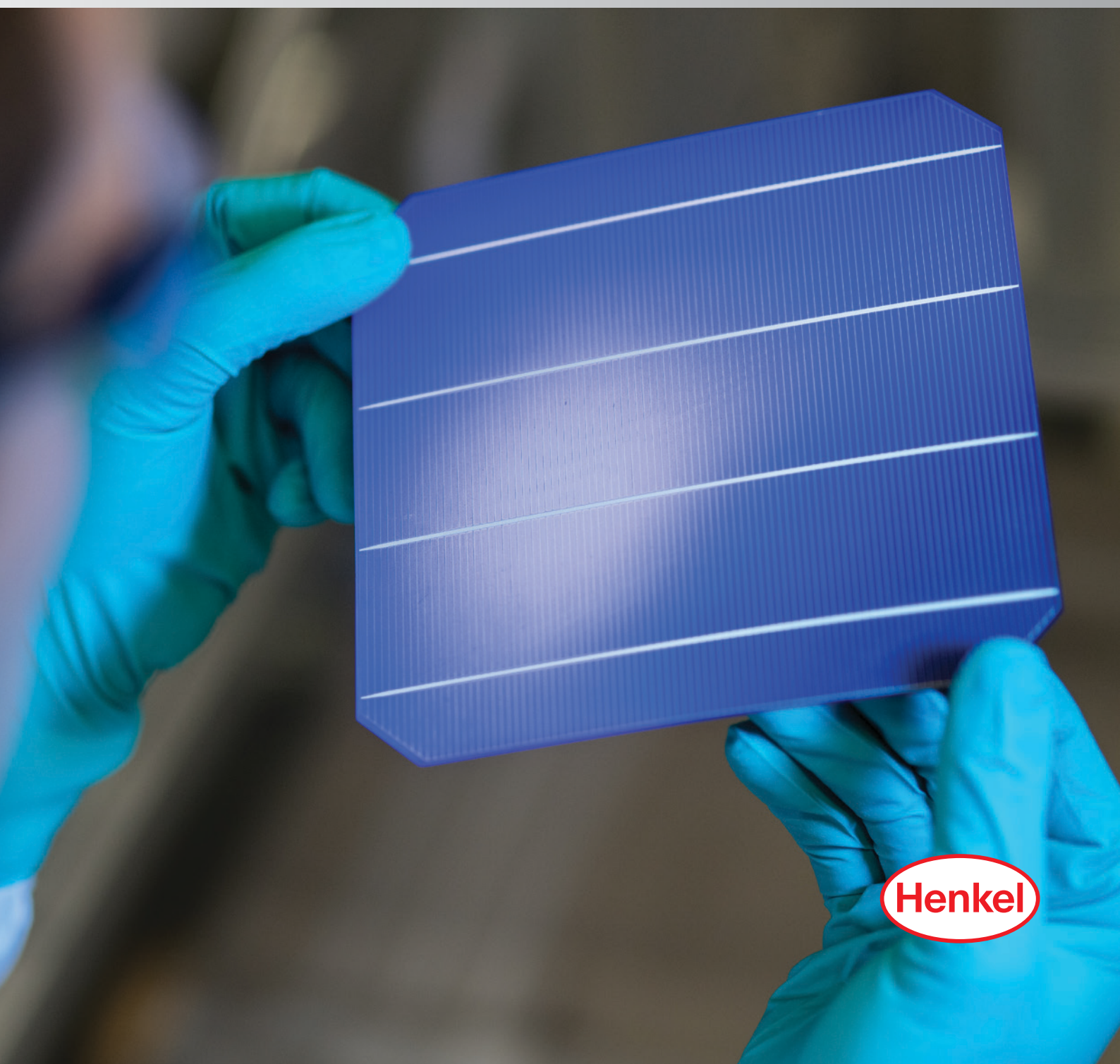


LOCTITE[®]

MATERIALS FOR ADVANCED PHOTOVOLTAICS

LOW TEMPERATURE MATERIALS FOR THE NEXT GENERATION OF PHOTOVOLTAICS



Henkel

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HENKEL IN SOLAR

Advanced Energy Solar Applications

At Henkel, we know that materials innovation is a primary catalyst for the widespread adoption of Renewable Energy. As the leading innovator of electrically conductive adhesives (ECAs), low temperature conductive pastes, printed inks for BIPV and third-generation PV, as well as novel solders and encapsulants, Henkel is facilitating the manufacture of next-generation solar technologies with the lowest total cost of ownership and lowest levelized cost of energy (LCOE).

Helping solar specialists deliver profitable results is at the core of Henkel's development efforts, as our customers' profitability is critical for the future of PV.

SUSTAINABILITY

Leadership in sustainability is one of Henkel's corporate values and our ambition is to achieve more with less. This means we create more value for our customers and consumers, for the communities we operate in, and for our company –at a reduced environmental footprint.

FACTOR 3.

www.sustainabilityreport.henkel.com

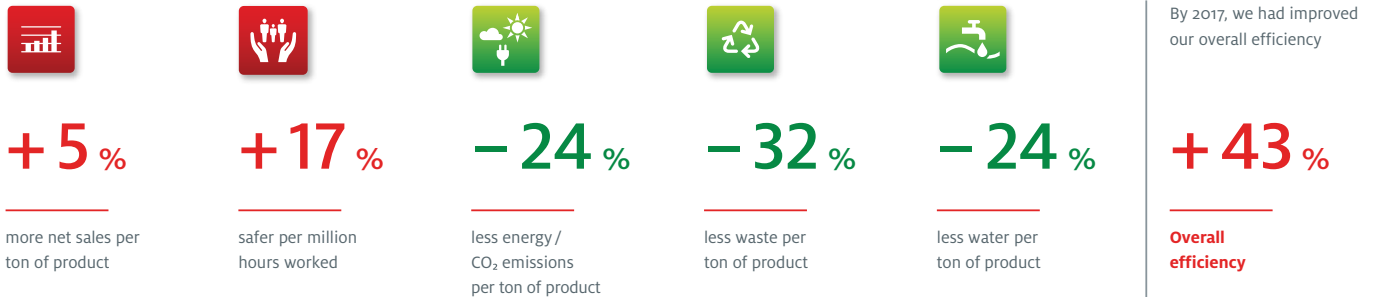
Our 20-year goal, set in 2010, is to triple the value we create for the footprint made by our operations, products and services by the year 2030. We call this ambition Factor 3 – to become three times more efficient.






