

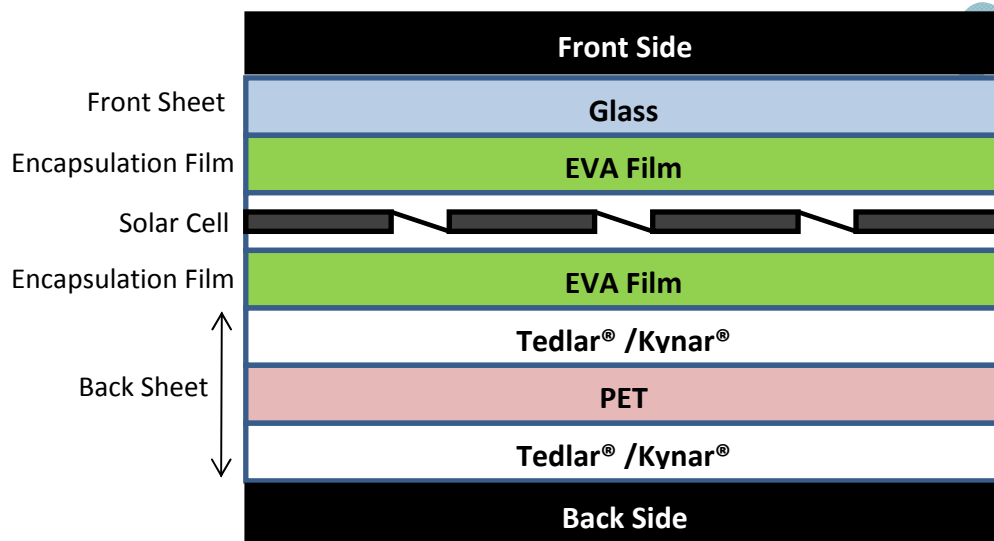
SPECIALITY POLYMER PRODUCTS & PROJECTS

- 1) **EVA Encapsulation Film used in Solar PV Panels**
- 2) **Synthetic (Stone) Paper**
- 3) **Extrusion of clear PMMA & PC Panels**
- 4) **Expanded Polyethylene (PE Foam)**
- 6) **Expanded Poly Styrene (EPS) Foam Board**

KPS Consultants

EVA ENCAPSULATION FILM USED IN SOLAR PV PANEL

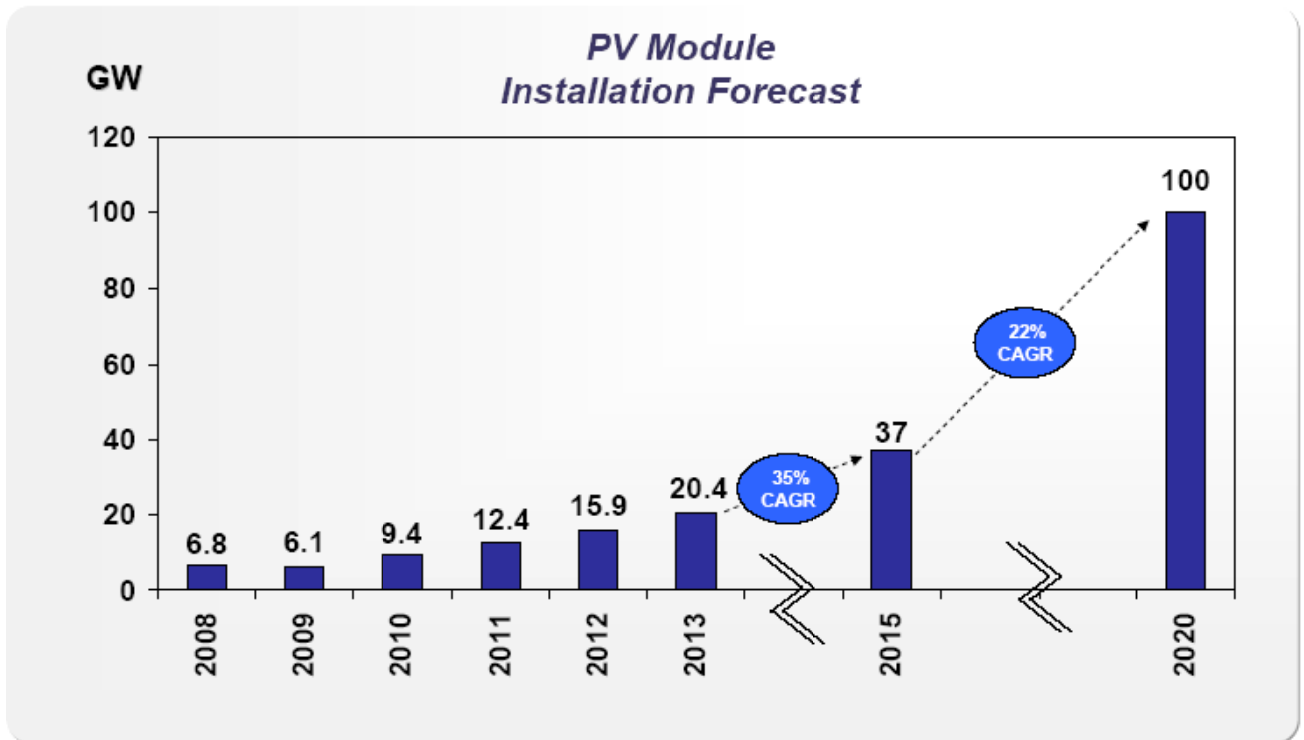
The field of solar photovoltaic for the generation of power is today one of the most upcoming and profitable business. Ethyl Vinyl Acetate (EVA) sheet is used for the encapsulation of Solar PV cells. Back Sheet consists of PET film laminated with Polyvinyl Fluoride (PVF) film on either side. Basic structure of a PV panel is given below.



