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Silicone Solutions for Solar Energy

Bluestar Silicones. Delivering Your Potential.



More than just outstanding silicone properties

Silicone polymers are inorganic compounds with inherently unique properties, especially thermal and chemical stability within a wide temperature range, UV resistance, and environmental compatibility. In the scope of solar applications, the most important performance of silicone is its durability, which has been proven in many other fields and is clearly outperforming durability of organic polymers.

As a photovoltaic module has to be warranted for 20 to 25 years, durability is definitively a key requirement. Solar module manufacturers have to ensure that power output remains as stable as possible. Protection of solar cells and electrical connections in order to withstand harsh environmental conditions over the lifecycle of the solar module becomes a basic technical requirement.

Bluestar Silicones has developed a special range of sealants and adhesives (CAF), encapsulants and potting materials (ESA) for solar applications, designed to provide long-term sealing, bonding, and protection against moisture, chemically aggressive environment, UV, thermal cycling and mechanical stresses. Our range of solar module assembly solutions includes high-performance frame sealing and Junction box bonding materials, as well as cell module coatings, cell encapsulants and Junction box potting agents.

Bluestar Silicones and Sustainable Development: meet the needs of the present without compromising the ability of future generations to meet their own needs.

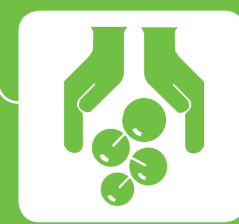


Responsible, sustainable development has always been a part of Bluestar's identity. Water recycling and filtering was the reason behind the foundation of Bluestar in the 1980s, and remains one of the Group's key activities. In this process, Bluestar Silicones is committed to a sustainable development strategy promoting the use of new technologies in order to better protect nature and respect man, for the sake of future generations. Bluestar Silicones' ambition is to improve the day-to-day management of the natural resources. At the Kyoto summit (1989)

and the Copenhagen summit (2009), reducing greenhouse gas emissions through the use of renewable energies such as solar, has been a key element in the different governments' strategies. Through the silicone products present in various applications in the photovoltaic processes, Bluestar Silicones is contributing to a better use of this energy source which is free, abundant and renewable. This presentation of Bluestar Silicones' products for solar applications will help to better describe the Company's contribution to sustainable development.

Product Overview

- **CAF:**
 - One component, room temperature vulcanizing with air moisture (RTV-1)
 - Flexible elastomers with outstanding properties
 - Self-adhesive product on metals & plastics
 - Non corrosive
- **Bluesil™ Pastes:**
 - Highly hydrophobic
 - Corrosion resistance,
 - Outstanding weatherability
- **Bluesil™ Resins:**
 - Spreadability
 - Thermal resistance
 - Outstanding resistance to climatic and ageing agents.
- **Bluesil™ ESA:**
 - Two components adhesive silicon RTV-2 and Gels
 - Self-adhesive system designed to bond to most of the plastics and metals
 - Non Corrosive
 - Optical clear
 - Thermal conductive



An ongoing commitment to safety, protection of health and the environment

Having signed its name to the U.C.I. (Chemical Industry's Union) commitment to progress, Bluestar Silicones is committed to manufacturing its products and carrying out its operations with a continuous focus on improving safety and protecting health and the environment.



A quality system certified to NF ISO 9001: 2000 and NF EN / AS 9100 standard

Silicone Solutions for Solar Energy

Absorbing SOLAR ENERGY...

Having signed its name to the Responsible Care commitment to progress, Bluestar Silicones has committed in managing industrial and commercial operations with a continuous focus on improved safety, health and environment.

Bluestar Silicones is very proud to provide technical solutions in order to improve solar energy systems and ensure renewable energy to be used more intensively in a near future. A complementary range of products for Solar Module manufacturing has been designed providing:

