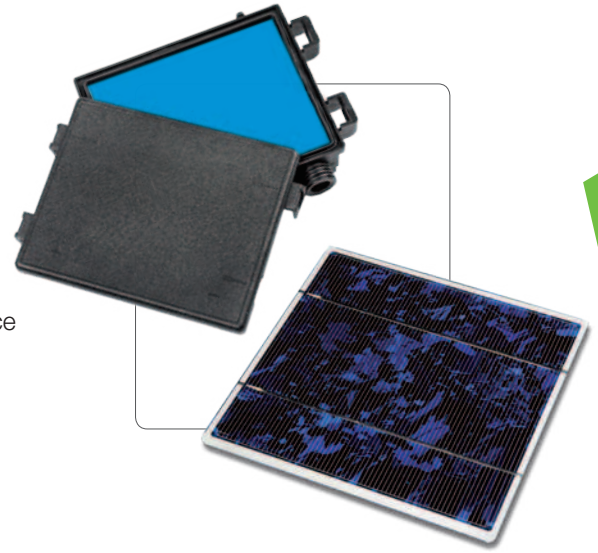
Silicone Solutions

For Potting & Encapsulation

Bluestar Silicones materials are used for photovoltaic module applications to improve their reliability and durability due to their unique features. ESA products, Electronic Silicone Adhesives, are two components silicone elastomers which cure at room temperature (RTV-2) by polyaddition reaction. The curing can be accelerated by heating. After curing, gels or elastic materials are available from the ESA range.

ESA Potting materials have excellent weather resistance and give an excellent protection against moisture. These properties associated with high electrical insulation performances, fire resistance (UL approvals), thermal conductivity, wide temperature range stability (-40°C to +150°C) are key parameters for a long term operation of the Junction box. Suitable for automated dispensing, ESA potting agents are ideal for mass production. A quick curing version is also available, which allows to turn the panel around 15 minutes after having applied the product.

ESA Encapsulation materials have an excellent optical transmittance over a wide light spectrum. This high transparency combined with outstanding UV stability, high temperature and electrical stability, and protection against moisture make ESA encapsulants excellent candidates to improve long term cell efficiency.
In addition, ESA encapsulation agents also provide excellent adhesion properties.



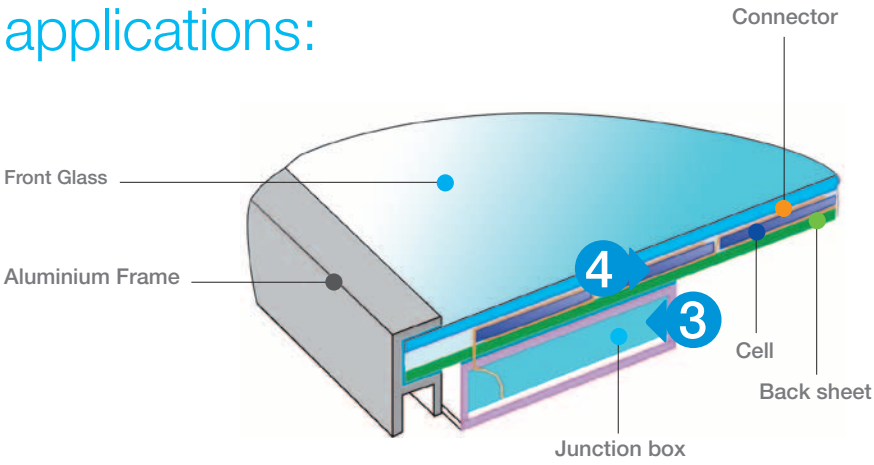
BENEFITS

- Quick curing at room temperature, excellent deep section cure
- Wide temperature range stability
- Excellent adhesion on various substrates
- Optically clear and opaque grades
- Thermal conductive grades
- Wide range of hardnesses, from gels to 55 Shore A
- Excellent dielectric properties
- UL approvals

Bluestar Silicones. Delivering Your Potential.

