

ELPEGUARD® - New Big Five



... Made in Germany



source: municipality of Kempen

Hightech from a town
with tradition



Stadt
Kempen

A good community!

Worldwide Unique!

**ELPEPCB®**

peters

Complete range of printed circuit coatings which fulfil highest demands in pcb manufacturing

ELPESPEC®

peters

Universally usable auxiliary products for electronic productions

ELPEGUARD®

peters

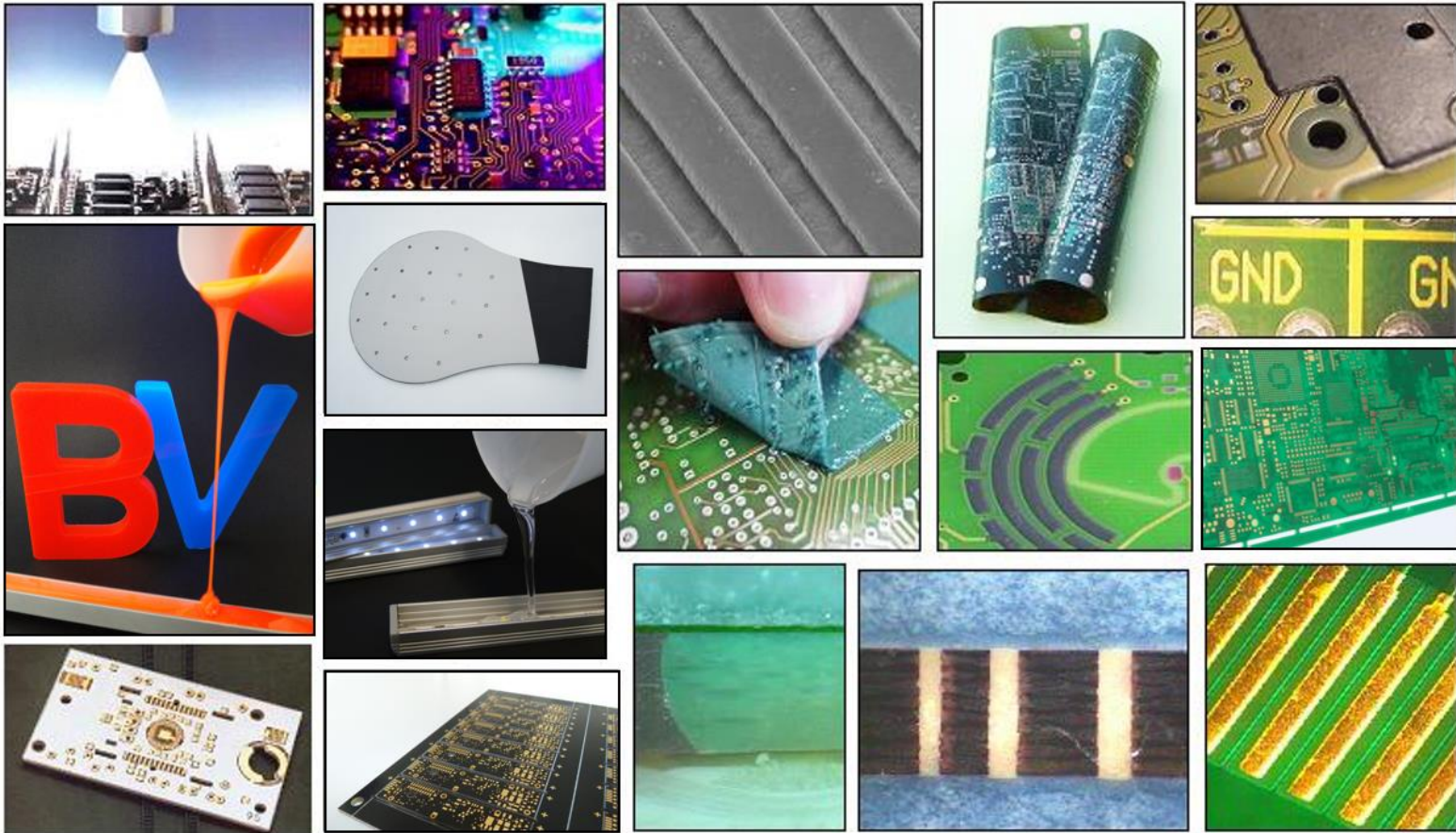
Conformal and thick film coatings for assembled pcs