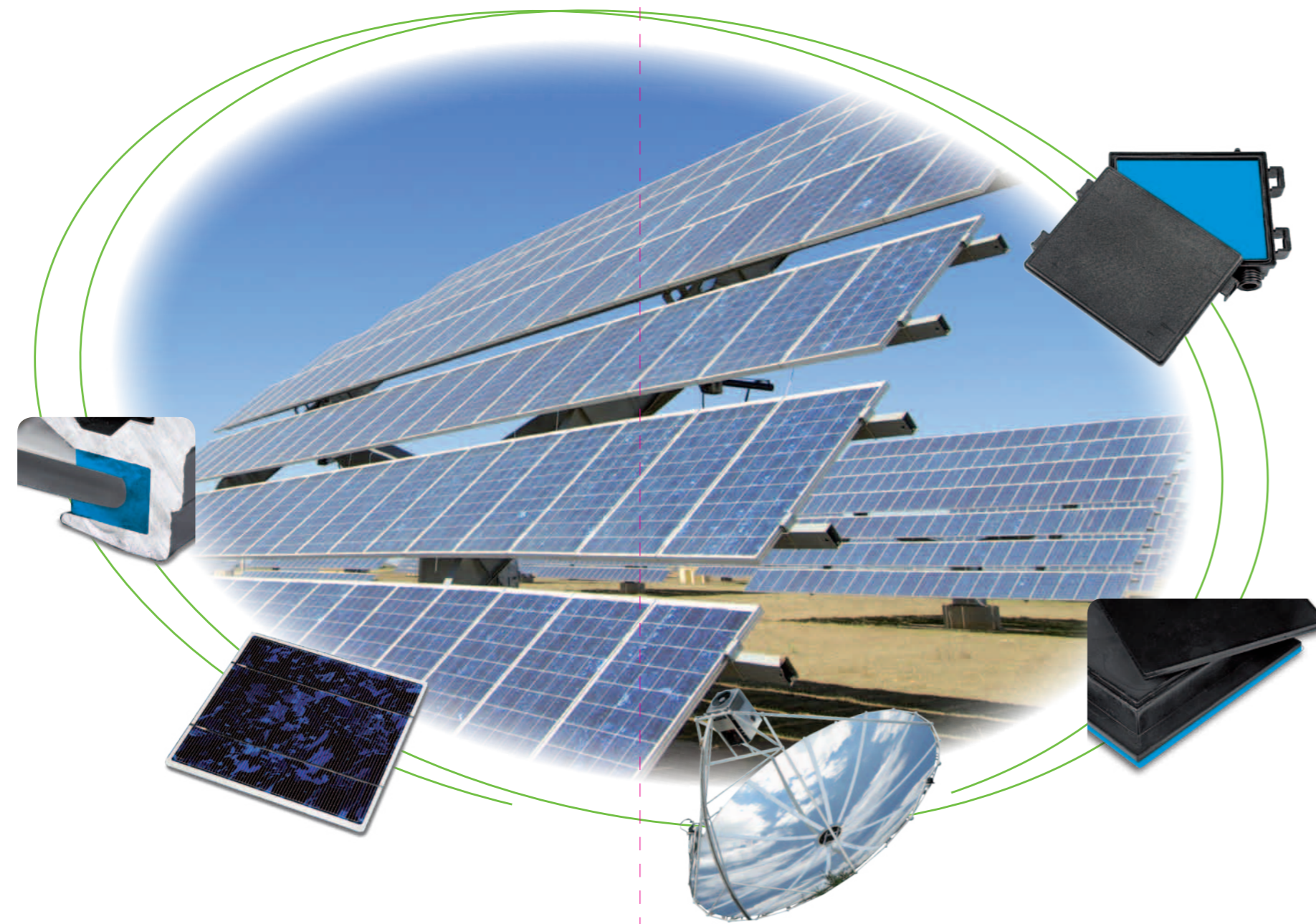
- cost effectiveness
- increased durability
- improved performances

Bonding & Sealing of PV frame

The adhesives (CAF) required for modules are exposed to extreme conditions. They have to withstand and compensate alternating temperature fluctuations of up to 100°C between hot and cold weather conditions, as well as to resist to the wind, snow, moisture and mechanical stresses.

Cell Encapsulation

For the cell encapsulation application, long-term durable transparency is required. This is the reason why our encapsulant agents (Bluesil™ ESA) are well suited for these needs thanks to their excellent optical transparency over a wide light spectrum, outstanding UV stability, high temperature and electrical stability and protection against corrosion. These encapsulants contribute to improve long term cell efficiency.



There are several categories of specific standards for photovoltaic modules:

- performance qualification of the crystalline module : IEC 61215, ISPR 503
- performance qualification of the thin-film module : IEC 61646, CEC 701
- Safety qualification depending on the country: TÜV safety class II in Germany, UL 1703 for North America and IEC 61730 for international.

Our Solar products have been homologated according these standards with different type of photovoltaic modules. Independently of the technological assembly type of the solar module, we also perform ageing tests on our materials (particularly for adhesion) like the hot and wet test (85°C ± 2°C, 85% ± 5% HR for 1000 hours) described in the IEC 61215 for example.

... and converting to ELECTRICAL POWER

One of the key parts of the module is the part where all the energy coming from each individual solar cell is collected and delivered on the grid through standard cables. Junction box is the usual name of this essential part of the solar module.

Potting of the Junction boxes

The Junction box, usually positioned on the back-sheet of the module, is used as an exit for the cables but could also be an entry-point for moisture. This could lead in worst cases to destruction of the electrical unit. Moisture protection combined with flame resistance, electrical insulation and thermal conductive properties of potting agents (Bluesil™ ESA) are key parameters for a long term operation of Junction boxes.

Bonding of the Junction boxes

Moreover, the Junction box must be connected to the back-sheet for all the life of the module. Our adhesives (CAF) are designed to provide long-term bonding and protection against moisture, environmental attack, mechanical and thermal shock.

Technical service

Our Technical Customer Service Laboratory support our customers by developing analysis and tests to assess performance of our materials and contribute to an optimized design of the parts where our materials are used. We also offer our customers the opportunity of producing prototype series with our dispensing equipment or in close cooperation with dispensing equipment suppliers. Technical support for mass production can be provided by our team of technicians who have a strong experience of managing silicone materials in a wide range of applications like adhesive, potting, encapsulating and sealing applications. We also have the facilities to perform tests in ageing conditions involving UV exposure, moisture and thermal cycling.