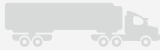



Sustainability at Henkel

Achievements

In 2017, we made significant progress toward the achievement of these interim targets (base year 2010):



Deliver more value at a reduced footprint

 <h3>Energy and climate</h3>	 <h3>Materials and waste</h3>	 <h3>Water and wastewater</h3>
<p>We want to reduce our energy consumption and our climate-damaging emissions</p> <p>-30% (per ton of product)</p>	<p>We want to use less raw materials and generate less waste.</p> <p>-30% (per ton of product)</p>	<p>We want to reduce water consumption and wastewater.</p> <p>-30% (per ton of product)</p>
<p>-5% Logistics emissions </p> <p>"Climate-positive" vision</p> <p>50% electricity generated from renewable energy sources</p> <p>-50 millions CO₂ generated by our customers and consumers</p> <p>100% electricity generated from renewable energy sources by 2030</p> <p>-75% CO₂ footprint of our production by 2030 </p>	<p>Sustainable palm oil</p> <p>100% mass balance 100% traceability</p> <p>Increasing availability of sustainable palm oil through cooperations</p> <p>Packaging</p> <p>-20% Weight (per sales unit) -9% recycled aluminum</p> <p>+33% recycled PET in EU 300 million consumers informed about recycling</p> <p>ZERO landfilled waste by 2030</p>	<p>We want to reduce water consumption during production and when our products are used. </p> 

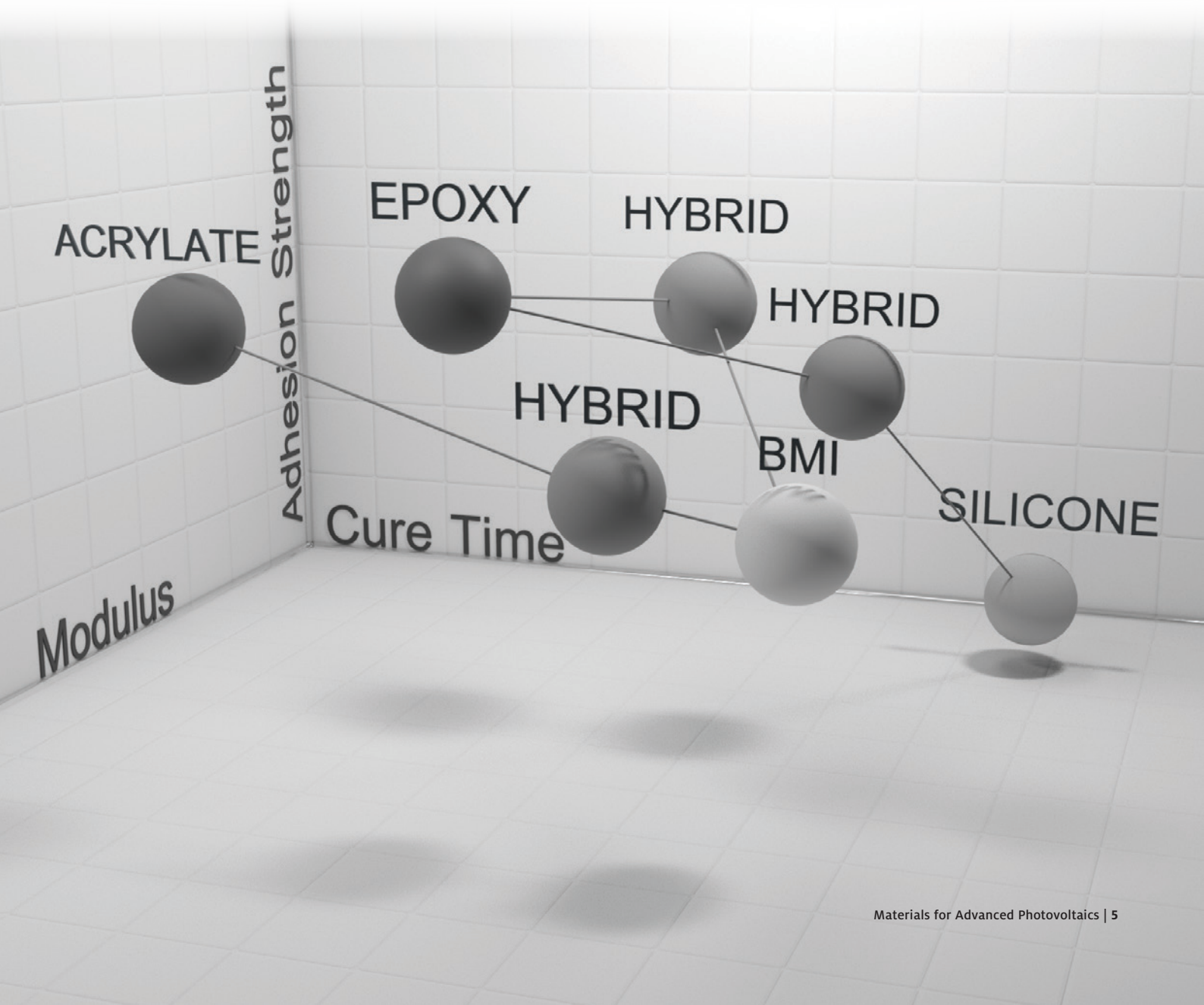
Electrically Conductive Adhesives Technology Leader

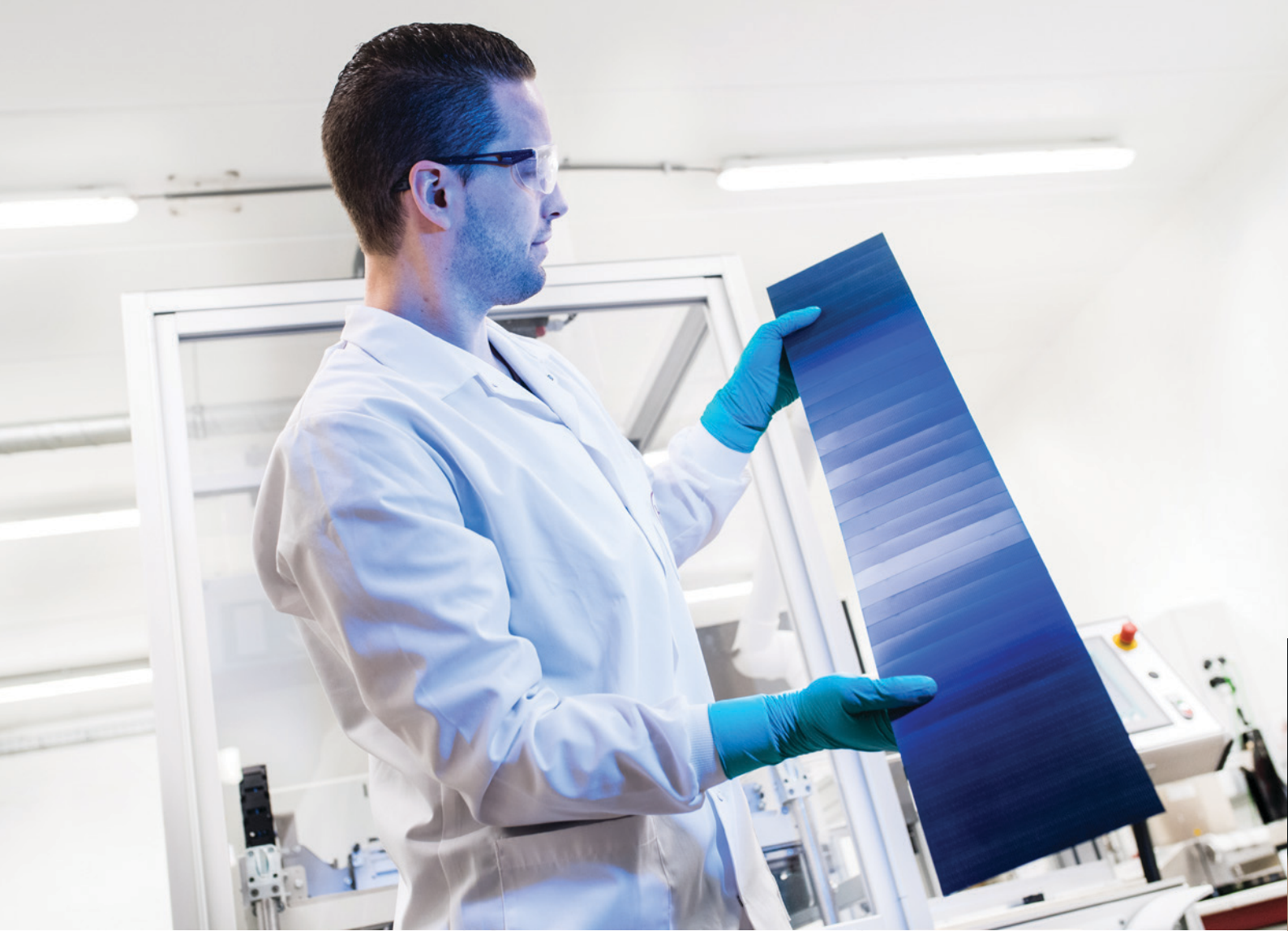
Since inventing electrically conductive adhesives (ECAs) in the 1950's, Henkel's dominance in ECA innovation and global market share have remained unmatched. Our broad understanding of material formulation and in-use behavior has led to the development of over 300 commercial ECA products.