ELPECAST®

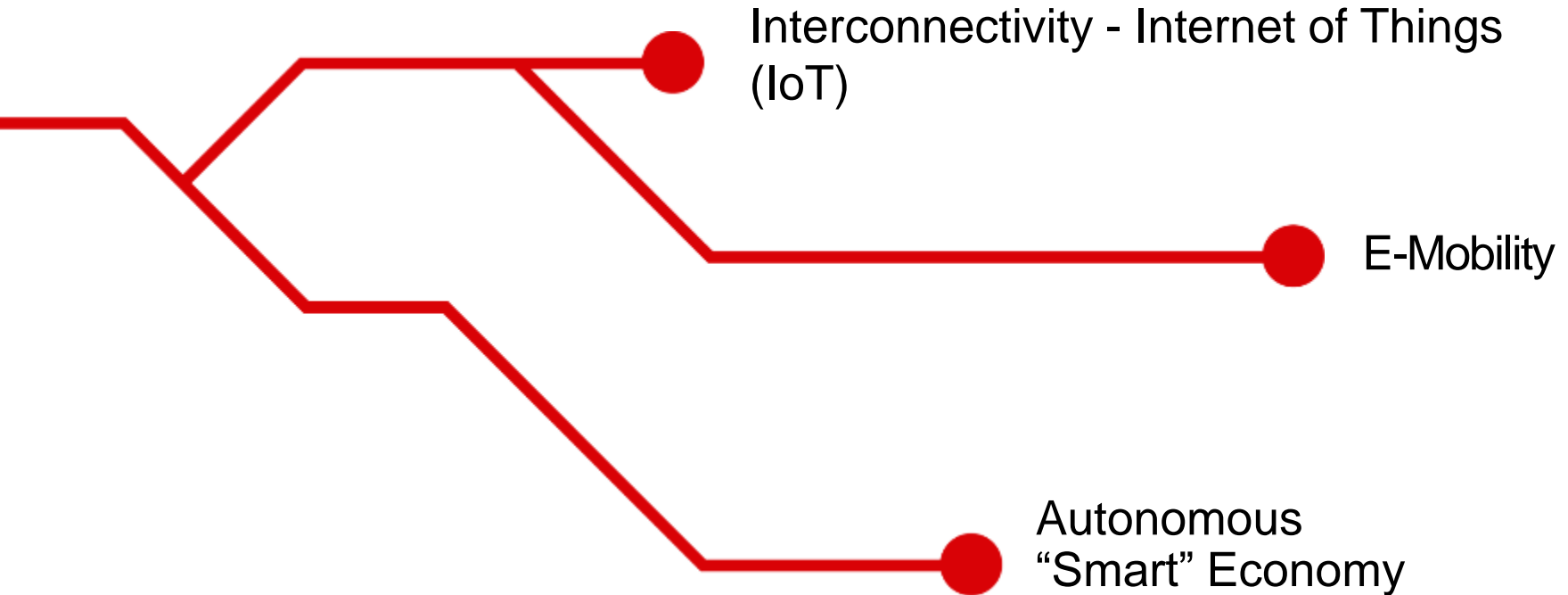
peters

Casting compounds protect and insulate electronics, sensor technology and lighting electronics against extreme weather conditions and aggressive media

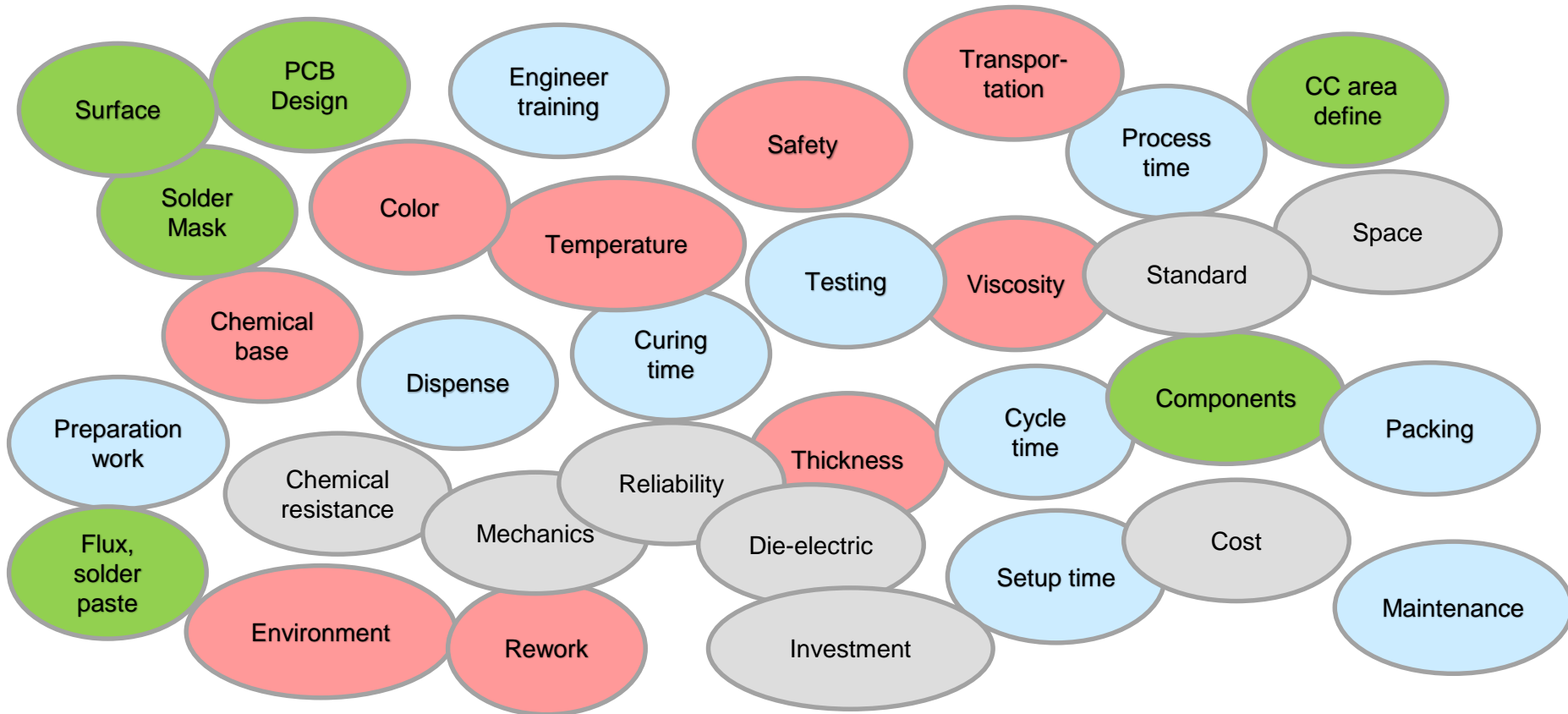
Coating Innovations for Electronics



Tech Trends & Impact on Electronics Reliability



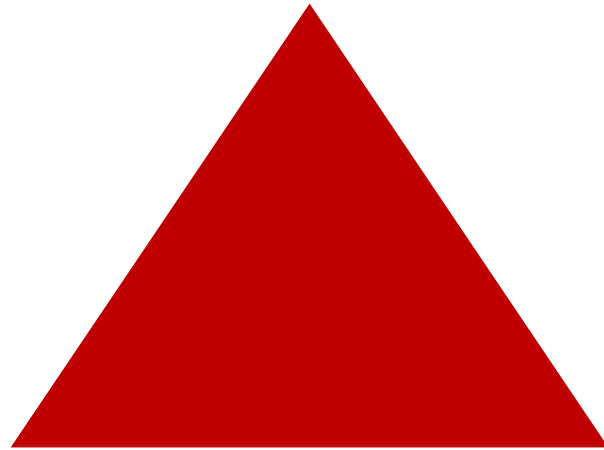
Impact on Reliability Factors?



....and many more....