Requirements of PV Panel Encapsulation Film:

- > High light transmission for front encapsulation film
- > Low modulus
- > Protect PV cell from corrosion
- > Good Adhesion to front glass and PV cell
- > Good Adhesion to back sheet and PV cell
- > Solar Grade EVA films have high VA content

PV GLOBAL MARKET FORECAST



Some highlights of the Jawaharlal Nehru National Solar Mission

- Make India a global leader in solar energy and the mission envisages an installed solar generation capacity of 25,000 MW by 2020, 100,000 MW by 2030 and of 200,000 MW by 2050.
- The total expected investment required for the 30-year period will be around Rs. 85,000 Crores to Rs. 105,000 Crores.
- Between 2017 and 2020, the target is to achieve tariff parity with conventional grid power and achieve an installed capacity of 25 Gigawatts (GW) by 2020.
- 5 GW of installed solar manufacturing capacity by 2017

Features

- Film Width: 1000 mm (95% of the PV encapsulation film market \leq 1000 mm)
- High line speed (up to 20 meters / minute) and Extrusion Shrinkage $<$ 2%
- Extruded EVA film requires no interlayer (PE / Paper) hence cost saving

Polyvinyl Butyral (PVB) film is extensively used as an interlayer film in laminated (safety) glass used in automotive and architectural fields due to its optical clarity, toughness, flexibility, good binding and adhesion to glass etc.

We can provide complete project consultancy for the manufacture of EVA Encapsulation Film and PVB Interlayer Film. We can assist you in the selection and sourcing of complete plant & machinery (from West or China) as well as various other services for the implementation of the project. These project implementation services include preparing Plant Layout Drawing and Factory Building Architectural Drawing, compounding & process know-how, coordinating installation / commissioning & trial run of plant, recruiting of technical manpower, quality control & testing systems etc.

We look forward to hearing from you in the matter.

Dr. ANOMITRA CHAKRAVARTY

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SYNTHETIC (STONE) PAPER

What Is Synthetic or Stone Paper?

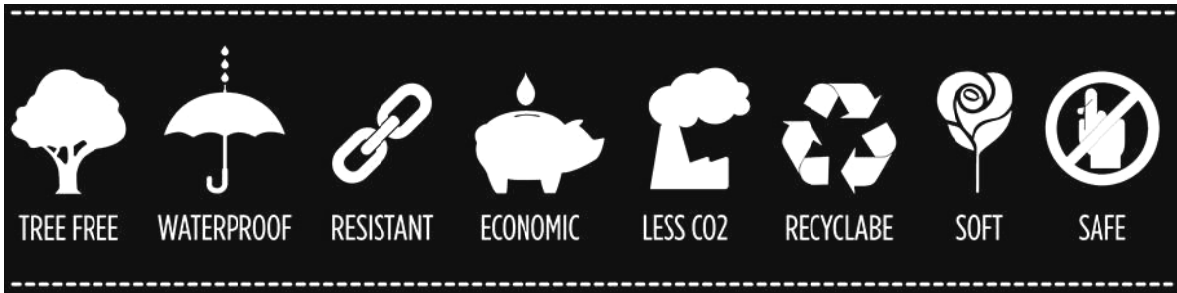
This innovative & advanced paper is produced from calcium carbonate bonded with a thermoplastic resin like Polypropylene (PP) or High Density Polyethylene (HDPE) and other additives. This results in a paper that is naturally white with smooth surface, water resistant and high tear strength.