Highly-customized ECAs that are fit for purpose, combined with our expertise in the chemistry nuances of all ECA chemistry platforms including Acrylates, Epoxies, Silicones, Bismalimides and Hybrids; our customers realize success in the design, manufacture and performance of advanced photovoltaic (PV) systems.

In the solar market, Henkel's comprehensive ECA toolbox is enabling the delivery of next-generation solar cell and module designs that are more efficient, more reliable and cost-effective.

300+ Commercial ECA's in 8 Chemistry Families





ECAs Custom Designed for Photovoltaics

Prioritizing performance, processability and cost as measured by \$/W, Henkel's portfolio of customized ECAs for solar applications deliver:

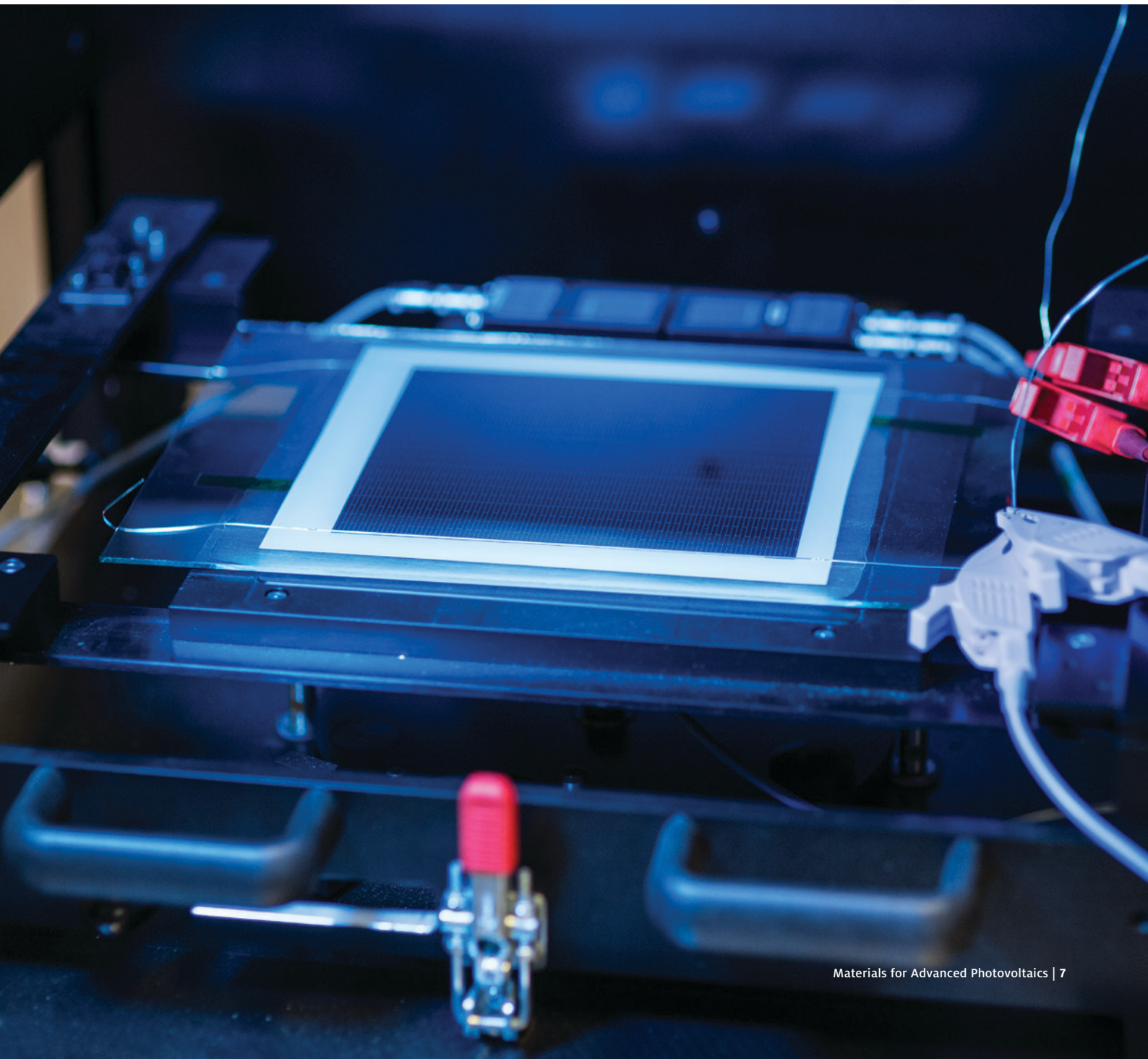
- **Lower Costs** – **\$0.005/W – \$0.02/W** ECA cost per panel
- **High Throughput** – **200 mm/sec.** application speeds for all common application methods, **full cure in under 10 sec.**
- **High Yield** – High precision of alignment with **< 300 µm deposition** width in production settings
- **Expert Technical Support** – Loctite ECAs are supported by world-leading ECA engineering staff with open testing and **characterization labs in all global regions**
- **Reliability** – 100% silver solution ensures bankability, **eliminating** both high-volume production challenges and warranty **risks of using copper-containing ECA's**
- **Optimization** – **Customized material** flexibility, adhesion, substrate compatibility, processing and curing mechanisms for any design requirement
- **Broad Material Selection** – Comprehensive range of **Epoxy, Acrylate, Silicone and Hybrid solutions** makes Henkel distinct in our ability to optimize ECAs specifically for each application
- **Quality Assurance** – **State-of-the-art quality** systems customized for ECA production
- **Fast and Flexible** – Solar ECA Production and **R&D in all regions**
- **Global Supply Chain** – End-to-end **international compliance and global presence with employees in 120 countries** removes regulatory challenges and concerns regarding frozen goods

Technical Consultation

Ensuring Productivity and Cost Targets are Met

For projects that demand a level of support beyond the boundaries of standard technical service, Henkel can provide complete engineering services. Utilizing state-of-the-art test labs in Europe and Asia, Henkel:

- Co-designs ECA materials and Processes – Supports testing and characterization work to validate and optimize production lines
- Formulates products to align with specific equipment sets and customer requirements – Engineering teams partner with customer technical specialists to collaboratively optimize materials and manufacturing processes
- Offers full-time production line support to ensure our mutual success