The Reliability Triangle 3P's

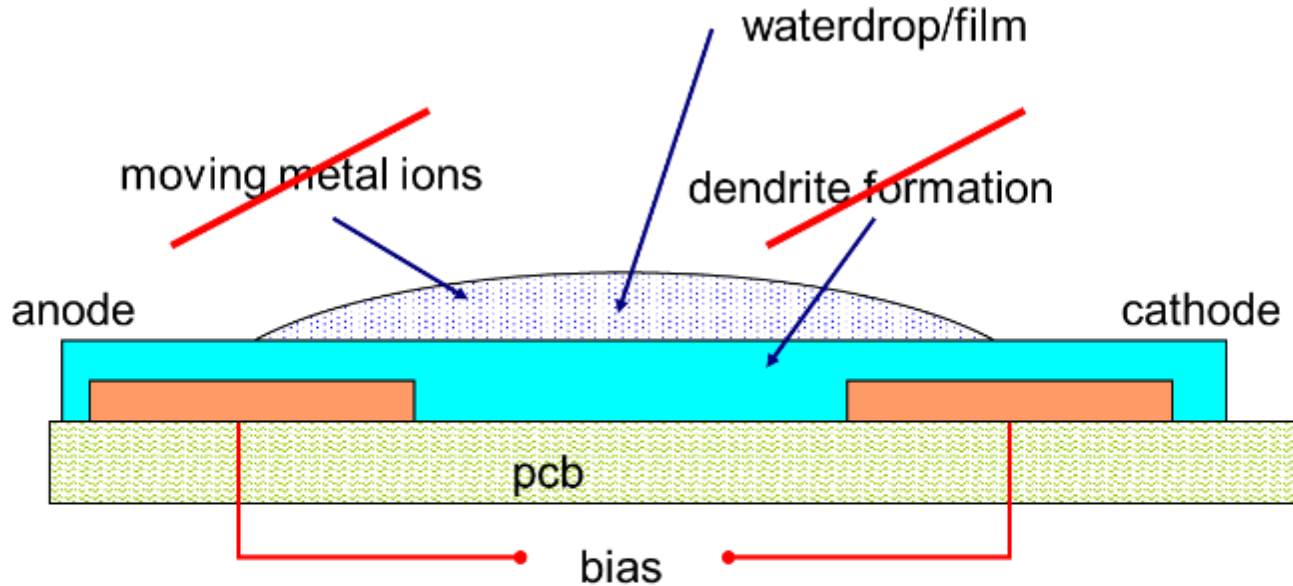
Printed Circuit Board (PCB)



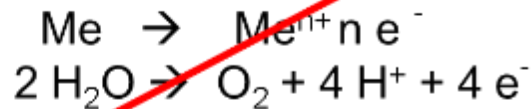
**Protection
Material**

Process
(People + Machine + Parameters)

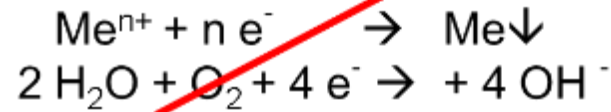
Prevention of Electrochemical Failure



anode:



cathode:



Important Properties of Conformal Coatings

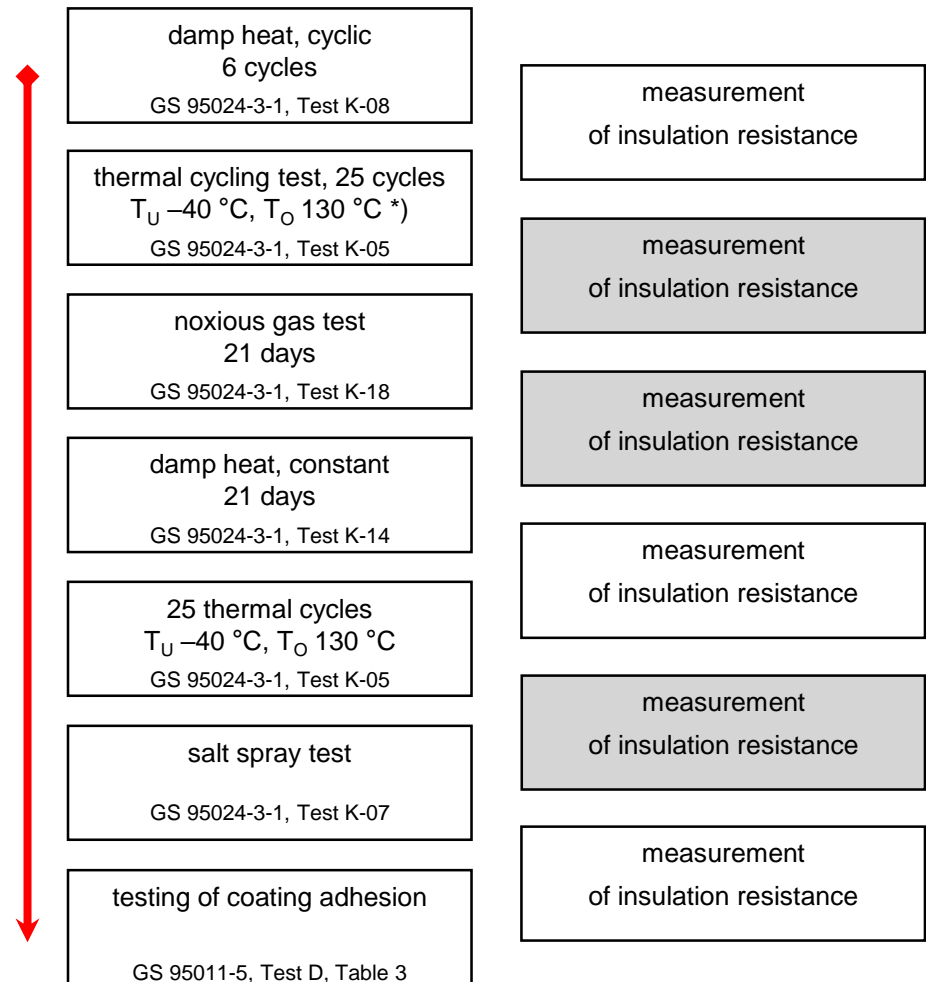
- Protection against humidity
 - > Adsorbed water
 - > Condensed water (dew point condensation)
- ➔ Electrical insulation under moisture load!
 - Moisture & Surface Insulation Resistance (M&SIR/SIR in MOhm)

Current and New CC Requirements

- Automotive approval tests
Environmental stress
(serial)



Freude am Fahren



Current and New CC Requirements

- Hyundai MS 941-04
- IPC 61086-2
- IPC 60664-2
- DIN EN 45545
- UL 746E / UL 94
- IPC-CC 830 C / MIL-I-46058 C
- ...
- ...