Features of Synthetic / Stone Paper

- Saving of natural resources and lower environmental impact
- No timber pulp is used in the production process thus saving forest resources (One ton of standard copy paper requires four tons of wood pulp)
- No water is used in the production process. (One ton of standard copy paper produces 60,000 liters of contaminated waste water)
- 50 % less power required to produce synthetic paper as compared to virgin paper and 30% less power required as compared to recycled paper.
- No chemicals like chlorine, acid, alkali etc. used.
- Synthetic paper is recyclable. Trims / Scrap are reused – no wastage.
- Synthetic paper is photo-biodegradable on exposure to UV light.

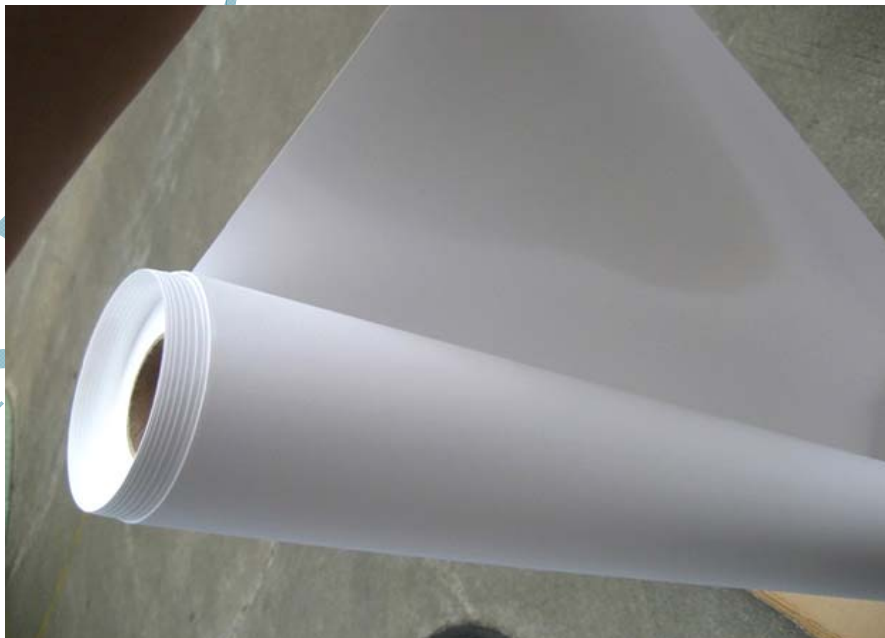
Advantages of Synthetic / Stone Paper

- Naturally white & smooth surface
- Excellent printability (lower ink consumption)
- Tear & Bending resistant
- Water & Grease resistant
- Acid Free & Anti Static
- No Grain Direction – strength in both directions
- Insect Resistant



Applications of Synthetic / Stone Paper

- **General Graphics**
- **Packaging & Labels**
- **Shopping Bags**
- **Banners & Large Format Signs**
- **Catalogue, Brochure, Manual, Maps etc.**
- **Wall paper & Decoration paper**
- **Greeting, Invitation & Business Cards**
- **Boxes, Cartons & Envelopes**
- **Calendars, Flyers & Tickets**



Manufacturing process involves (i) Dry mixing of ingredients, (ii) Extrusion, (iii) Calandering, (iv) Bi-axial Stretching (in machine & cross direction), (v) Side Trimming, (vi) Coating (if required), (vii) Winding into Rolls / Cutting into Sheets.

Thickness 80 to 1000 microns & Width 1000, 1200 mm etc.

Typical Density 0.77 to 0.80 g / cm³

Suitable Printing Methods

- Web / Sheet Offset Lithographic
- UV Web / Sheet Offset Lithographic
- Flexographic
- Gravure
- Digital (Latex / solid ink)
- Not suitable for copying machine paper, laser printer, and toner printers.

