transparent Backsheet	Tedlar® based	FEVE Coating	PET
No. of wipes to wear through outer layer	>1000	35	180





Transparent FEVE coating has poor chemical resistance and should not be cleaned with solvent

GB/T 13448-2006 Methods of test for color coated steel plates and strips - Part 10: resistance to organic solvents (MEK)

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- Use current manufacturing equipment, **no additional capital investment**
- No loss in **yield rate**
- **Faster line speed**, more capacity

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Seamless Transition for Module Manufacturing Process

Zero
Capital Investment

- No need for additional capital investment to upgrade production lines

No loss
in Yield Rate

- Usual process control does not reduce production yield
- G/G requires stricter process control and the industry lacks mass production experience, which leads to reduced production yield

Faster
Production Speed
(More Capacity)

- Improvements in manufacturing speed yields faster production
- Thinner tempered glass in G/G modules needs longer time to raise and lower temperature to reduce cracking; this slows down lamination speed by 10-20%

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