Current and New CC Requirements

- Automotive approval tests



Who's Who

Chinese automakers and their foreign partners

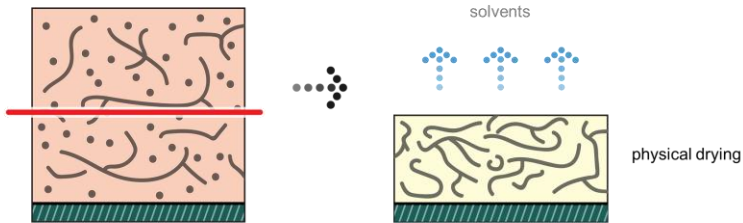
Shanghai Auto (SAIC)	Volkswagen, General Motors
Dongfeng Group	PSA, Nissan, Honda, Kia Motors, Renault
Changan Group	Ford, Mazda, Mitsubishi, PSA, Suzuki
Beijing Auto (BAIC)	Daimler, Hyundai
Guangzhou Auto (GAC)	Toyota, Honda, Fiat Chrysler
Jianghuai Automobile (JAC)	Volkswagen
Zotye	Ford
Brilliance Auto*	BMW
FAW	Volkswagen, GM, Toyota

Source: Bloomberg research
 *Note: BMW is in talks with Great Wall for second JV

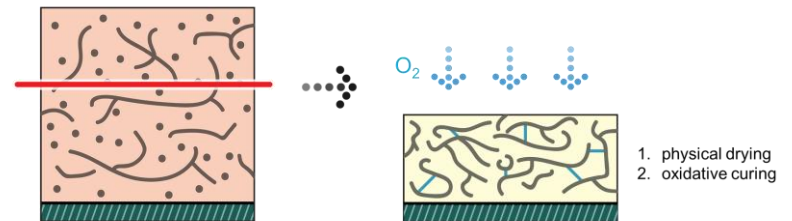
Bloomberg

Types of Conformal Coatings

Film formation of physical drying coatings
Series ELPEGUARD® SL 1307-FLZ/2

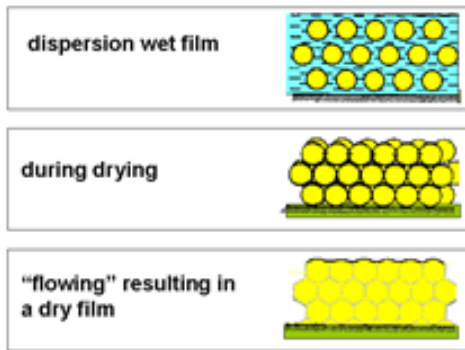


Film formation of oxidative curing coatings
Series ELPEGUARD® SL 1301 ECO-(BA)-FLZ

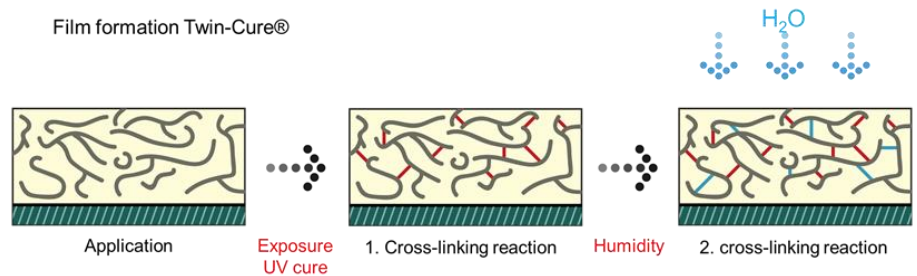


Stages of film formation polymer dispersions

ELPEGUARD® SL 1305 AQ-ECO series



Film formation Twin-Cure®



ELPEGUARD® Conformal Coating Family

„Big Five“

- **Oxidative Curing**
ELPEGUARD® SL 1301 ECO-(BA)-FLZ series
- **Water dilutable**
ELPEGUARD® SL 1305 AQ-ECO series
- **Basis: Acrylics**
ELPEGUARD® SL 1307 FLZ/2 series
- **UV curing, solvent-free**
ELPEGUARD® Twin-Cure® DSL 1600 E-FLZ series
- **Silicones**
ELPEGUARD® DSL 17XX FLZ

Conformal Coatings of the Future



„Innovation is the only way to win.“ [Steve Jobs]

