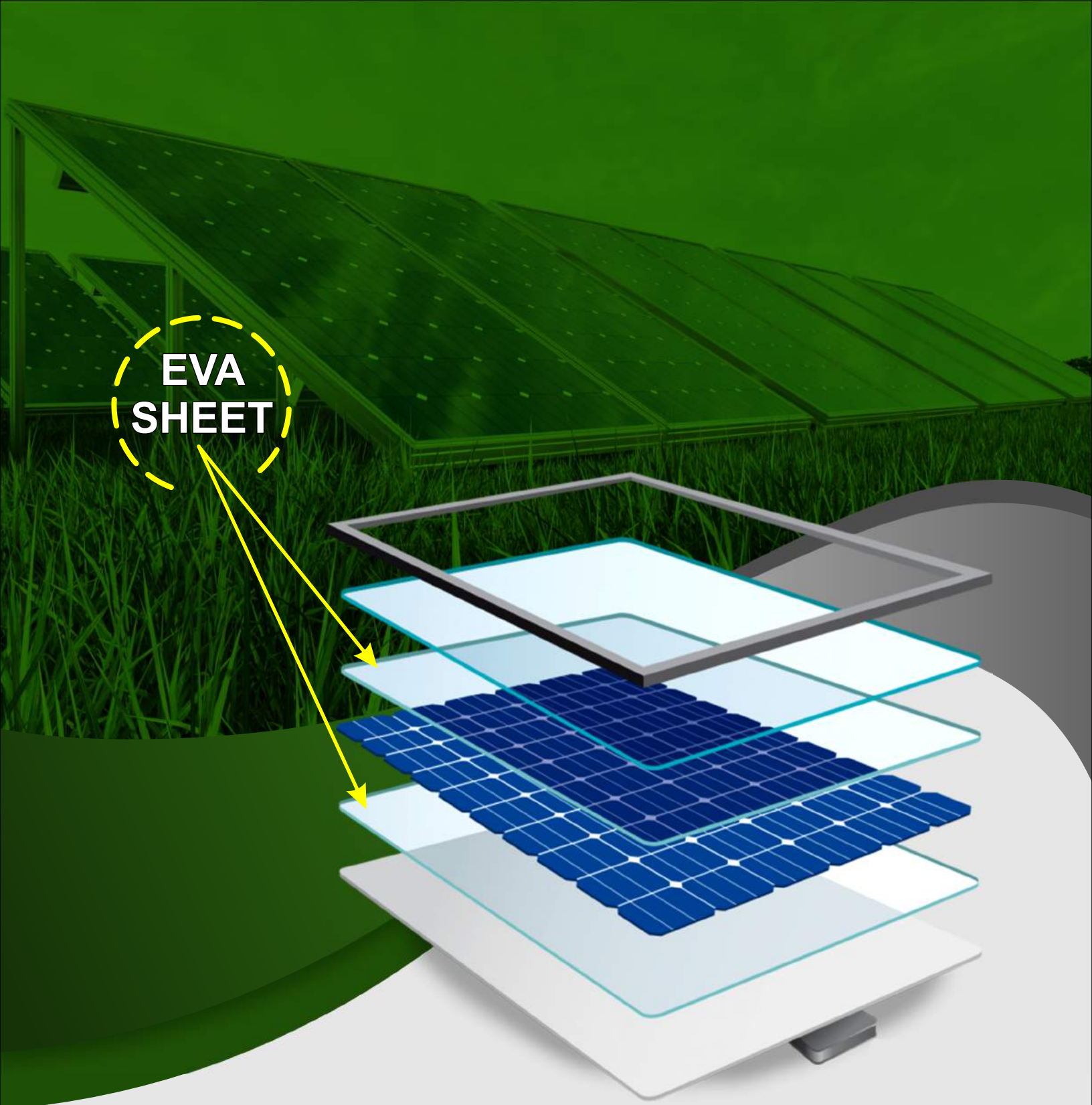

ALISHAN

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Who We Are

Alishan Green Energy shall be a hub to manufacture module raw material EVA Film. Backed with strong technical support and background, the company's scope involves both forward integration and reverse engineering of the solar products and manufacturing processes.

In parallel, the company is also backed with a strong financial background of ALISHAN GROUP. The blend of a young team, under guidance of experienced players, makes Alishan Green Energy versatile for creative operations and futuristic innovations. The backbone of the company's conduct and goodwill is – Quality and Integrity. The other core values that showcase the company and its culture are: Transparency, Accountability, Consistency and Innovation.As the world adheres to the solar energy revolution, Alishan Green Energy envisions to globally provide efficient solar energy products and solutions. Thus, contribute and enhance the Global Climate Sustainability.

