

3M Products for Solar



Powering Your Future

3M

Build it better — with 3M



For more than a decade, 3M has been a trusted supplier of advanced materials to the solar industry. Today, we offer you a broad range of products and technologies designed to enhance your products' performance, improve reliability and drive down the cost-per-watt.

With 3M, you benefit from an established global technology partner with a long history of delivering innovative solutions to the marketplace. As one of the world's leading suppliers of advanced films, tapes and coatings – with decades of experience in high-volume manufacturing of reliable outdoor materials – we will work with you to design and build more performance and profit into your products.

Innovative solutions for the solar power industry

- Bonding solutions
- Light management
- Thermal management
- Fabrication solutions
- Environmental durability

Thin Film Photovoltaic



3M™ Charge-Collection Tapes

Tin-plated, deadsoft copper foil tapes with a pressure-sensitive adhesive, used in applications requiring excellent electrical conductivity from the substrate through the foil backing. The tin plating facilitates soldering to the backing, and resists oxidation and corrosion. These tapes are available in a wide range of configurations for applications as a charge collector or bus within thin film solar panels.

3M™ Dielectric Tapes

- Excellent high temperature tapes for crystalline silicon (c-Si) and thin film applications
- Reliable electrical insulation
- Automation potential allows for rapid application – high productivity
- Low outgassing adhesive
- Available in custom widths



Featured Solution: 3M™ Specialty Films

3M is one of the world's leading suppliers of advanced films – from materials that provide very high barriers to oxygen and moisture to precision-coated, multilayer electronic display films that are tuned to transmit or reflect specific wavelengths.

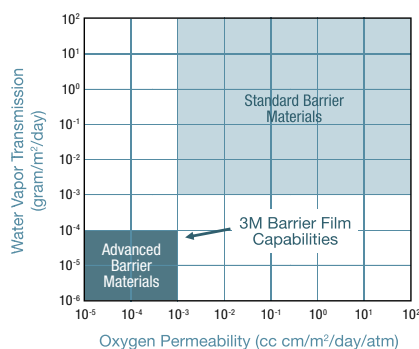
With decades of design and manufacturing expertise, 3M can tailor front and backside films with properties and configurations to meet your most exacting specifications.

For example, 3M Barrier Film technology offers outstanding resistance to moisture and oxygen permeation. Used to encapsulate sensitive components from the elements, it can provide a cost-effective solution for extending system life and reliability.

Features

- Excellent UV stability
- Very low moisture vapor transmission rate
- Good Optical Transmission 400-1400 nm
- Flexible

Advanced Barrier Materials



Featured Solution: 3M™ Scotchshield™ Film 17T

 UL Recognized Component

3M™ Scotchshield™ Film 17T is a backside barrier film for photovoltaic solar modules. The outer surface is treated to facilitate the use of a broad range of adhesives, tapes and labels. Similar to other commercially available backside films, it utilizes a fluoropolymer layer as a key component. Fluoropolymers have excellent resistance to degradation from sources such as UV, heat and moisture. Their weatherability exceeds that of non-fluorinated materials. Film 17T is designed for easy use by module manufacturers. It can be used as received with most existing production equipment and cycles, with no pre-treating required. During lamination, strong, stable, bonds are formed to standard peroxide curable EVA encapsulants.

Features

- Conformable and flexible, for easy lamination
- Robust processing window for wrinkle-free lamination
- Excellent retention of interlayer adhesion after environmental aging
- Excellent UV stability
- Very low moisture vapor transmission rate
- Solvent-free process, no residual solvents
- Resilient, low flammability fluoropolymer
- No special packaging or storage required
- 1100 VDC rating (IEC 60664-1)

Crystalline Silicon (c-Si)

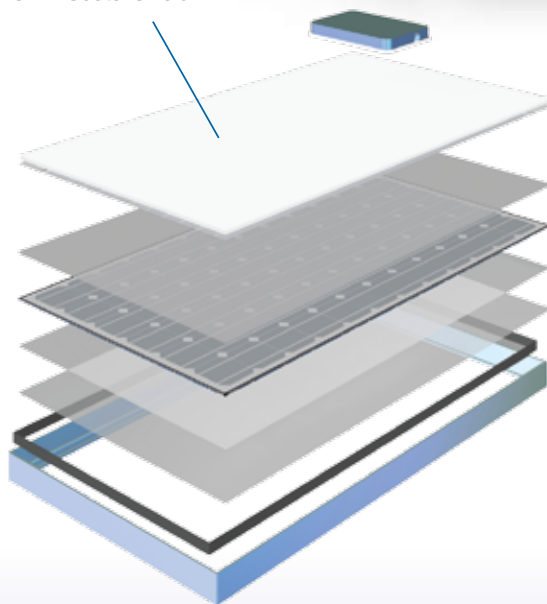


Solar Acrylic Foam Tapes

The easy, no-mess application of 3M™ Solar Acrylic Foam Tapes allows for faster fabrication of a solar module. It also results in a cleaner look, compared to liquid sealants and mastics.