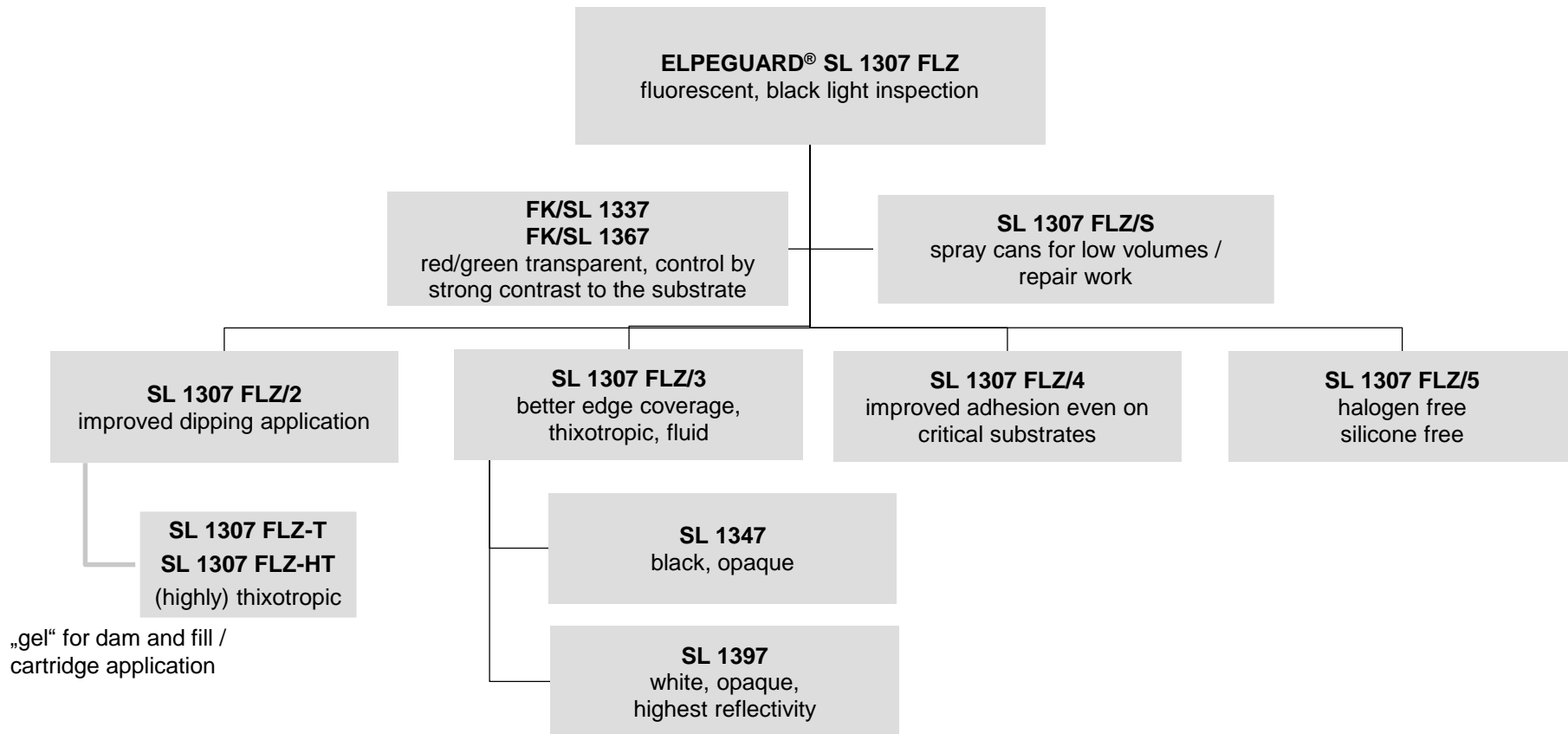
ELPEGUARD® Conformal Coating Family

„Big Five“ – New!

- **Acrylates:** ELPEGUARD® (solvent-based)
 - > ELPEGUARD® SL 1307 FLZ family
 - > ELPEGUARD® SL 1800 FLZ series
 - > ELPEGUARD® SL 1801 FLZ series
- **UV-Technology:** ELPEGUARD® Twin-Cure® UV curing (solvent free)
 - > ELPEGUARD® Twin-Cure® DSL 1600 E-FLZ series
 - > ELPEGUARD® Twin-Cure® DSL 1602 FLZ/400
 - > ELPEGUARD® Twin-Cure® DSL 1707 FLZ
- **2-Component-Technology:** ELPEGUARD® 2-Component conformal coatings
 - > ELPEGUARD® SL 9400 FLZ
 - > ELPEGUARD® SL 9407 FLZ series
- **Synthetic Rubber:**
 - > ELPEGUARD® UTC 1507 FLZ series
- **Silicones**
 - > ELPEGUARD® DSL 1705 FLZ
 - > ELPEGUARD® DSL 1706 FLZ series
 - > ELPEGUARD® DSL 1707 FLZ

1 of 5 - Acrylates „Allrounder“

ELPEGUARD® SL 1307 FLZ series



1 of 5 - Acrylates „Allrounder“

ELPEGUARD® SL 1800 FLZ

- Basis: Acrylate
- Resin modification of ELPEGUARD® **SL 1307 FLZ/2**
- Improved low-temperature flexibility

1 of 5 - Acrylates „Allrounder“

ELPEGUARD® SL 1800 FLZ – Current Products

- ELPEGUARD® SL 1800 FLZ/900
 - > Viscosity approx. 900 mPas (DIN EN ISO 3219)
 - > Application by spraying = higher layers can be achieved
- ELPEGUARD® SL 1800 FLZ/500
 - > Viscosity approx. 500 mPas (DIN EN ISO 3219)
 - > Application by spraying or monofilament = higher layers can be achieved
- ELPEGUARD® SL 1800 FLZ (FP 120-0518; research product)
 - > Viscosity 18 sec. 4 mm DIN 53211
 - > Application by means of film coater = thin layers => UltraThin Coating according to IPC-CC-830 C (Type UT)

For more information please see TDS and ppt (SL 1800 FLZ klimatische tests 12082020 - engl.pptx)

1 of 5 - Acrylates „Allrounder“

ELPEGUARD® SL 1801 FLZ

- Basis: Acrylate
- Resin modification of ELPEGUARD® **SL 1307 FLZ/2**
- Improved low-temperature flexibility
- Contains silicone-modified components for a better wetting

