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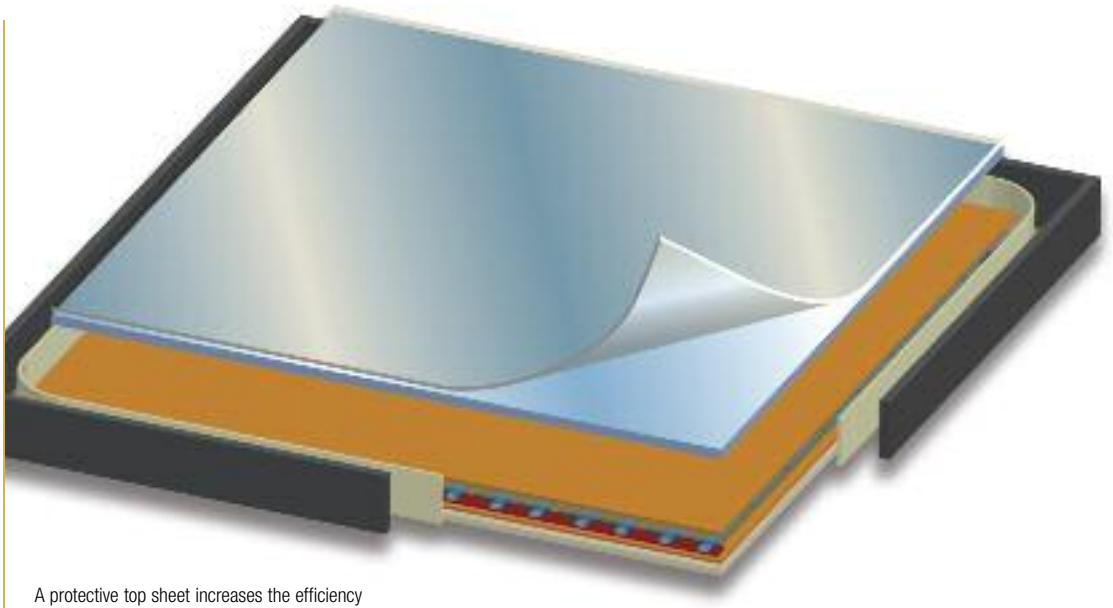
Protective Top Sheet Coatings for Solar Panels



A protective top sheet increases the efficiency and durability of a glass top sheet.

For rigid silicon solar panel manufacturers, the development of a new, protective top sheet material can offer increased protection to the glass top layer to improve efficiency and increase useful panel life.