Our Mission

We at Alishan Green Energy are committed to sustainable management of the environment and it's finite resources. We are serving the solar module manufacturing industry by providing our range of High Quality Fast Cure and Ultrafast cure EVA Encapsulants . Modern methods of manufacturing and strict supervision at every stage with the help of world class equipments make our products stand apart in the market.

We are committed to produce world class solar products and its key components for the domestic market as well as exports. Be a market leader for key solar components and create an identifiable Brand with good market reputation. With total commitment towards quality and customer satisfaction.

Our Vision

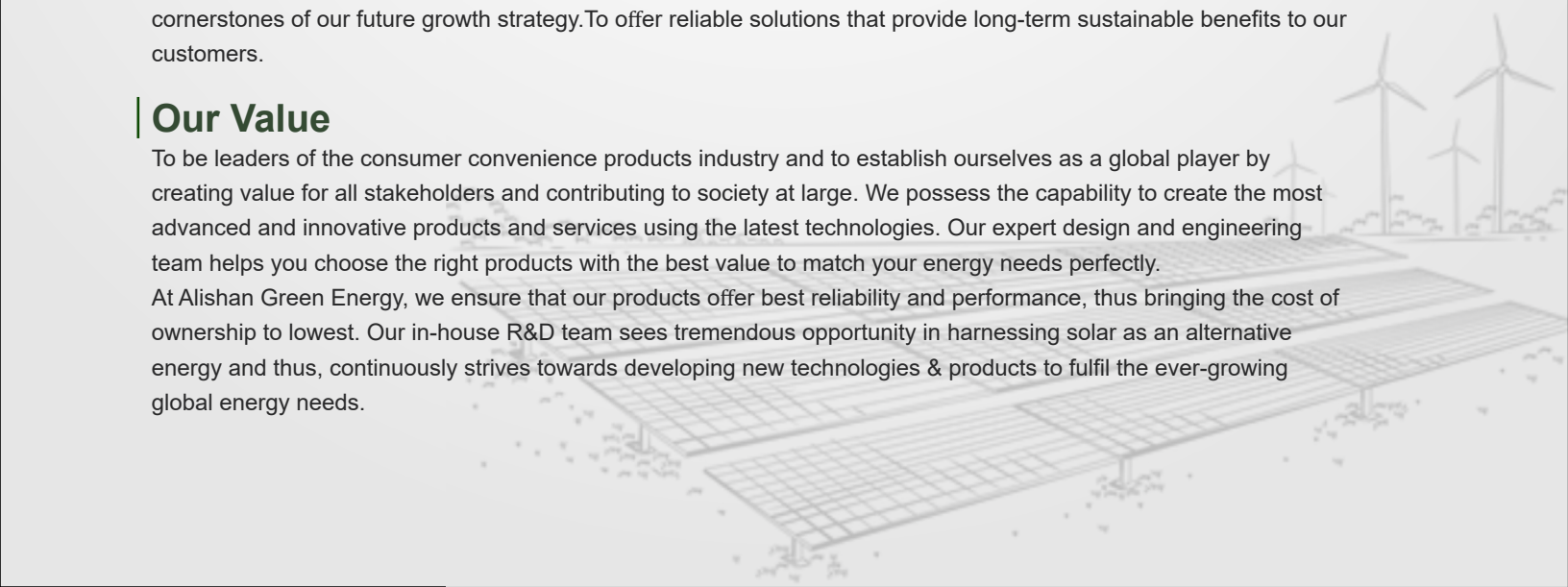
Our objective is in line with the vision of our honorable Prime Minister to Make India 'Atma Nirbhar'. Our Vision is to create a world class ecosystem for complete indigenisation of Solar/PV Modules by manufacturing all the key components locally.

High-quality products, active involvement of stakeholders and customer-oriented culture are fundamental cornerstones of our future growth strategy.To offer reliable solutions that provide long-term sustainable benefits to our customers.

Our Value

To be leaders of the consumer convenience products industry and to establish ourselves as a global player by creating value for all stakeholders and contributing to society at large. We possess the capability to create the most advanced and innovative products and services using the latest technologies. Our expert design and engineering team helps you choose the right products with the best value to match your energy needs perfectly.

At Alishan Green Energy, we ensure that our products offer best reliability and performance, thus bringing the cost of ownership to lowest. Our in-house R&D team sees tremendous opportunity in harnessing solar as an alternative energy and thus, continuously strives towards developing new technologies & products to fulfil the ever-growing global energy needs.