BLUESTAR SILICONES

Potting & Encapsulation applications:



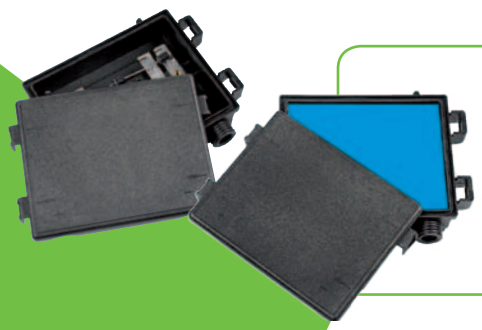
3 Junction box potting
4 Cells encapsulation

Pastes & Resin range: general properties

		Pastes				Resin
		Past 4	Past B431	Past 90	Past 340	Resin 991
	Main characteristics	Water repellency	Fluid potting	Potting	Thermal conductive	Conformal coating
Physical properties	Color	Translucent to whitish			White	Pale straw yellow
	Specific gravity @ 25°C	1.0	1.1	1.0	2.2	1.03
	Worked penetration (mm/10) (1)	260	390	330	280	Viscosity: 175 mm²/s
	Unworked / Rested penetration (mm/10) (1)	200	370	320	270	Dry matter content: 50%
	Exudation (%) (2)	<6	-	<1	<1.5	nc
	Evaporation (%) (2)	<2	<3	<1	<1.5	nc
	Drip point (°C) (3)	-	-	>250	-	nc
Thermal properties	Service temperatures (°C)	-40 to +200	-60 to +200	-50 to +200	-40 to +200	-20 to +200 *
	Thermal conduction @ 25°C (W/mK)	0.21	0.25	-	0.52	nc
Dielectric properties	Dielectric strength (kV/mm) (4)	20	20	-	15	80
	Dielectric constant @ 1kHz (5)	2.6	2.6	-	3.5	2.7 (100Hz)
	Power factor @ 1kHz (5)	5 E-4	2 E-3	-	5 E-3	1 E-3 (100Hz)
	Volume resistivity (W.cm) (6)	1 E13	1 E13	-	1 E13	1 E14
Storage	Shelf life from the production date (months)	36	36	36	18	12

(1) NF T 6012, ASTM D 217, DIN 51804
(2) After 24 h at 200°C
(3) ASTM D 566
(4) NF C 26225 - ASTM D 419 - IEC 60 243
(5) NF C 26230 - ASTM D 150 - IEC 60 250
(6) NF C 26215 - ASTM D 257 - IEC 60 093

* these values are given for information; for any other range of temperature we recommand to realize some preliminary tests

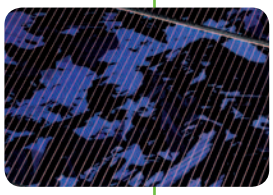


BSI provides Junction box potting agents that offer a unique combination of benefits: moisture protection, electrical insulation, thermal conductive properties, fire resistance (UL registration), quick curing at room temperature. In addition ESA range of silicone rubbers and gels also provide excellent adhesion properties, damping performances as well as outstanding weatherability.