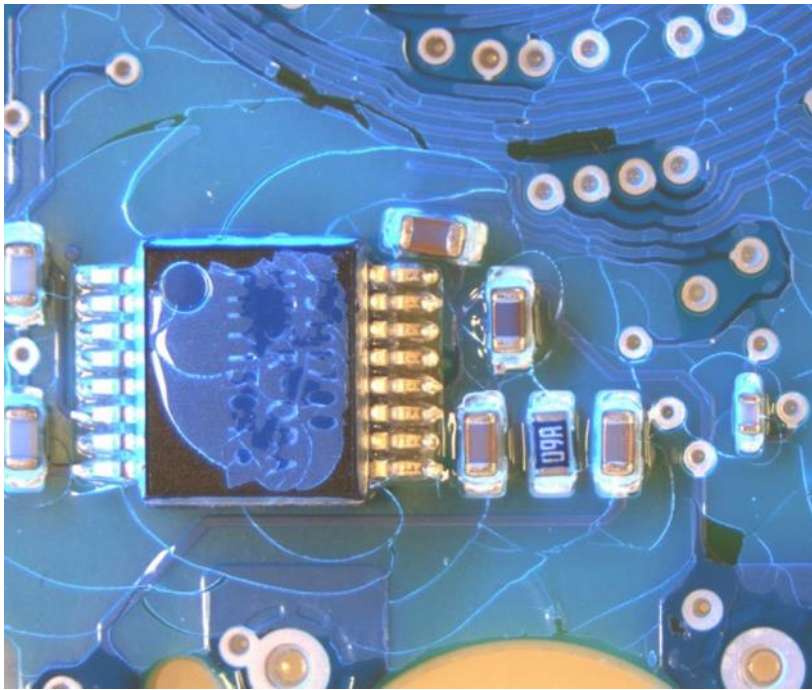
1 of 5 - Acrylates „Allrounder“

ELPEGUARD® SL 1801 FLZ – Current Products

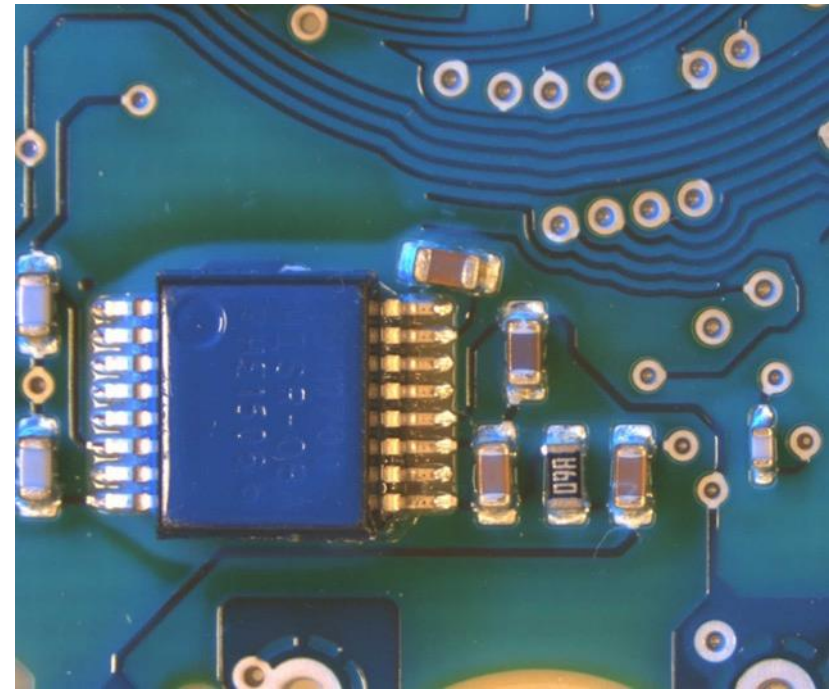
- ELPEGUARD® SL 1801 FLZ/900
 - > Viscosity approx. 900 mPas (DIN EN ISO 3219)
 - > Application by spraying = higher layers can be achieved
- ELPEGUARD® SL 1801 FLZ/500
 - > Viscosity approx. 500 mPas (DIN EN ISO 3219)
 - > Application by spraying or monofilament = higher layers can be achieved
- product for filmcoater application possible

For more information please see TDS and ppt (SL 1800 FLZ klimatische tests 12082020 - engl.pptx)

1 of 5 - Acrylates „Allrounder“ - Thermal Cycle Test -1,000 Cycles -65 °C / 125 °C

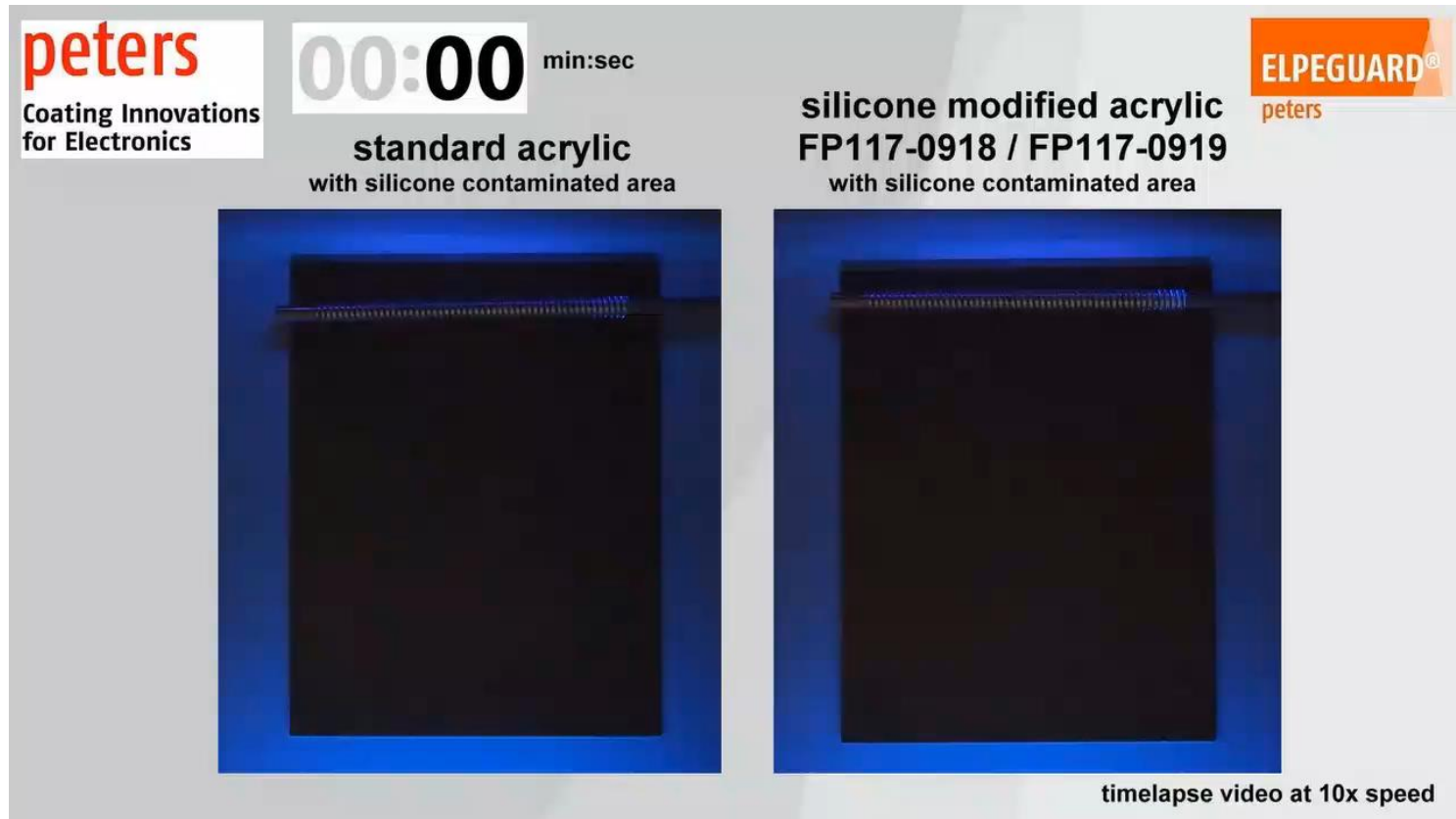


Standard Acrylates (not modified)