ECA Product Properties

Product Name	Key Attributes	Tensile Lap Shear Strength (N/mm ²)	Volume Resistivity (Ω • cm)	Glass Transition Temperature, T _g (°C)	Storage Modulus, 25°C (Mpa)	Cure Speed
Acrylate						
LOCTITE ABLESTIK CA 3556HF	Very flexible, snap cure, high adhesion applicable for print and dispense speeds at > 150 mm/sec.	12	2.5 E-03	-20	800	< 30 sec cure at 120°C, < 10 sec. cure at 150°C
LOCTITE ABLESTIK ICP 8118	Low silver, jet, auger and time/pressure dispensable, snap cure with application speeds > 200 mm/sec.	11	1.1 E-03	-20	300	< 30 sec. cure at 120°C, < 10 sec. cure at 150°C
LOCTITE ABLESTIK ICP 8282	Low silver, screen and stencil printable snap cure with application speeds > 250 mm/sec.	10	1.1 E-03	-20	300	< 30 sec. cure at 120°C, < 10 sec. cure at 150°C
LOCTITE ABLESTIK ICP 8311	Sn and SnPb compatible, very stable contact resistance on non-noble metallization with print and dispense speeds above 180 mm/sec.	11.5	3.4 E-04	-20	200	< 30 sec. cure at 120°C, < 10 sec. cure at 150°C
Epoxy						
LOCTITE ABLESTIK CE 3103WLV	Very stable electrical performance and high adhesion on Ag, Sn, SnPb and Cu. Dispensable version.	13	8.0 E-04	114	4,500	< 90 sec. cure at 180°C
LOCTITE ABLESTIK CE 3104WXL	Very stable electrical performance and high adhesion on Ag, Sn, SnPb and Cu. Stencil and screen printable version.	9	7.0 E-04	114	4,500	< 90 sec. cure at 180°C
LOCTITE ABLESTIK 2030SC	Low stress, snap curable designed for high speed production applications.	2.7	2.0 E-04	28	3,300	< 30 sec. cure at 120°C, < 10 sec. cure at 150°C
Silicone						
LOCTITE ABLESTIK ICP 4001	Good conductivity, low temperature cure and outstanding elongation performance.	> 1.7	4.0 E-04	-50	40	Lamination cure
LOCTITE ABLESTIK ICP 4015	Excellent conductivity, low temperature cure and outstanding elongation performance.	> 1.5	7.0 E-04	-50	40	Lamination cure

LOCTITE ABLESTIK ICP 8000 Series

Leading the Next Generation of Photovoltaic Module Design

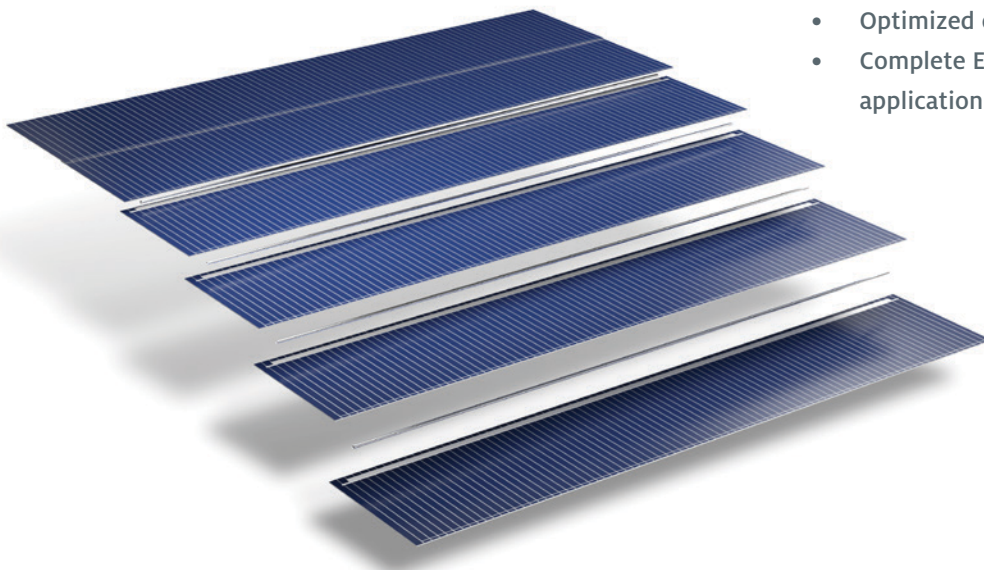
Cell Interconnect Ribbon Bonding



- Enabling reliable tabbing with wafer thicknesses below 160 μm
- Designed for both Ag and Sn and SnPb ribbon
- \$ 0.007/W – \$ 0.02/W
- 1.2 N/mm+ peel strength on Ag, Sn and SnPb
- 200+ mm/sec. print speeds
- Fully cured before lamination improving throughput, in-line testing and yield
- < 30 sec. cure at 120°C, < 10 sec. cure at 150°C
- Compatibility with Heterojunction and third-generation cell architectures

Shingled Solar Modules

Enabled by Henkel’s Loctite Ablestik ICP 8000 series electrically conductive adhesives, shingled solar modules are the latest c-Si cell connection innovation, delivering better performance and reduced material consumption versus alternative designs.



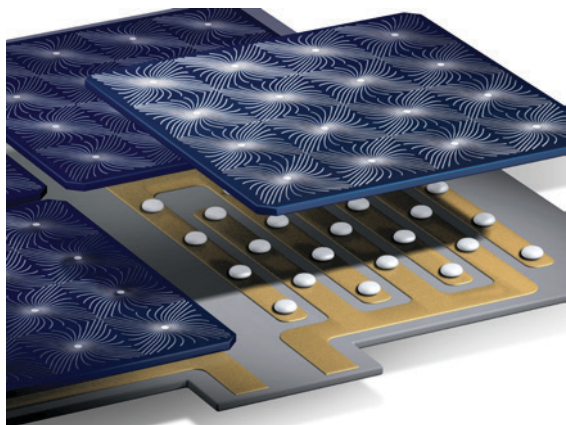
- \$ 0.005W – \$ 0.018/W
- 200+ mm/sec. dispense and print speeds
- < 30 sec. cure at 120°C, < 10 sec. cure at 150°C
- Optimized on equipment vendor’s tool
- Complete Engineering Guides for all application methods

Back Contact Cells

Metal Wrap Through (MWT) and Interdigitated Back Contact (IBC)

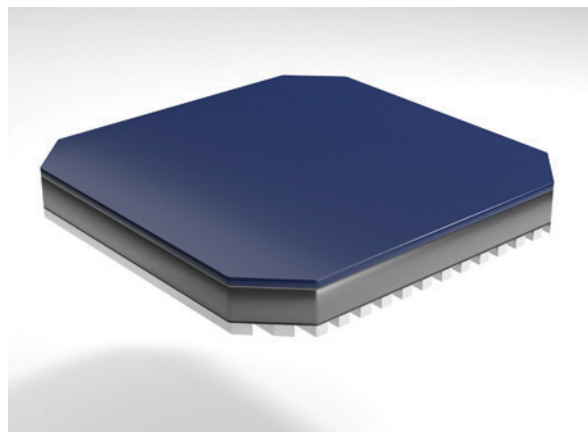
Henkel began custom designing ECA's for MWT designs in 2011. We have a suite of low cost ECA products tailored to both jet dispense and screen printing processes.