We can provide Technology / Know-how and related technical services for the planning & implementation of the project. We can provide Project Consultancy Services such as - Selection & Sourcing of Equipment, Utility & Support facility, Installation & Commissioning, Compounding & Processing, Quality Control & Testing and trial running of plant along with foreign equipment suppliers.

As a first step we can prepare a Techno - Economic Project Report for setting-up such a plant in India. This report will clarify all points associated with the project, help you to approach financial institutions for loan purpose, approach Govt. departments for statutory clearances etc.

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**Extrusion of Clear PMMA & PC Panels used in Monitor, Laptop,
Mobile Phone, Tablet, LED Lighting etc.**

Polymethyl Methacrylate (PMMA) is a thermoplastic with very good light transparency. It is light in weight, rigid and has good surface hardness, impact resistance, weather and chemical resistance. The properties of **Polycarbonate (PC)** are similar to PMMA, however it has higher impact & scratch resistance, useable over a greater temperature range and has higher light transmission. PMMA / PC are used in various applications across automotive, electronics, construction, signs and displays, sanitary ware, lighting fixtures and other industries.

The fastest growing application of PMMA & PC is in following areas

- Display Panels / Screens in Desktop Monitors, Laptops / Notebooks, Tablets, Mobile Phones and other electronic items.
- Light Guide Panels used in LED - LCD TVs
- Display Panels in LED Lights and Signage etc
- Automotive Head & Tail Lights

Following statistics provide an indication of the market size in India

- Sale of Smart Phones in FY 2013 - 14 **21.47 million units**
- Sale of Tablets in FY 2013 - 14 **3.84 million units**
- Sale of Desktops & Laptops FY 2013 - 14 **12.11 million units**
- Sale of Flat Panel TVs in FY 2013 - 14 **6.0 million units**

To our knowledge there is no well-known manufacturer in India in the organized sector and above requirement is met through imports.

The **manufacturing process** involves extrusion of optical grade PMMA and / or PC resin into clear sheets of 0.5 to 8 mm thickness with high dimensional accuracy. The process also involves specially developed precision three roll calandering and transverse / longitudinal cutting of the sheets for desired width & length. The width of clear sheets produced may be as high as 1500 mm. State of the art extrusion system and process control is required for the manufacturing process.

The manufacture of Light Guide Panel requires further inline imprinting a dot matrix structure and / or etching on one face of the clear sheet in a clean-room environment. Light Guide Panels are part of Back Light Unit (BLU) and are used to provide uniform illumination to the TFT - LCD screen used in LED TVs.

It is also possible to co-extrude Polycarbonate (PC) and PMMA to manufacture two layered – single clear sheet. Polycarbonate layer provides added impact resistance to the sheet. Such sheets are also used in outer display panels / touch screen of mobile phones and tablets.

We can provide Technology & Process Know-how for the manufacture of Clear PMMA / PC Sheets used in various applications. We can assist you in the selection and sourcing of complete plant & machinery as well as various other services for the implementation of the project. These project implementation services include preparing Plant Layout Drawing and Factory Building Architectural Drawing, compounding & process know-how, coordinating installation / commissioning & trial run of plant, recruiting of technical manpower, quality control & testing systems etc.

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Expanded Polyethylene (PE Foam)

Expanded Polyethylene or PE Foam is mainly produced through extrusion technologies. The foams are created by first dissolving and mixing an inert gas in the molten PE, secondly expanding the gas into a lot of small bubbles or cells and finally cooling the expanded PE and thereby creating the final foam. The LDPE is also cross-linked to provide additional strength & properties

The foam can be shaped in different semi-finished products such as tubes, profiles, sheets and blocks. The expansion results in a substantial reduction of the polyethylene density and hence weight. LDPE as the raw material for these foam has typically a specific density of 920 kg / m³. On the other hand the average density of PE foams is 30 kg / m³. This weight reduction is obtained by expanding the PE approximately 30 times. It is possible to produce PE Foams of specific density from 15 kg / m³ to 90 kg / m³ with proper equipment and technology.

Correctly foamed polyethylene has a structure of small regular cells. Due to this factor it has a high heat and sound insulation capacity and excellent shock absorbing capability. The building, packaging and automotive industry and the producers of sports and leisure articles are happy to utilize these excellent properties. PE foams can be produced in any colour desired. Modern technology utilizes inert gases like CO₂, N₂, Butane, LPG etc. as physical blowing agents and a foaming amplifier when low densities and high foam homogeneity is required. Production capacity of equipment ranges from 30 to 400 kg per hour.