3M foam tapes are used to attach and seal junction boxes on rigid solar panels quickly and permanently, without mechanical fasteners. They offer long-term durability for harsh outdoor applications.

3M™ Scotchshield™ Film 17T



Durable Performance Label Materials

3M provides a broad range of label substrates and adhesives designed to withstand harsh outdoor environments.

Concentrated Photovoltaic



3M™ High Air Flow (HAF) Air Filters

Designed for applications where regular filter replacement is difficult or impractical, but where low airflow resistance is important.

The open channel construction of 3M HAF filters offers low initial airflow resistance, while its unique microstructure and electrostatic charge provides effective particle capture and retention. In certain applications, this may translate into fewer filter changeouts... and/or reduced maintenance costs.

3M™ Optically Clear Adhesives

Designed to provide crystal-clear, high reliability optical coupling and mechanical joining for various transparent materials. These advanced, optical-grade adhesives offer a number of significant performance and productivity-enhancing advantages:



- Environmental stability under high temperature and high humidity
- Excellent choice for high outgassing plastic substrates (e.g. PMMA, PC)
- Available in widths up to 60" (1524mm)

**Featured Solution:
3M™ Solar Concentrator Lens Panels**

3M helped pioneer the practical application of solar power, with products such as 3M™ Fresnel Lens Films. These durable, high-fidelity films have been used for over ten years, helping to reduce the cost and improve the efficiency of large-scale concentrating photovoltaic arrays.

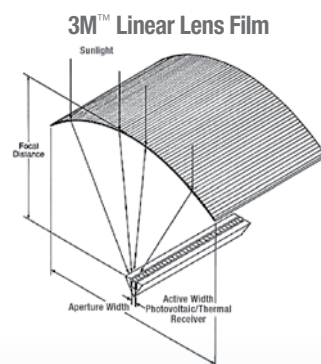
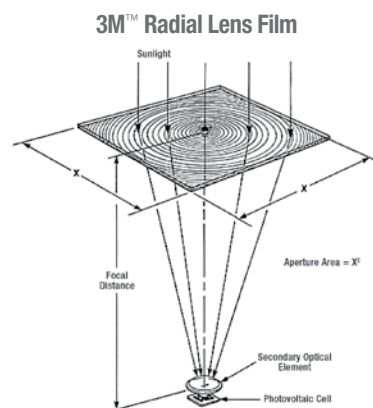
In 3M Solar Concentrator Lens Panels, our Fresnel films are bonded to an optically-clear acrylic substrate, to enhance structural stability and integrity. Lens panels with radial Fresnel patterns are used primarily in high-concentration solar photovoltaic applications. Lens panels having linear patterns may be used in either flat or curved configurations, for both concentrating photovoltaic and thermal applications.

3M's proprietary microreplication technology provides the cost-saving benefits of continuous manufacturing and the fidelity required for high-efficiency Fresnel optics. Tests conducted by Sandia National Laboratories have demonstrated that weatherable acrylic lenses maintain high optical transmission over 17 years of outdoor exposure.*

Characteristics

- Light weight – allows the use of lower-cost substructure designs
- Extremely durable
- 1.49 refractive index

*SAND 74-0241, "Effect of Outdoor Aging on Acrylic Sheet"



3M™ Solar Concentrators on Glass are Fresnel lens panels comprised of radial prism patterns manufactured using an optically clear silicone on a glass substrate. Features include: broad UV stable optical properties, abrasion and impact resistant exterior surface, and excellent dimensional stability over temperature and humidity. Plus, the high fidelity of 3M Solar Concentrators on Glass means that your product matches your design.