Metal Wrap Through (MWT)



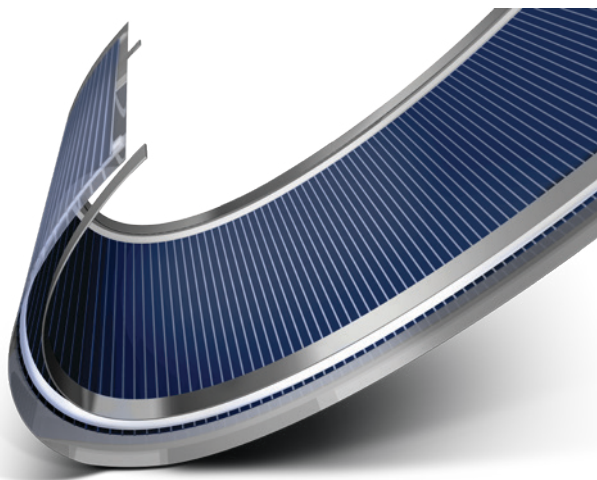
- Screen, stencil printing or jetting with consistent dots and high planarity
- Highly flexible with high stress absorption
- Low and stable contact resistance on Copper

Interdigitated Back Contact (IBC)



- Low temperature, low-cost SnBiAg solder paste
- Low-cost solder paste formulated with SAC 0307
- Jettable solder paste
- Busbar metallization paste

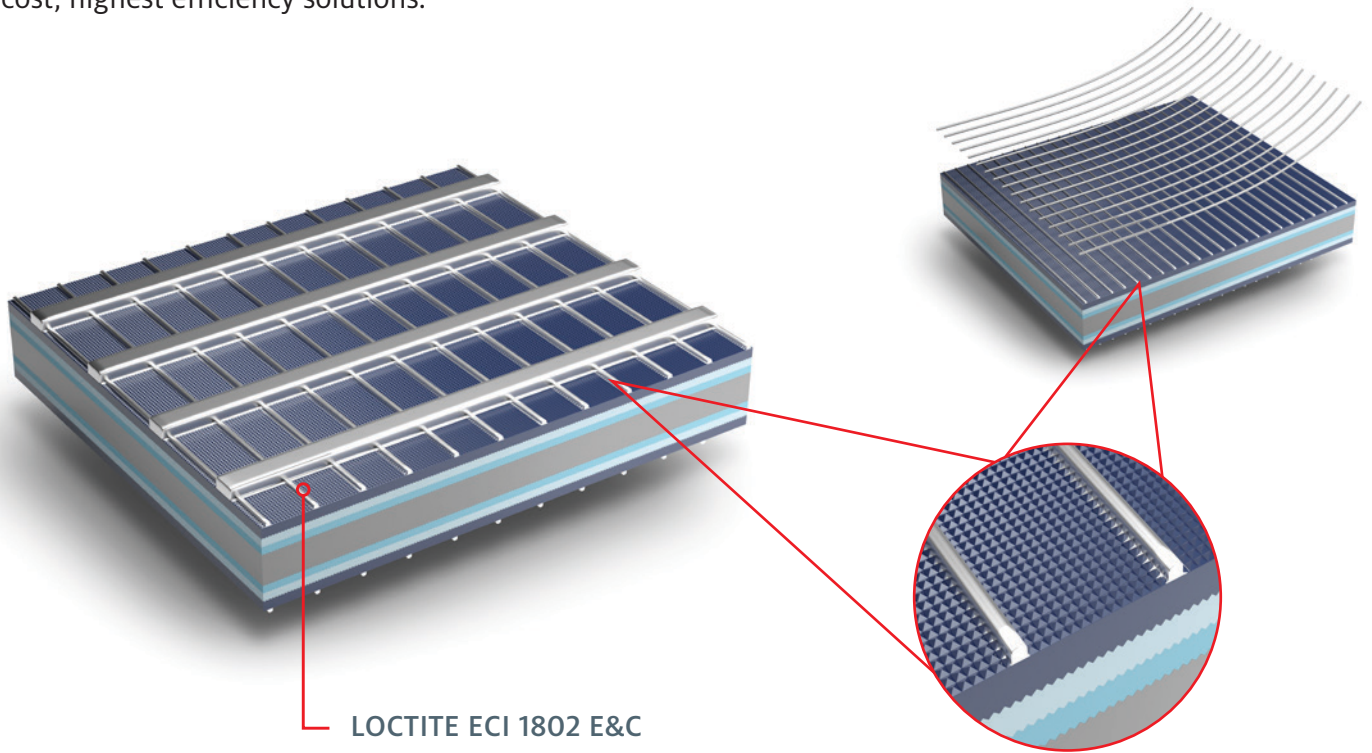
Thin Film Solar Modules



The performance and reliability of Henkel's thin film ECAs have been proven in the field for well over a decade. With multiple solutions for thin film interconnect and bussing, Henkel is uniquely positioned to support your requirements.

Heterojunction (HJT) and Third-Generation Photovoltaics

As one of the first companies to formulate low temperature metallization pastes, Henkel draws on the expertise founded in the company’s printed electronics market leadership and its knowledge base surrounding highly-filled, conductive, polymer systems. Custom formulations for heterojunction, perovskite or other third-generation cell architectures ensure Henkel helps customers achieve the lowest cost, highest efficiency solutions.