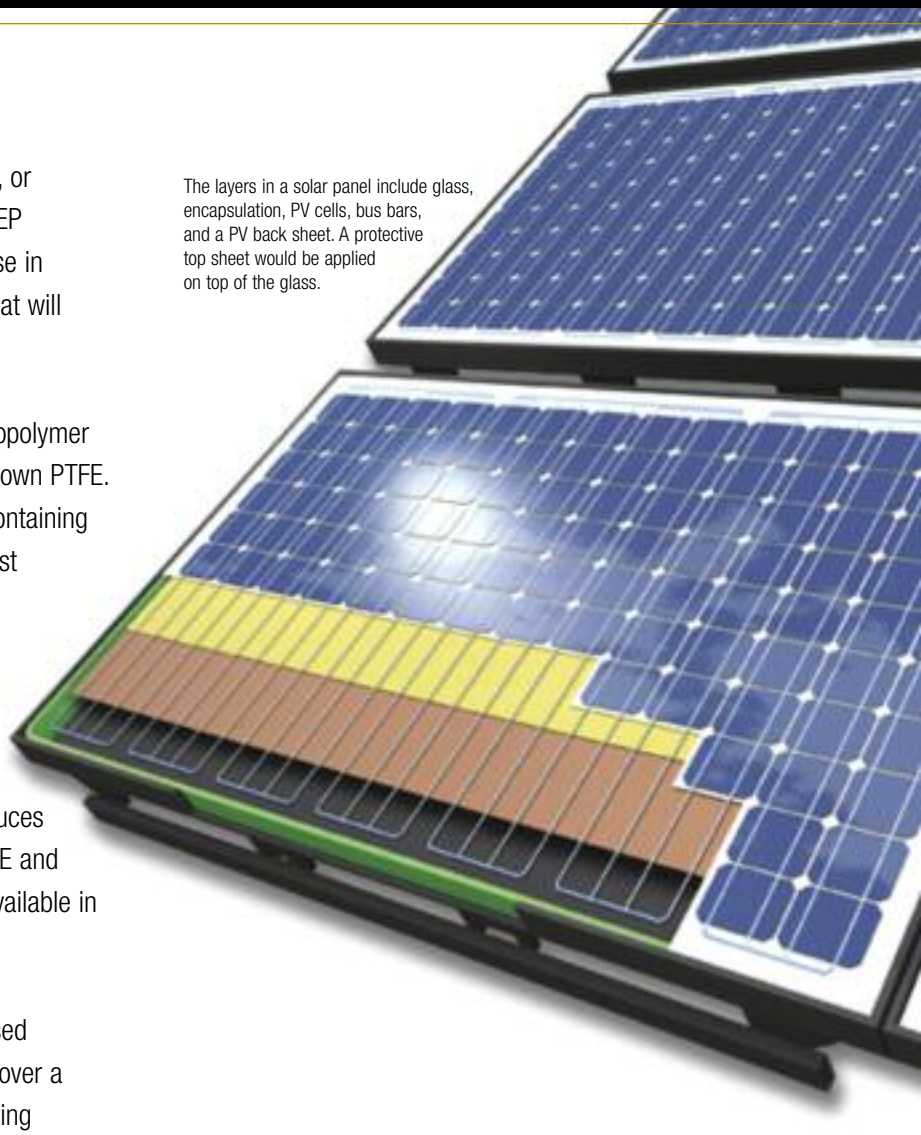
Solar panels need protection during manufacturing, shipment, installation, and everyday use. Harsh weather and abrasions suffered during installation or normal operation can effect panel efficiency.

If the panel manufacturer, integrator, or installer is looking for panel protection from dust, dirt, or scratches during the manufacturing and installation process, then Fabrico has several cost-effective films available, including opaque films. These films will eliminate light from powering the panel until panel installation is complete.

Long Term Solar Panel Protection

These protective top sheets are typically clear monolayer fluoropolymer films like PTFE, FEP, ETFE, or derivatives of these substances. PTFE, ETFE, and FEP are low surface energy plastics and require expertise in selecting adhesives and potential pre-treatments that will bond them securely.

- PTFE (polytetrafluoroethylene) is a synthetic fluoropolymer of tetrafluoroehtylene. Teflon® is the most well-known PTFE.
- PTFE is hydrophobic – neither water nor water-containing substances wet PTFE. It also has one of the lowest coefficients of friction of any solid.



The layers in a solar panel include glass, encapsulation, PV cells, bus bars, and a PV back sheet. A protective top sheet would be applied on top of the glass.

FEP (fluorinated ethylene propylene) is another form of Teflon. It is often foamed in constructions to reduce its dielectric constant. FEP film can be used as an adhesive as well as a substrate. It produces strong bonds between two surfaces of PTFE or ETFE and can withstand temperatures greater than 332°C. Available in film form on rolls, it offers handling convenience.

Ethylene tetrafluoroethylene (ETFE) is a fluorine-based plastic with high corrosion resistance and strength over a wide temperature range. ETFE has a very high melting temperature, excellent chemical, electrical, and UV radiation resistance properties. Compared to glass, ETFE film has 1% of the weight, transmits more light, and costs less to manufacture and install. Other qualities that make it well-suited for solar panel use include resiliency, self-cleaning (non-stick surface), and recyclability.

