EVONIK INDUSTRIES

We turn solar power into next generation energy

Evonik. Power to create.

About us

Evonik, the creative industrial group from Germany, is one of the world leaders in specialty chemicals. Its activities focus on the key megatrends health, nutrition, resource efficiency and globalization. Profitable growth and a sustained increase in the value of the company form the heart of Evonik's corporate strategy. Evonik benefits specifically from its innovative prowess and integrated technology platforms.

Evonik is active in over 100 countries around the world. In fiscal 2011 more than 33,000 employees generated sales of around €14.5 billion and an operating profit (adjusted EBITDA) of about €2.8 billion.

We turn solar power into next-generation energy

Looking for ways to use solar energy creatively? Evonik can show you how it's done. A carport captures sunlight, turning it into new energy for your vehicle. Microstructured lenses boost the efficiency of solar systems. Flexible barrier films make it possible to integrate solar cells into the architecture in an amazing number of different ways. And with over 60 years of silicon chemistry experience, we keep developing new processes for producing solar silicon more cost-effectively.

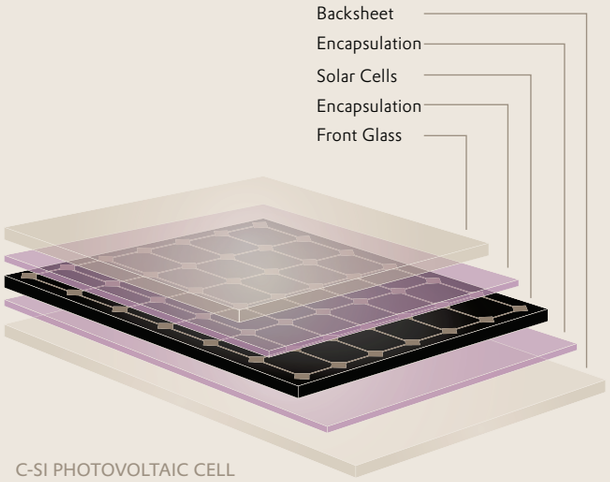
With our wealth of ideas and solutions, we help harness the sun's power. We're the creative industrial group from Germany.

Market segments we serve

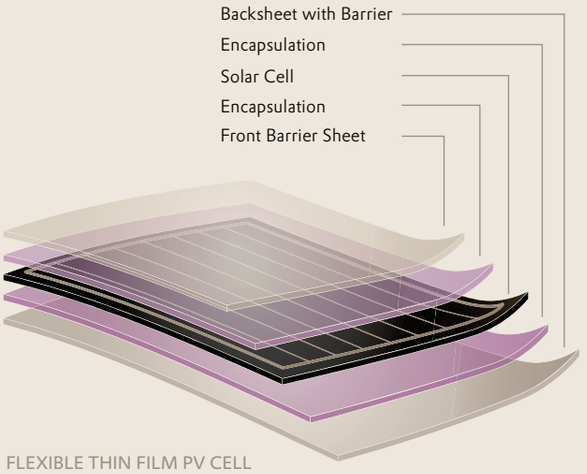
Materials & Services

- c-Si Photovoltaics
- Rigid Thin-Film Photovoltaics
- Flexible Thin-Film Photovoltaics
- Concentrating Photovoltaics (CPV)
- Concentrating Solar Thermal Power (CSP)
- Lightweight Solar Modules

c-Si Photovoltaic Cell & Flexible Thin Film PV Cell



C-SI PHOTOVOLTAIC CELL



FLEXIBLE THIN FILM PV CELL

Products and solutions for photovoltaics

Silicon raw materials

With decades of experience in silicon chemistry under its belt, Evonik supplies high-purity Siridion® chlorosilanes and monosilane for producing solar silicon and photoactive films in thin-film solar modules. Moreover, Evonik keeps developing new processes for producing solar silicon at minimal costs, and thus for generating power from solar energy more cost-effectively. In this way, the company is making an important contribution to grid parity, meaning generating one's own power costs the same as purchasing the power from the grid.

Siridion® is a synonym for

- **Purity**

Siridion® chlorosilanes (dichlorosilane, trichlorosilane, silicon tetrachloride, and hexachlorodisilane) and monosilane are used in the photovoltaics, fiber optics, semiconductor, and flat-panel display industries. Such pioneering application fields where the quality and performance of the endproduct depend on the absolute purity of its key component materials.

- **Cooperation**

Because our customers use cutting-edge processes and technologies, we appreciate the importance of both the quality and the availability of raw materials. The Evonik approach is to bridge with the customer's organization and processes so that our expertise and infrastructure can add value to every stage of the supply and logistics chain, all the way to the actual application area for Siridion® products. Close cooperation with Evonik accelerates development, optimizes manufacturing, and supports the customer's core competencies.