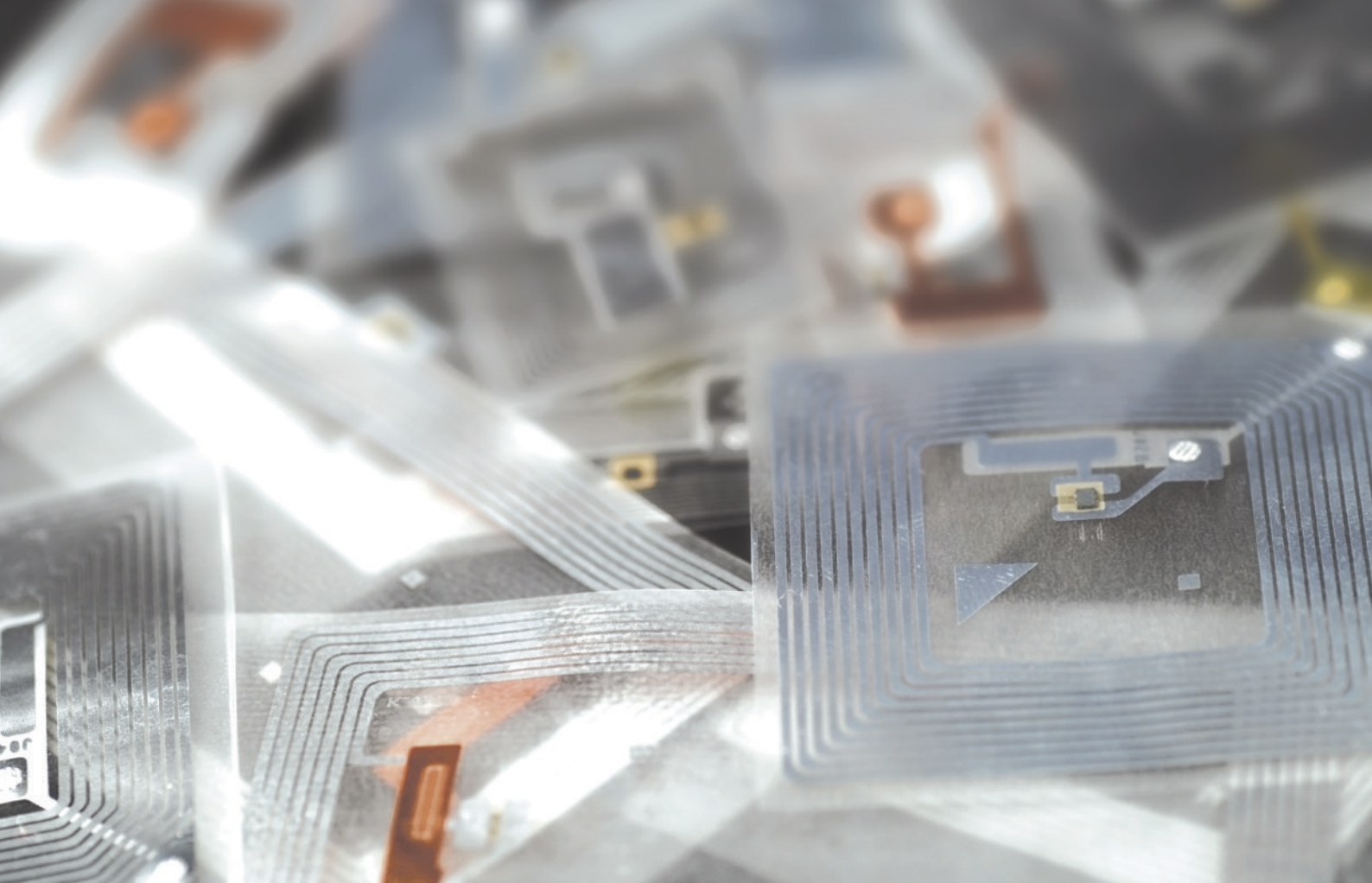


LOCTITE ECI 1802 E&C

LOCTITE ECI 1803 E&C / LOCTITE ECI 1800 Finger Paste SERIES

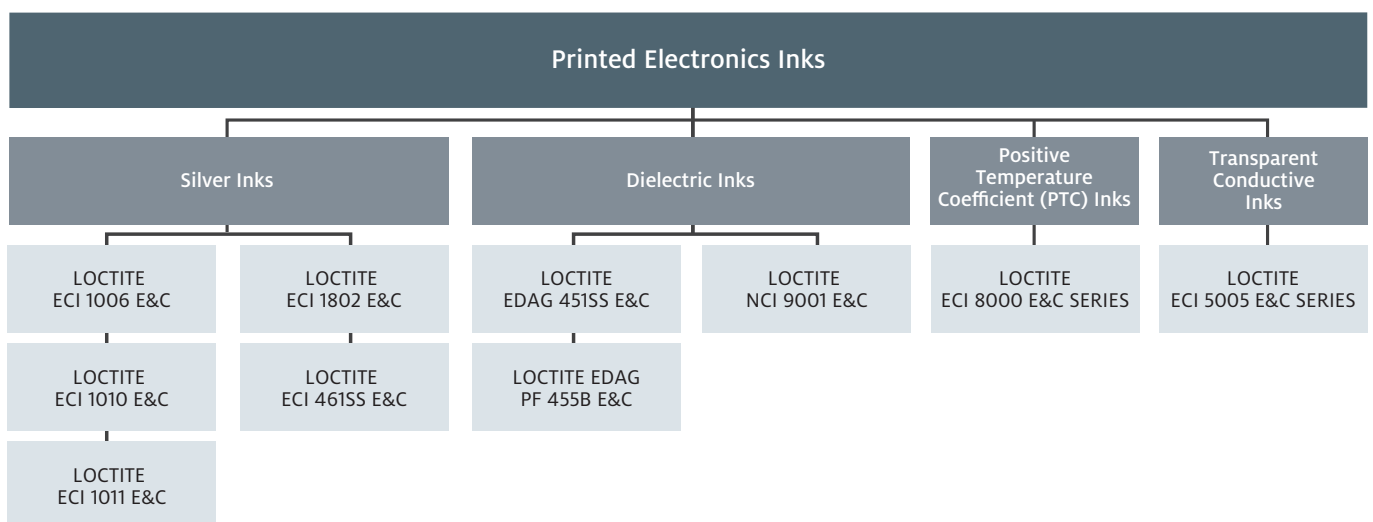
Product Name	Key Attributes	Ag loading	Volume Resistivity ($\Omega \cdot \text{cm}$)	180° Peel Strength on ITO (N/mm)	Print Height to Achieve Peel Strength (μm)
Silver Inks					
LOCTITE ECI 1802 E&C	Busbar paste with very high peel strength on ITO/solder at low deposits, low silver loading and 200 mm/sec. print speeds.	70%	4.1×10^{-5}	1.6	10

Product Name	Key Attributes	Contact Resistance on ITO ($\text{m}\Omega \cdot \text{cm}^2$)	Volume Resistivity ($\Omega \cdot \text{cm}$)	Aspect Ratio (40 μm Line Opening)	Cure Time
Silver Inks					
LOCTITE ECI 1803 E&C	Ultra fine line capability down to 30 μm opening without line interruptions, ideal for smartwire HJT.	0.4	$4.24 \text{ E-}6$	0.28	Dry (< 10 min.) – cure (< 20 min.) at 200°C
LOCTITE ECI 1800 FINGER PASTE SERIES	Balanced Line resistance and high volume printability to reduce 4 – 5 busbar HJT fingers down to < 40 μm opening.	0.54	$4.86 \text{ E-}6$	0.36	Dry (< 10 min.) – cure (< 20 min.) at 200°C



Building-Integrated Photovoltaics (BIPVs)

Henkel has developed a broad portfolio of printed inks that are ideal for embedding electronic circuitry of BIPV modules into windows and building facades. In particular, our rotogravure and flexographic conductive and dielectric inks are capable of meeting very high volume demands with exceptional manufacturability. Off-the-shelf conductive, dielectric and transparent inks lead the market in conductivity, processability, sheet resistance and cost : performance ratio.



Product Properties

Product Name	Application	Key Features	Flex	Rigid	Sheet Resistance ($\Omega/\text{sq}/25 \mu\text{m}$)	Processing	Substrates	Cure
Silver Inks								
LOCTITE ECI 1006 E&C	<ul style="list-style-type: none"> Busbar support for ITO films Digitizers Flexible circuits Membrane switches Photovoltaic Touch screens 	<ul style="list-style-type: none"> Halogen-free Excellent fine-line and high resolution printability 50 μm lines and spaces attainable Excellent adhesion to sputtered ITO and PET good electrical conductivity 	X		< 0.030	Screenprint	Treated and untreated PET, Kapton, ITO film	10 min. at 130°C
LOCTITE ECI 1010 E&C	<ul style="list-style-type: none"> Flexible circuits RFID SmartCards 	<ul style="list-style-type: none"> High conductive with optimum mechanical performance Compatible with LOCTITE EDAG 440A E&C, LOCTITE EDAG 440B E&C and LOCTITE EDAG PF 455B E&C 	X		< 0.007	Screenprint	Treated and untreated PET, Kapton	10 min. at 120°C
LOCTITE ECI 1011 E&C	<ul style="list-style-type: none"> Flexible circuits RFID SmartCards 	<ul style="list-style-type: none"> Appearance of the coating is very smooth and shiny 	X		< 0.003	Screenprint, Flexographic	Treated and untreated PET, Kapton, ITO film	10 min. at 120°C
LOCTITE EDAG 461SS E&C	<ul style="list-style-type: none"> Flexible circuits Touch screens Photovoltaic cells flexible 	<ul style="list-style-type: none"> Halogen-free Good adhesion to sputtered ITO films and difficult to adhere to substrates Low temp cure for heat sensitive substrates 	X		< 0.020	Screenprint	Sputtered ITO, PET, ABS	30 min. at 71°C