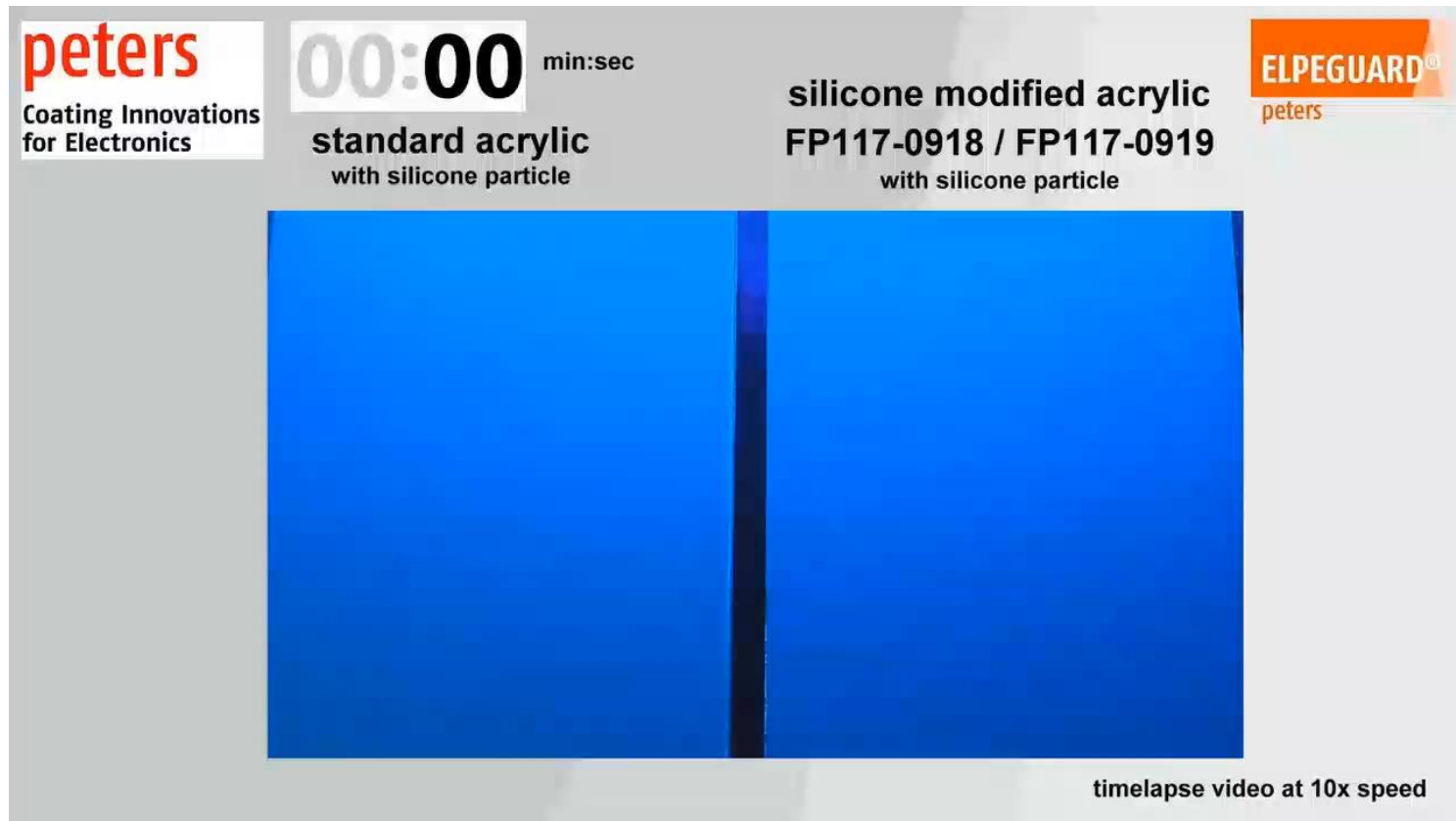


modified Acrylates
ELPEGUARD® SL 1800 FLZ /
SL 1801 FLZ

1 of 5 - Acrylates „Allrounder“ ELPEGUARD® SL 1801 FLZ - Wetting

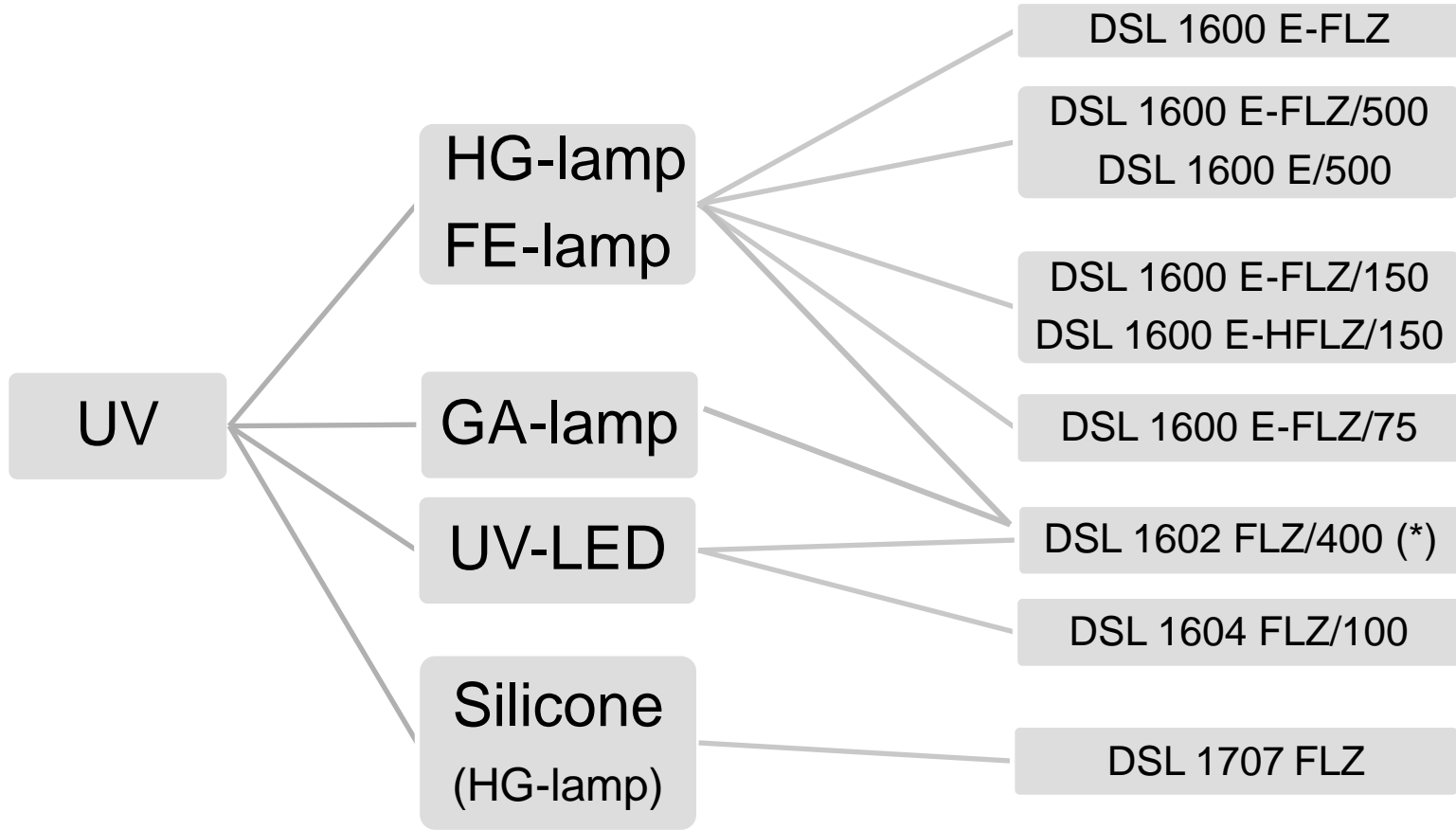


1 of 5 - Acrylates „Allrounder“ ELPEGUARD® SL 1801 FLZ - Wetting



2 of 5 – UV-Technology

ELPEGUARD® Twin-Cure®



(*) For possible curing conditions see test report [dsl1602flz400_comparison_LED_Hg_Ga_lamp_e.pdf](#)

2 of 5 – UV-Technology

ELPEGUARD® Twin-Cure® DSL 1600 E-FLZ

	Twin-Cure® DSL1600 E-			
	current versions			
	FLZ	500	FLZ/150	FLZ/75
Insulation values	green	yellow	green	yellow
TCT stability	red	red	yellow	green
Processing	red	green	yellow	green
Underdrying	green	green	yellow	yellow
Resistance against media	green	green	green	green
Suitable for optical appl.	green	green	yellow	red

green = excellent
 yellow = ok
 red = with reservations

2 of 5 - UV-Technology – IEC 60664

- ELPEGUARD® Twin-Cure® **DSL 1600 E-FLZ/75** tested according to IEC 60664-3
- Test report Note 2 in our UL file

Coatings for Use on Recognized Printed Wiring Boards E80315
 Guide Information

LACKWERKE PETERS GMBH & CO KG
 HOOGHE WEG 13, KEMPEN 47906 DE

TWIN-CURE DSL 1600 E-FLZ/75 (Note2)
 Conformal coatings "ELPEGUARD" for use on Recognized printed wiring boards, furnished as: one component liquid

Color	Coating Min Thk (mic)	Coating Max Thk (mic)	Coating Flame Class	Elec. Temp (°C)	Environmental Conditions	Laminate Min Space (mm)	Laminate ANSI Type	Laminate Min Thk (mm)
NC	270	320	HB	120	indoor	0.2	FR-4.0	0.8