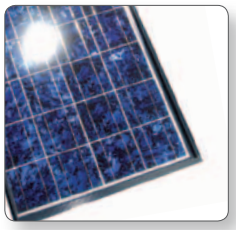
ESA range: general properties

		BLUESIL™ ESA					
		RTV II PA				Gel PA	
		ESA 7250 A&B	ESA 7251 A&B	ESA 7252 A&B	ESA 7252 QC A&B	ESA 6024 A&B	ESA 6110 A&B
	Main characteristics	Optically clear, UL 94 HB (1mm)	Optically clear, high adhesion	UL 94 V0 (3,4mm); good thermal conductivity	UL 94 V0 (3,4mm); quick curing	self-adhesive, high damping, low extractables, low viscosity	Optically clear, low viscosity
	Color	Transparent	Transparent	Black	Black	Blue	Transparent
	Specific gravity @ 25°C (1)	1.02	1.02	1.4	1.4	0.97	0.98
Process	Viscosity (mPa.s) (2)	4 000	2 000	6 000	6 000	1 300	1 200
	Ratio	10:1	10:1	1:1	1:1	1:1	1:1
	Pot-life	4h	8h	90min	<5min	90min	50min
	Cure temperature	1h 150°C	1h 150°C	5min 150°C	10min 23°C	24h 23°C	3h 23°C
Mechanical properties	Shore A hardness for 6 mm thick section (points) (3)	52	27	48	48	-	-
	Penetration (1/10mm) (6)	nc	nc	nc	nc	300	250
	Tensile strength (MPa) (4)	6.2	2.1	2.3	2.3	-	-
	Elongation at break (%) (4)	115	190	170	170	-	-
	Tear strength (kN/m) (5)	4	2	5	5	-	-
	Adhesion	100% CF glass	100% CF metals, glass, plastics	100% CF glass	100% CF glass	Tacky	Tacky
Dielectric properties	Dielectric strength (kV/mm) (7)	20	20	18	18	23	23
	Dielectric constant @1kHz (8)	2.7	2.7	3.2	3.2	2.8	2.8
	Power factor @ 1kHz (8)	1 E-3	1 E-3	5 E-3	5 E-3	1 E-3	1 E-3
	Volume resistivity (W.cm) (9)	1 E+15	1 E+15	8 E+13	8 E+13	1 E+15	1 E+15
Thermal properties	Thermal conduction at 25°C (W/m.K)	0.16	0.16	0.42	0.42	0.15	0.15
	Minimum service temperature (°C)	-70	-50	-60	-60	-40	-40
	Maximum service temperature in continous use, 1000 h (°C)	180	180	180	180	150	150
	Maximum service temperature in peak, 72 h (°C)	200	200	200	200	180	180
Flame retardancy	UL 94	HB	HB pending	V0	V0 pending	HB pending	HB pending
Storage	Shelf life from the production date (months)	24	12	20	20	12	12

(1) ISO R 1183, DIN 53479, NM 703
(2) Brookfield NF T 76105, ASTM D 445
(3) ISO R 868, DIN 53505, ASTM D 2240, BS 903 (A7), NF T 46003, NM 471
(4) ISO R 37 (H2), DIN 53504, ASTM D 412, BS 903 (A2), NF T 46002 (H2), NM 470
(5) ASTM D 624 éprouvette A, NM 492
(6) DIN ISO 2137 (150g hollow cone)
(7) IEC 60 243-1
(8) IEC 60 250
nc: non concerned



High light transmittance in UV-visible wavelength associated with outstanding optical stability make Bluesil™ ESA 7250 A&B, ESA 7251 A&B and ESA 6110 A&B excellent candidates for encapsulation of a wide variety of cell designs.
Their optical clarity and stable properties upon exposure to heat and moisture make these products the best choice for cell encapsulation.



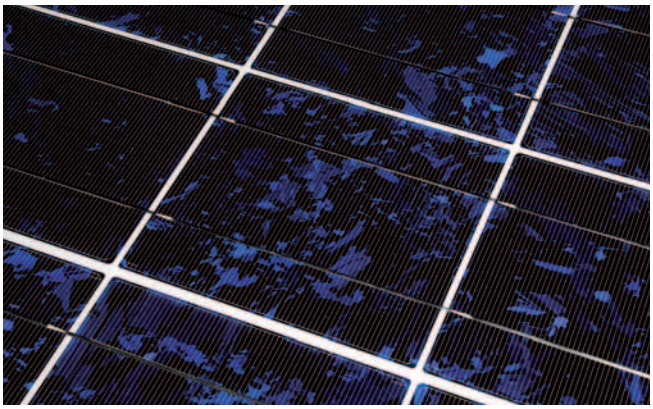
Functions & Applications

		BLUESIL™ ESA					
		RTV II PA				Gel PA	
Function	**Examples of Application**	**ESA 7250 A&B**	**ESA 7251 A&B**	**ESA 7252 A&B**	**ESA 7252 QC A&B**	**ESA 6024 A&B**	**ESA 6110 A&B**
Potting & Encapsulating	PV Junction box potting			●	●	●	
	Cells encapsulation	●	●				●

			Pastes				Resin
Function		**Examples of Application**	**Past 4**	**Past B431**	**Past 90**	**Past 340**	**Resin 991**
Potting	Removable	PV Junction box potting	●	●	●		
	Heat transfer	PV Junction box potting				●	
Coating	Protection	PV Cells & module coating					●

Coating & Durability

Bluestar silicones offers coating specifically designed to provide an excellent durability and thermal stability required for solar consumer products. Outstanding resistance to UV solar radiation, climatic and ageing agents also ensures long term protection efficiency.



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