Product Name	Key Attributes	Ag loading	Volume Resistivity ($\Omega \cdot \text{cm}$)	180° Peel Strength on ITO (N/mm)	Print Height to Achieve Peel Strength (μm)
Silver Inks					
LOCTITE ECI 1802 E&C	Busbar paste with very high Peel Strength on ITO/solder at low deposits, low silver loading and 200 mm/sec print speeds.	70%	4.1×10^{-5}	1.6	10

Product Name	Application	Key Features	Flex	Rigid	Processing	Substrates	Cure
LOCTITE EDAG 451SS E&C	<ul style="list-style-type: none"> Flexible circuits Flexo high speed 	<ul style="list-style-type: none"> UV cure Smooth film Compatible with LOCTITE EDAG silver and carbon inks 	X		Screenprint, Flexographic	Untreated and print receptive polyester and polycarbonate film	0.3 to 0.7 J/cm ²
LOCTITE EDAG PF 455B E&C	<ul style="list-style-type: none"> Flexible circuits RFID Medical electrodes Biosensors 	<ul style="list-style-type: none"> Excellent humidity resistance Excellent printability Excellent adhesion Good dielectric strength UV cure 	X		Screenprint	Treated and untreated polyester film	80 W/cm ²
LOCTITE NCI 9001 E&C	<ul style="list-style-type: none"> Touch screens Flexible circuits 	<ul style="list-style-type: none"> Minimal dielectric strength Excellent flexibility Resistant to abrasion Primer coat for difficult to adhere to substrate 	X		Screenprint, Flexographic	Flexible copper circuits, ITO sputtered polyester film, metals and glass	5 min. at 130°C



Product Properties – Continued

Product Name	Application	Key Features	Flex	Rigid	Sheet Resistance ($\Omega/\text{sq}/25\ \mu\text{m}$)	Processing	Substrates	Cure
LOCTITE ECI 8000 E&C Series	• Heating elements	<ul style="list-style-type: none"> • Positive Temperature Coefficient (PTC) printable ink • Self regulating heater 	X		1,700	Screenprint	Polyester, PEN, Kapton	10 min. at 120°C

Product Name	Description	Key Features	Print Mesh	Sheet Resistance (Ω/sq)	Transmittance (% at 550 nm)	Haze (%)
LOCTITE ECI 5005 E&C Series	Highly conductive, screen-printable ink with excellent transparency and low haze	<ul style="list-style-type: none"> • Competitive to current market ITO materials • Excellent transparency and lowest haze of the ECI 5000 Series • Low-temperature cure • Additive process – No laser etching needed • Better flexibility than sputtered ITO 	305/34	~55	~90	1.6
			420/30	~75	~95	1.1



Henkel's Solder Portfolio

SOLDER MATERIALS

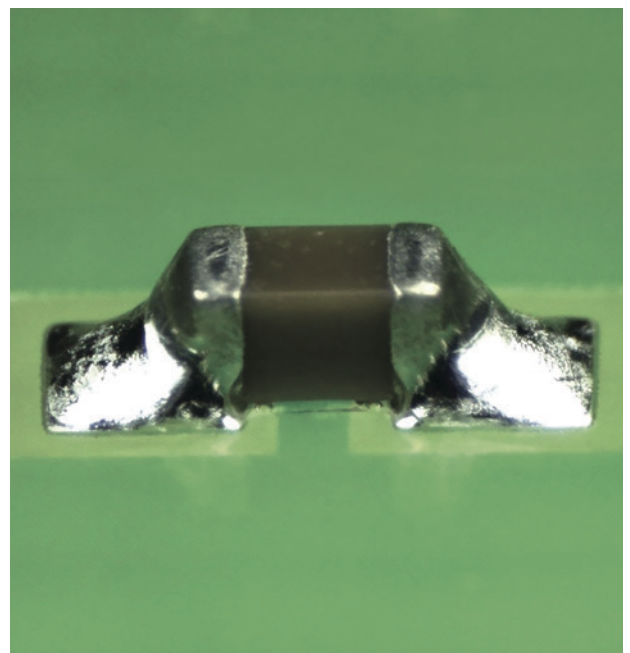
Solder Pastes

Liquid Fluxes

Solder Wires

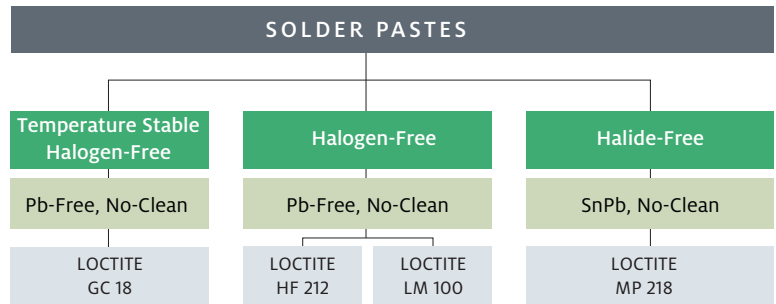
With solder solutions that span diverse applications within numerous market sectors, Henkel is the solder technology market leader. A history of innovative formulations and market firsts – from high-reliability alloys to game-changing, temperature-stable solder pastes – continue to deliver the performance that electronics specialists require for today's demanding assemblies.

Materials development ingenuity is at the core of every Henkel LOCTITE solder material – and has been for decades. Our multi-award-winning solder portfolio has earned the praise of industry experts and the trust of our customers. With a broad selection of solder pastes, cored and solid wires, liquid fluxes and multiple alloys, Henkel offers a total solution for current and future solder materials requirements.



SOLDER PASTES

Henkel's commitment to best-in-class solder performance, printability, reflow and reliability is unyielding. This, in combination with our focus on enabling a sustainable future, has led to some of the industry's most advanced formulations. Henkel's halogen-free solder paste materials have set the bar high for environmental compliance. With zero deliberately added halogens and integrating the purest raw materials available, we can assure our customers that Henkel's halogen-free formulations are, indeed, halogen-free. We take our obligation to advanced materials development so seriously that Henkel has pledged to ensure all future solder paste formulations are either halogen-free, temperature stable or both.



SOLDER PASTES

PRODUCT	DESCRIPTION	ALLOY*	PARTICLE SIZE DISTRIBUTION*	IPC J-STD-004B CLASSIFICATION	OPTIMAL SHELF LIFE
Temperature Stable, Halogen-Free					
LOCTITE GC 18	Ultra-low voiding, temperature stable solder paste. Designed to improve transfer efficiency for fine-pitch components such as 01005s and 0.4mm CSPs, the material's slump resistance at higher soak temperatures allows for thorough fluxing action on challenging surface finishes such as Cu OSP and ImSn.	SAC305	Type 3, 4	ROLO	12 months up to 26.5°C
Halogen-Free					
LOCTITE HF 212	High tack, low voiding, RoHS-compliant solder paste with excellent fine pitch coalescence and extended stencil life and abandon time. Designed for medium to large boards and compatible with many Pb-free alloys. Suitable for vacuum soldering.	965 SAC305	Type 3, 4	ROLO	6 months at 0 – 10°C
LOCTITE LM 100	RoHS-compliant solder paste designed for use with low-temperature, Pb-free alloys. Formulated to provide excellent dispensability, printability and solderability in various reflow profiles.	Bi58	Type 2.5 (2A)	ROLO	6 months at 0 – 10°C
Halide-Free					
LOCTITE MP 218	High activity, soft residue, colorless solder paste with pin-testable flux that displays resistance to high temperature and humidity environments. Suitable for a large range of assembly processes, including Rheometric Pump, Proflow, large and high-density.	Sn63	Type 3, 4	ROLO	6 months at 0 – 10°C