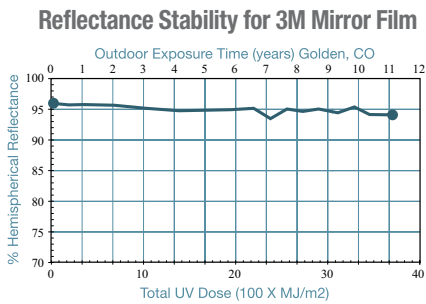
Featured Solution: 3M™ Mirror Films

3M™ Mirror Films offer many advantages over traditional glass mirrors, including higher reflectance, less weight and improved mechanical properties. These features can increase the output and design flexibility of your CSP system.

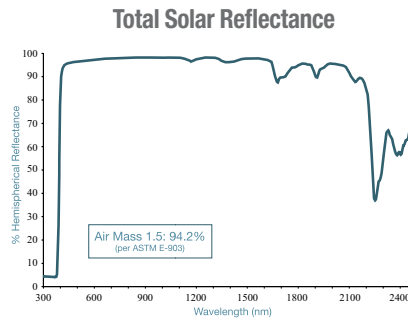
3M Mirror films have been field tested under production-scale conditions for use as parabolic and heliostat reflectors since 1995. 3M has been collecting weathering data on these advanced materials since the 1980s.

Features

- Highly reflective
- Light weight – allows the use of lower-cost substructure designs
- Extremely durable
- Lead-free
- Backside contains 3M pressure sensitive adhesive for quick installation



Reflectance data courtesy of National Renewable Energy laboratory

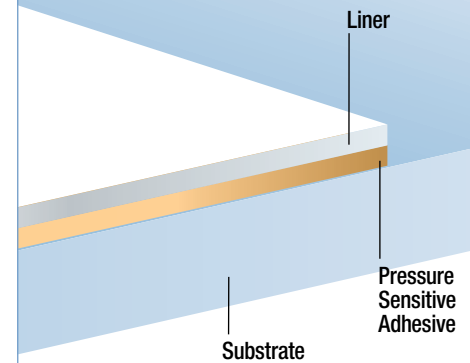


3M Metallized Polymer Films exhibit broad spectrum reflectance

Concentrated Solar Power

3M™ Laminating Adhesive 501W

Features low outgassing acrylic adhesive. Ideal for applications where excellent adhesion and low outgassing and ionic characteristics are desired. Excellent room temperature and high temperature shear performance for holding strength. Low odor, low outgassing of volatile components which can cause fogging or condensation.



3M™ Scotch-Weld™ Structural Adhesives

A family of load-bearing epoxy, acrylic, and urethane adhesives offering high cohesive strength. Available in a wide range of formulations, allowing you to tailor the combination of bond strength, flexibility and other properties to suit the particular needs of your application.



Liquid Filtration

CUNO Incorporated, a 3M company, provides innovative liquid and gas filtration technologies for PV cell manufacturing, including:

- Acids and bases
- Etchants
- Conductive pastes
- Water
- Air

Proper filtration is essential to provide the desired fluid quality, and to protect key process equipment, thereby minimizing downtime and repairs.



a 3M company

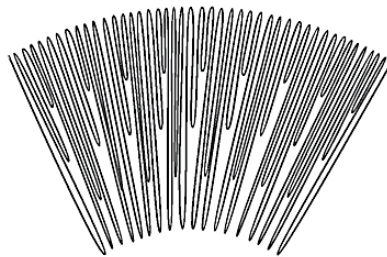
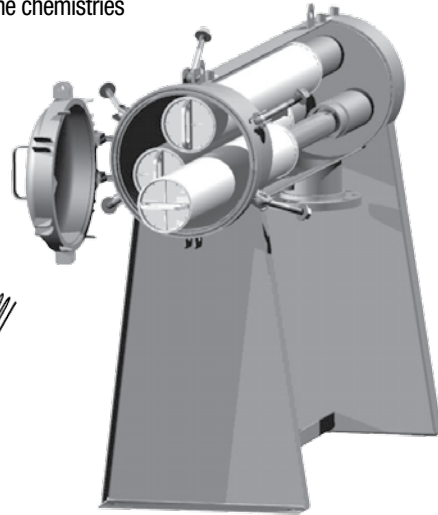
Featured Solution: CUNO High Flow Filtration System

For process cooling water applications, both open and closed loop systems.

- High dirt load capacity
- Compact design
- Patent-pending radial pleat
- High particle removal efficiency

3M Process Chemical and Water Filtration

- A full line of filtration products for all of the chemistries used in PV cell manufacturing
- Patented Advanced Pleat Technology
- Absolute-rated depth and membrane cartridges



3M CUNO Membrane Filtration Cartridges, with Advanced Pleat Technology



More 3M Products for Solar

The following is a representative sample of products from 3M's portfolio of over 50,000 products.