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Product
Key Features

Manufacturing facility

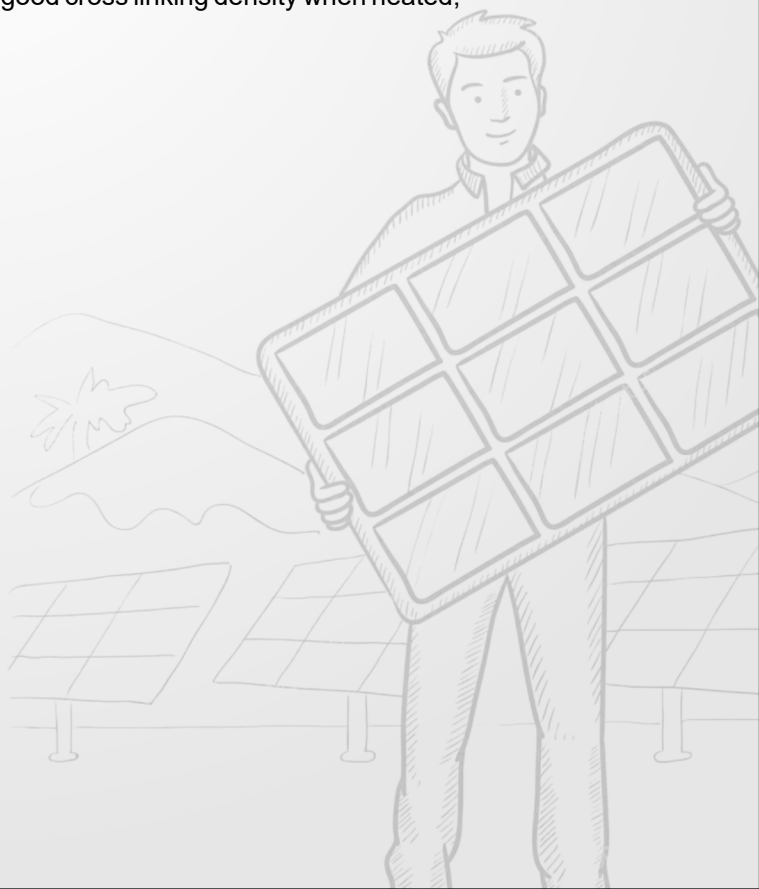
With the state of art manufacturing facility and extrusion process we follow stringent quality control in the manufacturing of Alishan EVA encapsulant. Our extrusion process is fully automated imported machinery which rarely needs human interventions in the process control. The manufacturing process includes clean room facility to ensure clean EVA film is manufactured.

With our expertise in polymer and in extrusion process, Alishan EVA is manufactured with proven & premium raw materials with optimized process parameters. Alishan EVA films were tested for all quality parameters especially long term reliability. Alishan EVA is compatible with all types of laminators and will improve the productivity in module line. We have fast cure and ultra fast cure type of EVA. Apart from these two types we also make custom made EVA films.

Alishan EVA provides very good adhesion with solar cells, Glass and the backsheet. the top surface and the rear surface of the PV module. These encapsulants will be stable at high temperatures and high UV exposure. It will be optically transparent and will also have a very good cross linking density when heated, which is an important parameter in module manufacturing.

Below are few properties of our EVA

- **Low Thermal Shrinkage.**
- **Short Lamination Cycle time**
- **Superior Bonding to Glass and Backsheet**
- **PID Resistant**
- **High Transmittance**
- **Provides good optical transmission**
- **Excellent UV and damp-heat stability**



Alishan FC
EVA Encapsulant

Alishan FC is one of the fast cure variants of EVA encapsulants manufactured by Alishan Green Energy Private Limited, in the world class manufacturing technology and proven raw materials. Alishan EVA's are PID and snail trial resistant. Our EVA ensures the reliability and life of solar modules in the field, these fast cure EVA encapsulants can be laminated at upto 15 minutes at a temperature varying from 140 - 150 °C