SOLDER PASTE REFLOW PROPERTIES

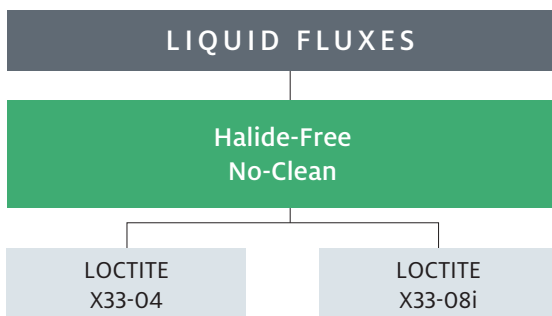
PRODUCT	SUITABLE ATMOSPHERE	ALLOY	MELTING POINT (°C)	TIME ABOVE LIQUIDUS, LINEAR (SECONDS)	TIME ABOVE LIQUIDUS, SOAK (SECONDS)	SOAK TEMPERATURE (°C)	SOAK TIME (SECONDS)
LOCTITE GC 18	Designed for air; Suitable with nitrogen	SAC305	217	37 – 105	60 – 120	150 – 200	60 – 200
LOCTITE HF 212	Air and nitrogen	SAC305	217	15 – 99	20 – 78	161 – 179	34 – 115
		965	221				
LOCTITE LM 100	Air and nitrogen	Bi58	138	30 – 60	30 – 60	100 – 120	45 – 70
LOCTITE MP 218	Air and nitrogen	Sn63	183	30 – 75	30 – 75	130 – 165	30 – 120

* Example of process guidelines

SUSTAINABILITY FROM START TO FINISH

AREA OF IMPROVEMENT	LOGISTICS	INDUSTRIAL PROCESSING	SERVICE/USE	DISPOSAL
PERFORMANCE	Longer shelf life and no need for air freight	Zero start-up time and fewer end-of-line defects	Consistent performance on increasingly smaller devices for improved reliability	20% reduced scrap rate
MATERIALS AND WASTE	Less packaging – no cold packs needed	Reduced material waste, elimination of nitrogen requirement and universal qualification for all applications	Extends product life of devices	Greater than 95% paste utilization
ENERGY AND CLIMATE	Eliminates refrigerated transport	Eliminates refrigerated storage	Zero added halogens and lead-free; less wasted material	Zero added halogens and lead-free; less wasted material
WATER AND WASTEWATER	–	No post-reflow residue cleaning required for LOCTITE GC 10; shorter cleaning times for LOCTITE GC 18	–	–

LIQUID FLUXES



Henkel has developed a variety of liquid flux formulations to facilitate Pb-free and SnPb wave soldering processes, rework operations and laser soldering. No-clean, low-residue, VOC-free, halide-free and halogen-free flux formulas provide manufacturers with several options for specific manufacturing requirements, delivering high-performance, defect-free soldering and excellent throughput. Henkel’s liquid flux technologies are environmentally responsible and align with sustainable manufacturing approaches.

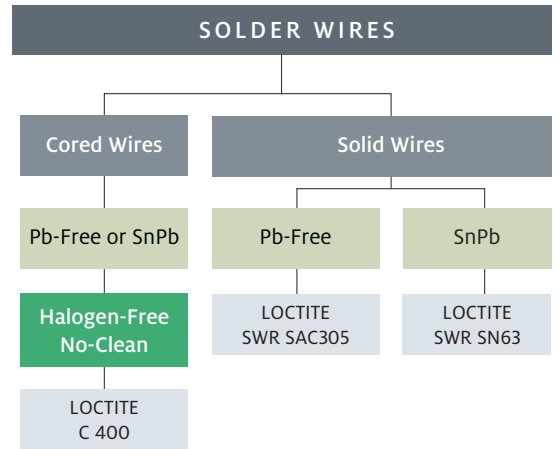
LIQUID FLUXES

PRODUCT	DESCRIPTION	SOLID CONTENT (% BY WEIGHT)	ACID VALUE (mg KOH/g)	APPLICATION	IPC J-STD-004B CLASSIFICATION
Halide-Free, No-Clean					
LOCTITE X33-04	Superior second generation no residue halide-free fluxes from the pioneers of ‘no clean’ technology. Unique patented formulation. Fast soldering on conventional leaded and SMD components – no bridges or icicles.	1.6	15	Foam, Spray or Wave	ORMO
LOCTITE X33-08i	Resin-free, no-clean, halide-free liquid flux for surfaces with poor solderability from the pioneers of “no clean” technology. Fast soldering on conventional leaded and SMD components - shiny joints; no bridges or icicles. Sustained activity for maximum process window.	1.6	17.5	Foam, Spray or Wave	ORLO

*Solid content can be further reduced with additional solvent, please see Henkel TDS for additional information

SOLDER WIRES

Available in both solid and cored versions, Henkel's LOCTITE brand solder wire products have been enabling rework and hand soldering operations for decades. Award-winning multiple flux core technology in our cored wire options distributes flux evenly throughout the solder wire, offering fast wetting and high solder joint reliability. LOCTITE cored wire is available in Pb-free, SnPb and halogen-free formulas. For assemblers who prefer a non-cored option for selective soldering applications, LOCTITE solid wire products are offered in both Pb-free and SnPb options.



CORED WIRES

PRODUCT	DESCRIPTION	APPROXIMATE FLUX CONTENT (% BY WEIGHT)	DIAMETER RANGE (mm)	ALLOY Pb-FREE	ALLOY SnPb	IPC J-STD-004B CLASSIFICATION
Halogen-Free, No-Clean						
LOCTITE C 400	Clear residue, cored solder wire with increased flux content for improved wetting on challenging surfaces. Features the award-winning multiple flux core technology that ensures consistent distribution of flux throughout the solder wire. Suitable for manual and robotic soldering.	2.2	0.38 - 1.63	SAC305	Sn60 Sn63	ROLO

CORED WIRE OPTIONS

Flux content dependent on alloy, diameter and number of cores

NUMBER OF CORES	FLUX CONTENT (% BY WEIGHT)
1	0.5% - 1.0%*
3	1.0% - 2.5%

*Other flux content available upon request



SOLID WIRES

PRODUCT	ALLOY	SILVER CONTENT (% BY WEIGHT)	DIAMETER* (mm)	ROHS COMPLIANT
Pb-Free				
LOCTITE SWR SAC305	SAC305	3.0	3	Yes
SnPb				
LOCTITE SWR SN63	Sn63	0	3	No

*Other diameters for certain products available upon request

Henkel Process Capabilities



- R&D
- Manufacturing
- Sales and Engineering Support
- ★ R&D/Manufacturing/Sales and Engineering Support

Global Footprint and Broad Industry Partnerships

We have invested in state-of-the-art solar testing capabilities in facilities in Europe and China, as well as test and characterization labs and dedicated engineering staff in Korea, Japan, Taiwan, Europe, the U.S. and China. Henkel's collaborative technology partnerships with global research institutes and solar cell and module OEMs are driving the next generation of solar devices. Equipment suppliers, manufacturers and organizations seeking research and development alliances with Henkel can e-mail:

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