- **Reliability**

To our customers, reliable product quality and on-time delivery are essential. The challenge facing the supplier is to deliver the same high quality every time – and in the required quantities. This kind of consistency can be achieved only through experience in manufacturing and proven production capabilities. Evonik ensures maximum availability and planning certainty at manufacturing sites around the globe, for direct delivery or around the corner in fence-to-fence operations. Zero-defect production and high quality analytics are meaningless without superior logistics. That's what gives our customers the planning certainty they need.

Raw materials for encapsulants

Protecting the solar cells and circuits against chemical and mechanical impact, encapsulants are key components in extending the life time of solar modules. In addition, the encapsulant provides structural support and helps to position the solar cell circuit.
Used in the field for more than 25 years, EVA (ethylene vinyl acetate) is the standard encapsulation material, offering excellent processing properties and long-term module stability.

Our crosslinkers **TAC** and **TAICROS®** provide the following advantages:

- reduction of cycle time → cost savings, higher output
- less bubble formation → better module quality
- higher transparency → improved module performance
- improved color stability → extended module life

Dynasylan® functional silanes act as adhesion promoters between the inorganic glass or silicon layers and the EVA encapsulant layers of a solar module. Dynasylan® can easily be compounded into the EVA encapsulant film. Methacrylate-functionalized silanes are an excellent solution for bonding the encapsulant to glass substrates and frontsheets. Our front-runner here is Dynasylan® MEMO, but our R&D specialists are continuously developing more efficient silane solutions to improve process efficiencies and the shelf life of the EVA encapsulant film. Furthermore, epoxy and vinyl silanes have been successfully used to improve the properties of adhesives and sealants and cable insulations in the assembly of solar modules.

Etching of CI(G)S solar cells

CyPlus manufactures high quality potassium cyanide (KCN) suitable for etching CI(G)S solar cells. This process removes excess copper and sulfur from the surface to improve the properties of the semiconductor. CyPlus's holistic approach makes it possible to use cyanides sustainably. CyPlus offers a) specially designed stainless-steel containers and dissolution systems for transporting and dissolving solid cyanides (CyPlus® SLS-Solid-to-Liquid-System); b) cyanide monitoring and control equipment to measure and control cyanide concentration (CyPlus® CCS and Oxitrol®); and c) custom systems to safely treat cyanide-containing effluents in the solar industry (CyPlus® Cyanide Effluent Treatment).

PLEXIGLAS® Solar – the special solution

Evonik offers a complete range of **PLEXIGLAS®** molding compounds, films and sheet products for many demanding sheet, lens, and mirror applications in photovoltaics. There are four reasons why PLEXIGLAS® is the material of choice in this specialized field of application:

- excellent optical properties
- excellent resistance to weathering and UV light
- precision processing
- impact strength and low weight

Products of the PLEXIGLAS® Solar product group are distinguished by their special transmission characteristics across the spectral range. These are adjusted to the spectral response of the photovoltaic cells to obtain the highest possible module efficiency when photons are converted into electricity. Evonik offers products with customized UV transmission properties that selectively meet the demands of various PV technologies. These products include optical, UV transmitting and a full complement of UV-absorbing levels.

For lightweight solar modules, PLEXIGLAS® offers the highest transmission of all transparent plastics, coupled with outstanding weathering and UV resistance. The newly developed multilayer sheet product provides improved adhesion to various plastics and encapsulation materials. This avoids primer coating in most cases combined with UV-enhanced transparency. Lightweight solar modules find application in, for example, bus stops, golf carts, solar hatches for boats, solar catamarans, and solar radio towers.

The PLEXIGLAS® Solar product portfolio is supplemented by the innovative und user-friendly ACRIFIX® Solar adhesive system. This UV-curable reactive resin system is perfectly adjusted to the PLEXIGLAS® Solar products.

FLEXOSKIN® – Front barrier sheets for flexible photovoltaics

Front barrier sheets by Evonik combine barrier properties with excellent weather-resistance and light-transmission. Standard laminating processes can be used to attach them to the front side of solar cells. This innovative film makes it possible to produce flexible solar modules. It's not only weatherproof and UV-resistant, but also highly transparent. Furthermore, it provides electrical insulation. This combination allows for a cost-effective, flexible, and efficient thin-film technology, one that is also reliable and safe.

Polyamide backsheets

Backsheets based on VESTAMID® can give solar modules lasting protection against environmental and weather conditions – without the disadvantages of classical solutions. Backsheets made of VESTAMID® are cost-effective, safer for the environment than fluorine-based materials (the fluorine content makes recycling far more difficult), and yet still have all the properties required of a backsheet. It doesn't only protect the active components from humidity or ultraviolet radiation, but it also provides the required electrical insulation.