Product	Alishan FC			
Linear meter	Upto 150 meters			
Width	Upto 1350 mm			
Thickness	Upto 0.80 mm			
Properties	Description	Standard	UOM	Alishan FC
Physical property	Tensile strength	ASTM D 638	Mpa	≥ 16
	Elongation		%	≥ 600
	Adhesion with Glass	ASTM D 903	N/cm	≥ 75
	Adhesion with Backsheet		N/cm	≥ 75
	VA Content	COA	%	28 ± 2
Moisture Property	MVTR	ASTM F 1249	g/m2/day	≤ 18
	Water absorption	ISO 62	%	≤ 0.1
Thermal Property	Thermal Shrinkage	160 Deg C / 5 min	%	MD ≤ 3
				TD ≤ 1
	Thermal conductivity	ISO 22007	W/mK	0,2475
Electrical Property	Di-electric Strength	ASTM D 149	kV/mm	32
	CTI(Comparative Tracking Index)	IEC 60112	V	600
	Volume resistivity	ASTM 257-14	Ohm/cm	2.48×10^{15}
Gel content		ASTM D 2765	%	≥ 75
Optical Property	Transmittance	ASTM E 424	%	≥ 91
	UV cut off		nm	360 ± 30
	Yellow index		-	≤ 1
	Refractive Index	ASTM D 1218	-	1,4856
Lamination Property			UOM	Values
	Vacuum / Evacuation Time		Minutes	4 - 6
	Lamination / Pressing Time		Minutes	8 - 10
	Lamination Temperature		°C	140 – 150

Packing:

The EVA rolls is wounded on standard 3 inch (inner diameter) paper core, standard length of EVA film in a roll is 150 meter. Each roll wrapped in polyethylene film and placed in a carton box and 9 boxes placed in a pallet.

Storage:

Must be stored in a dry and temperature of ≤30 ˚C and humidity ≤ 60%, the shelf life of this product is 6 months from the date of manufacturing.

Alishan UFC EVA Encapsulant

Alishan UFC is one of the ultra fast cure variants of EVA encapsulants manufactured by Alishan Green Energy Private Limited, in the world class manufacturing technology and proven raw materials. Alishan EVA's are PID and snail trial resistant. Our EVA ensures the reliability and life of solar modules in the field, these ultra fast cure EVA encapsulants can be laminated at upto 12 minutes at a temperature varying from 140 - 150 °C

Product	Alishan UFC			
Linear meter	Upto 150 meters			
Width	Upto 1350 mm			
Thickness	Upto 0.80 mm			
Properties	Description	Standard	UOM	Alishan UFC
Physical property	Tensile strength	ASTM D 638	Mpa	. . .
	Elongation		%	≥ 600
	Adhesion with Glass	ASTM D 903	N/cm	≥ 75
	Adhesion with Backsheet		N/cm	≥ 75
	VA Content	COA	%	28 ± 2
Moisture Property	MVTR	ASTM F 1249	g/m2/day	≤ 18
	Water absorption	ISO 62	%	≤ 0.1
Thermal Property	Thermal Shrinkage	160 Deg C / 5 min	%	MD ≤ 3 TD ≤ 1
	Thermal conductivity	ISO 22007	w/mK	0,2475
Electrical Property	Di-electric Strength	ASTM D 149	kV/mm	32
	CTI(Comparative Tracking Index)	IEC 60112	V	600
	Volume resistivity	ASTM 257-14	Ohm/cm	2.48×10^{15}
Gel content		ASTM D 2765	%	≥ 75
Optical Property	Transmittance	ASTM E 424	%	≥ 91
	UV cut off		nm	360 ± 30
	Yellow index		-	≤ 1
	Refractive index	ASTM D 1218	-	1,4856
Lamination Property			UOM	Values
	Vacuum / Evacuation Time		Minutes	3 - 4
	Lamination / Pressing Time		Minutes	6 - 8
	Lamination Temperature		°C	140 - 150

Packing:

The EVA rolls is wounded on standard 3 inch (inner diameter) paper core, standard length of EVA film in a roll is 150 meter. Each roll wrapped in polyethylene film and placed in a carton box and 9 boxes placed in a pallet.

Storage:

Must be stored in a dry and temperature of ≤30 °C and humidity ≤ 60%, the shelf life of this product is 6 months from the date of manufacturing.

CERTIFICATE OF COMPLIANCE

Certificate Number	E522747
Report Reference	E522747-20210720
Date	2021-July-22

Issued to:

Alishan Green Energy Pvt Ltd
F101, Sky villas, Sector 8A, Kamal vihar
Raipur Chhattisgarh, 492001 IN

This is to certify that representative samples of

PHOTOVOLTAIC POLYMERIC MATERIALS - COMPONENT

See Addendum Page for Product Designation(s).

Have been investigated by UL in accordance with the component requirements in the Standard(s) indicated on this Certificate. UL Recognized components are incomplete in certain constructional features or restricted in performance capabilities and are intended for installation in complete equipment submitted for investigation to UL LLC.

Standard(s) for Safety:

UL746A - Standard for Polymeric Materials - Short Term Property Evaluations
UL 746B - Standard for Tests for Polymeric materials - Long term property evaluations

Additional Information:

See the UL Online Certifications Directory at https://iq.ulprospector.com for additional information

This *Certificate of Compliance* does not provide authorization to apply the UL Recognized Component Mark. Only the UL Follow-Up Services Procedure provides authorization to apply the UL Mark.