FEP and ETFE films are strong and lucid thermoplastics that Fabrico uses in various combinations to create a materials stack and form a protective top sheet for rigid crystalline solar modules.

These films provide for easy inclusion into the solar panel manufacturing process, or can be used as an “aftermarket” product applied during solar panel installation.

Top Sheet Films for Flexible Panels

A glass top layer is the industry standard for solar panels because of its ability to transmit light and provide a moisture barrier. Flexible panels by nature require a film top sheet. The film top sheet must provide many of the same characteristics as glass. Glass has a Water Vapor Transfer Rate (WVTR) of 10^{-6}. At this point in time there are only a few film manufacturers with barrier films that can reach WVTR of 10^{-4}. These films usually involve some version of a metalized PET and are thin (around 12 microns thick) and very delicate. Fabrico is working with manufacturers to develop customized top sheets for our customers. By combining different film technologies Fabrico has been able develop durable top sheet materials with excellent light transmission and a WVTR of 10^{-4}.

Fabrico Provides the Correct Protective Top Sheet for Your Needs

Fabrico provides a variety of die-cutting capabilities using rotary press, water jet, CNC, and laser die-cutting systems. In addition, Fabrico offers precision slitting, lamination, testing, and kitting.

Fabrico produces the parts to assemble a module, and participates in initial materials engineering. Fabrico develops materials to meet unique physical and performance requirements for protective top sheets and provides testing services that check incoming materials as well as products being delivered to customers.

With new developments in protective top sheet materials for all types of solar panels, Fabrico researches and tests materials and adhesives to ensure that they meet customer requirements. They ensure compliance with governing standards as well as provide expertise and support to optimize costs, minimize rejects, and meet manufacturing schedules. With that level of assistance from Fabrico and its suppliers, solar panels can evolve to the point of competing with, as opposed to just augmenting, conventional methods of power generation.

A protective solar top sheet can be fabricated using PTFE, ETFE, or FEP.

In-depth Adhesives and Materials Testing

With a fully equipped test laboratory, Fabrico ensures that customer materials meet designed in specifications before they move to the factory floor, often eliminating the need to test materials at the customer's facility. Testing capabilities include:

- Accurate and precise part dimension measurement and verification;
- Adhesive/release liner testing to determine converting properties and high speed application characteristics;
- Material strength measurements to ensure that material meets application requirements;
- Static shear testing to measure the cohesive strength of the adhesive to withstand a fixed load over time;
- Material weight measurement to determine adhesive coating weight;
- Microscopic imaging to determine differences between adhesive and material over time;
- Dielectric testing to determines a material's electrical insulation properties;
- Resistance and voltage testing to provide a complete profile of the electrical properties of an adhesive.

Fabrico provides precision die-cutting and slitting capabilities to exceedingly tight tolerances.

All test and measurement equipment is calibrated annually per ISO 17025 standards. Tests are performed to ASTM (American Society for Testing and Materials) International standards. ASTM International standards are tools for customer satisfaction for a wide range of markets including materials and adhesives testing. Typical ASTM tests performed in Fabricoís laboratory include:

- Adhesion Test Methods - 90 degree and 180 degree
  - ASTM D 3330
  - ASTM D 6265
  - PSTC tests
- Tensile Test ASTM D 828
- Dielectric Tests ASTM D 149 and 150
- Coat Weight Test ASTM F2217
- Resistance, capacitance, and voltage measurements

About Fabrico

Fabrico is the market leader in design and manufacturing services for flexible materials. The company offers a wide range of product design and engineering capabilities including custom die-cutting, rotary die-cutting, prototyping, manufacturing, and final assembly and kitting.

Fabrico is well-versed in material and manufacturing requirements for solar panels. Fabrico supplies bus bars, edge seal tape, junction box assembly material, and a variety of adhesive and laminate sheets to the world's largest solar manufacturer.

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