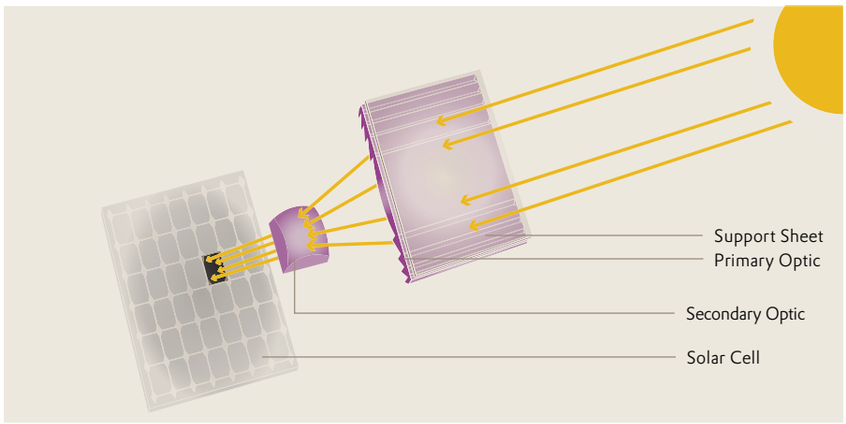
Products and solutions for concentrating photovoltaics (CPV)

PLEXIGLAS®
Solar primary lenses

With its innovative PLEXIGLAS® Solar product group, Evonik offers molding compounds and sheet products as well as lenses for many demanding lens and mirror applications for concentrating photovoltaics. These products are charcterized by their tailored UV transmission properties that selectively meet the demands of the various concentrating technologies.

Customized primary lenses are manufactured in a roll-to-roll process and are adjusted to the spectral response of photovoltaic cells to obtain the highest possible module efficiency.

Furthermore, Evonik offers under the brand name PLEXIGLAS® Solar Pre-Fab Lens Panel a complete acrylic lens package which is used as primary optics for concentrating photovoltaics (CPV). This new lens panel is an inexpensive solution for companies entering the CPV industry especially for startup companies. The lens panel can be delivered without long delivery times and without high costs for individualized tool design.



SAVOSIL® secondary lenses

Evonik is the sole manufacturer of silica glass components made with its patented **SIVARA™** sol-gel technology marketed under the trade name **SAVOSIL®**. SIVARA™ sol-gel technology makes it possible to produce silica glass objects of virtually any shape. The technology is protected by more than 30 patents filed over the years by Evonik. Evonik Cristal Materials is the Taiwanese joint venture between Evonik Industries AG and Cristal Material Corporation that manufactures SAVOSIL® lenses for CPV utilizing the SIVARA™ sol-gel techno-logy allowing the production of elements with very high geometric reproducibility. Because of their high transparency in the spectrum from deep UV to infrared, silica glass lenses made of SAVOSIL® maximize the percentage of the captured sunlight compared to CPVs consisting of conventional optical glass. CPVs can be custom-manufactured according to the customer's exclusive design.

Solar Thermal Power (CSP)

Innovative products from Evonik are also used in the production of effective concentrating solar thermal power plant components: PLEXIGLAS® for CSP.

PLEXIGLAS® weathering films are highly suitable for CSP applications. Moreover, Evonik develops solar mirror films for harnessing solar thermal power –an important energy source for the future.

Services for solar energy products

With extensive know-how and special advice, AQura GmbH, a subsidiary of Evonik Industries, supports its customers with its expertise in solutions to physical and chemical problems and in technical safety studies. About 230 dedicated employees at the Hanau and Marl laboratory sites guarantee efficient solutions to customer-specific issues and requirements concerning all aspects of investigation of materials and substances.

As an accredited test laboratory, AQura offers a number of methods for surface analysis (XPS, SIMS, AFM, ATR-FTIR, TD-GCMS), material characterization SEM- and TEM-EDX, XRD, TGA-MS, NMR, Raman, GPC), and bulk material analysis (combustion analysis, XRF, IR, GDMS, and ICP-MS). Ultra-trace analysis can also be performed on high-purity starting materials and chemicals and other photovoltaic materials. Furthermore, film analysis by GDMS can detect traces of impurities as well as intentional doping in the films.

AQura
analytical solutions

Siridion®

TAC / TAICROS®

Dynasylan®

CyPlus®

PLEXIGLAS® Solar

PLEXIGLAS® Films

EUROPLEX® Films

FLEXOSKIN®

SAVOSIL®

AQura

Evonik Industries is a worldwide manufacturer of PMMA products sold under the PLEXIGLAS® trademark on the European, Asian, African and Australian continents and under the ACRYLITE® trademark in the Americas.

Siridion®

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