Only those products bearing the UL Recognized Component Mark should be considered as being UL Certified and covered under UL's Follow-Up Services.

Look for the UL Recognized Component Mark on the product.

Bruce Mahrenholz, Director North American Certification Program

UL LLC

CERTIFICATE OF COMPLIANCE

Certificate Number	E522747
Report Reference	E522747-20210720
Date	2021-July-22

This is to certify that representative samples of the product as specified on this certificate were tested according to the current UL requirements

Product Designation:

Component - Photovoltaic Polymeric Materials

MATERIAL DESIGNATION: ALISHAN FC

Bruce Mahrenholz, Director North American Certification Program

UL LLC

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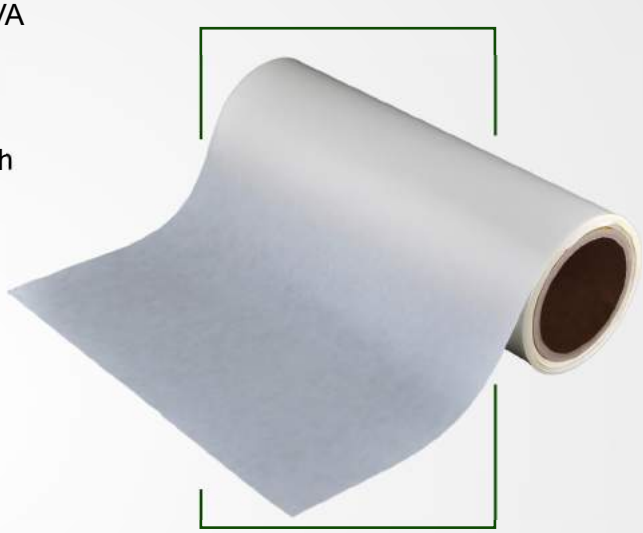
R&D

Solar module's life of 25 years depends mostly on the EVA encapsulant. It gives physical protection to the solar modules, best electrical insulation, moisture protection, high transparency etc, such critical properties are best maintained in our EVA with our team of expertise and with proven raw materials.



Our EVA's prime properties are

- **Custome made UV cut off wavelength**
- **Excellent moisture resistant and weather resistant**
- **Excellent adhesion with glass and backsheet**
- **Excellent PID resistance/electrical insulation**
- **No discolouration or yellowing**
- **Excellent thermal stability**
- **Excellent transparency**

UV Visible spectrophotometer used for stringent quality control testing of UV cut off, Yellowness Index and Transmittance % of EVA film. UV cutoff is the main parameter to identify whether it should be used as Front EVA or Rear EVA. Transmittance and Yellowness index are the main parameters for reliabiltiy testing of solar EVA. The Δ YI yellowness index before and after a reliability test i.e., Damp Heat, UV exposure etc are strictly maintained at ≤ 3.

Transmittance, UV cutoff and yellow index are tested as per ASTM E 424 test method

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Universal Testing Machine can be used to test the

- **Tensile strenght of EVA**
- **Elongation of EVA**
- **Adhesion strength of EVA with glass**
- **Adhesion strength of EVA with backsheet**

A polymer's reliability is measured in terms of retention % the above mentioned properties, an EVA's properties interms of reliability also evaluated with before and after datas of (of reliability tests) the above properties.
Applicable ASTM test methods are ASTM D 638 and ASTM D 903 for mechanical properties and adhesion testing respectively.

Gel content of EVA is the measure of degree of crosslinking in EVA. Lower the Gel content can indicate the lower degree of crosslinking, which is an serious issue in the reliability and mechanical integrity of solar module.
This gel content of EVA encapsulant can be measured by two methods, one is soxhlate and other is oven method. This is an important parameter as a part of stringent quality control tests. Though this is a time consuming test, but very important, reliable and a mandatry test in solar module or EVA manufacturing process.
The test method followed is ASTM D 2765

Hot Air Circulating Oven Unit

Lab scale laminator, to prepare samples for testing, usually A4 size modules were made for all testing, with solar glass, 2 layers of EVA and a backsheet. This laminator is also used to set the laminator recipe which will be helpful to set laminator recipe at customer end.
This laminator is mainly used for preparing samples for regular quality testing and to prepare modules for any alternate materials to test in reliability chambers.

Temperature Humidity Test Chamber

Pressure Accelerated Aging Test Chambe

UV Aging Environmental Test Equipment

Damp heat test chamber, Pressure cooker test chamber & UV chamber are the main reliability tests which the samples are tested as per IEC 61215 & 61730

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