Applications of Expanded Polyethylene

- Packaging of consumer electronic products like LED / LCD TV, Washing Machine, Air conditioner, Microwave Ovens, Laptops, Computer Monitors etc.
- Packaging of Furniture / Packaging of Fruits (Nets)
- Pipe insulation / Wall insulation in building construction
- Sports equipment
- Packaging of equipment / Export packaging



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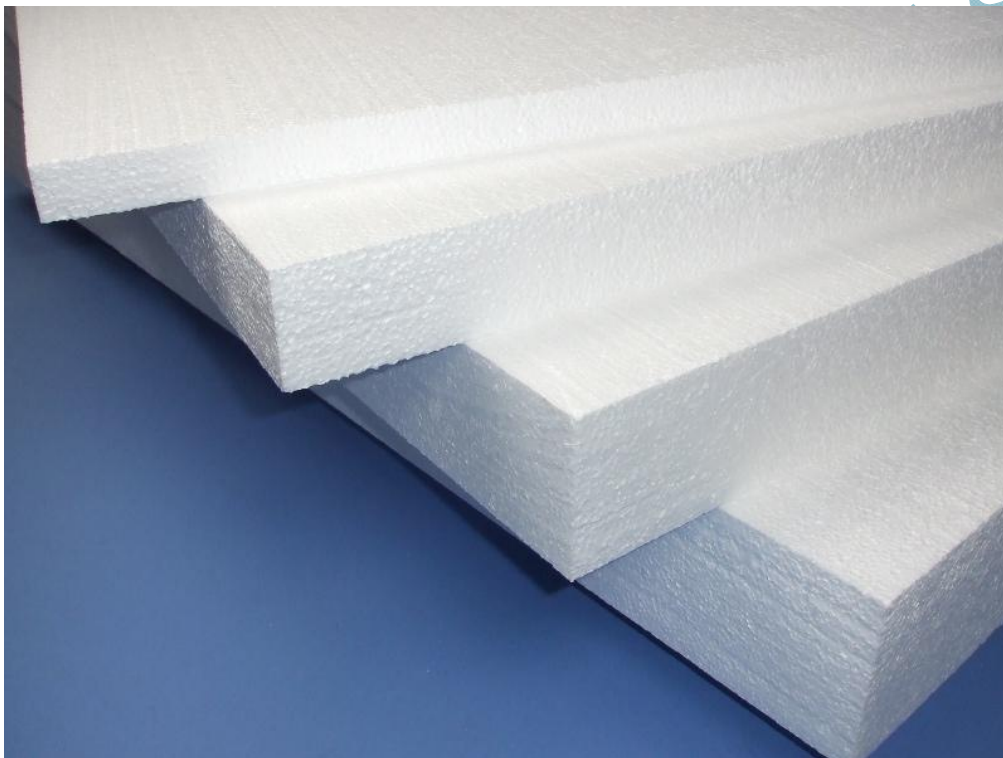
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Expanded Polystyrene (EPS) Foam Board

Expanded Poly Styrene (EPS) is mainly produced through extrusion process. The foam is created by first dissolving and mixing an inert gas like Carbon Dioxide or CO₂ in the molten polymer, secondly expanding the gas into a lot of small bubbles or cells and finally cooling the expanded PS and thereby creating the final foamed board.



EPS Foamed Board Width: 600 – 1200 mm

EPS Foamed Board Thickness: 20 to 100 mm

Production Output: 250 to 100 Kg / Hour

EPS foamed board has excellent heat insulation property, good sound insulation, high compressive strength, good dimensional stability, low water absorption and anti-corrosion performance. EPS foamed board is extensively used in Roof, Wall and Floor insulation in the building construction industry. It is used for insulation in Cold Storage buildings, Ducting and Sandwich Panel (with Aluminium Foil).

EPS Foamed Board Sandwich with Aluminium Foil



EPS foamed board is produced by tandem extrusion with a primary extruder (for plasticizing & mixing CO₂ into the polymer), metering pump (for injecting metered quantity of CO₂ into the primary extruder) and a secondary extruder (for mixing, homogenization and final extrusion).

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