Product Family	Application Area				Application Description
	Crystalline Silicon (c-Si)	Concentrated Photovoltaic	Concentrated Solar Power	Thin Film Photovoltaic	
Tapes					
3M™ Acrylic Foam Tape	●	●	●	●	Ideal for panel-to-frame bonding, junction box attachment, rail attachment, lens to housing attachment, thin glass mirror attachment, and general component assembly
Cell Positioning Tape	●				Cell positioning
Specialty Tapes	●			●	A variety of specialty tapes typical applications include processes requiring low outgassing and/or aesthetic considerations.
Charge-Collection Tapes				●	Connecting, bonding and grounding circuits to a variety of substrates.
Dielectric Tapes	●	●		●	Excellent high temperature tapes for crystalline silicon (c-Si) and thin film applications.
Electrically-Conductive Adhesive Transfer Tapes		●			For grounding and shielding. Tapes conduct electricity through the Z-axis and in the plane of the adhesive (X and Y planes).
Adhesives					
Structural Adhesives	●	●	●	●	General structural bonding applications
Optically-Clear Adhesives		●		●	Bonding optical elements
Laminating Adhesives		●	●	●	Ideal for applications where excellent adhesion and, low outgassing and ionics characteristics are desired
Adhesives/Sealants					
PV 1000	●	●	●	●	One-part adhesive/sealant with excellent UV resistance. Ideal for outdoor applications. Cures to form a firm, flexible, waterproof seal.
Labels					
3M™ Performance Label Materials	●	●	●	●	Product and company identification, serial numbers. Facestock options include clear, silver with glossy polyester and acrylic.
Reclosable Fasteners					
3M™ Dual-Lock Reclosable Fasteners	●			●	Used for attaching various components where repositioning or easy removal is required
Thermal Management					
3M™ Thermally Conductive Interface Materials		●			For bonding heat sinks, heat generating components
Filtration					
3M™ High Airflow (HAF) Filters		●			Used to maintain high airflow in CPV enclosures
CUNO Liquid Filtration	●	●		●	Extends life and maintains purity of process fluids used in the manufacture of PV components

Today's Answers — Tomorrow's Breakthroughs

3M manufactures over 50,000 products, derived from 40+ core technologies, ranging from microreplication and nanotechnology to precision coatings.

These technologies can be combined in an almost unlimited number of ways, to create unique solutions to your most difficult business challenges.

Whether your need is to improve system reliability, speed assembly, reduce per-unit cost or improve performance, we invite you to put 3M science to work for you!

Ad Adhesives	Am Advanced Materials	Bi Biotech										Rf Reclosable Fasteners	
Ab Abrasives	Dd Drug Delivery						Mr Microreplication	Pe Predictive Engineering & Modeling				Rp Radiation Processing	
Ac Acoustics	Dm Display Materials						Nt Nanotech	Nm Nonwoven Materials	Pm Polymer Melt Processing				Sm Specialty Materials
As Application Software	Do Dental & Orthodontic Materials	Fi Films	Fs Filtration, Separation, Purification	Ir Immune Response Modifiers	Md Medical Data Management	Mi Microbial Detection & Control	Pc Precision Coating	Po Porous Materials & Membranes			Su Surface Modification		
Ce Ceramics	Ep Electronic Packaging	Fl Fluorinated Materials	Im Imaging	Is Integrated Systems Design	Me Metal Matrix Composites	Mo Molding	Pd Particle & Dispersion Processing	Pr Process Design & Control			Wo Wound Management		
Cp Chemical Power Sources	Fc Flexible Converting & Packaging	Fo Fiber Optics	Ip Inks & Pigments	Lm Light Management			Pp Precision Processing	Tt Track & Trace			Vp Vacuum Processing		



3M Weathering Resource Center

Established over 60 years ago as a testing laboratory for reflective traffic control materials, 3M's state-of-the-art weathering facility is used to test various environmental factors, such as long-term exposure to heat and UV radiation, that could affect the performance of various tape substrates and bonding systems, including films for solar panels. Using both accelerated lab studies and data collected at multiple outdoor sites located in strategic climatic areas worldwide, we can continually improve our ability to produce durable, reliable tapes and other materials that will stand up to the elements.

For more information on our solar manufacturing product line, contact 3M Renewable Energy at 800-755-2654 or visit us at www.3M.com/solar.

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