(Note2) - Grade TWIN-CURE DSL 1600 E-FLZ/75 was compliant to IEC 60664-3 Edition 3.0, revision date 2016/11 for 97 micron thick coating on 1.6 mm FR-4.0 laminate; parallel conductors: 1.3 mm trace spacing for 0.27 mm trace width; lands: 0.15 mm trace to pad spacing for 0.21 mm trace width; working voltage of 50 V AC RMS. Test conditions: Type 1 protection, -40°C cold condition, 125°C dry heat condition, 3 degree of severity, and 10 day electromigration conditioning. Grade TWIN-CURE DSL 1600 E-FLZ/75 received a IEC 60112 Edition 4.1 - Issue Date 2009/10/01 CTI Rating of 600 Volts at a coating thickness of 85 microns on 1.5 mm Nan Ya FR-4.0 laminate FR-4-86 UV.

Report Date: 2014-07-21
 Last Revised: 2018-03-30 © 2018 UL LLC

IEC and ISO Test Methods		Units	Lam/Coat Thk (mm/mic)	Value
Test Name	Test Method			
Flammability	IEC 60695-11-10	Class (color)	0.8/270	HB75 (NC)

2 of 5 - UV-LED-Technology

- Twin-Cure® :
 - > Rapidly non-adhesive, thus inline-capable
 - > Electrical properties like series ELPEGUARD® Twin-Cure® **DSL 1600 E-FLZ**
- Twin-Cure® curing mechanism:
 - > Fast LED UV curing at 395 nm
 - > Combined with moisture reaction in shadow areas
- Upon UV curing
 - > **No** hazardous UVC radiation
 - > **No** ozone formation



2 of 5 - UV-LED Technology

ELPEGUARD® Twin-Cure® DSL 1604 FLZ/100

- Main customer Peters Italia
- „Exotic“ product

ELPEGUARD® Twin-Cure® DSL 1602 FLZ/400

- Comparable to ELPEGUARD® Twin-Cure® DSL 1600 E-FLZ/75
- Curing with mercury-, gallium-lamp and UV-LED (395nm) possible (test report available)

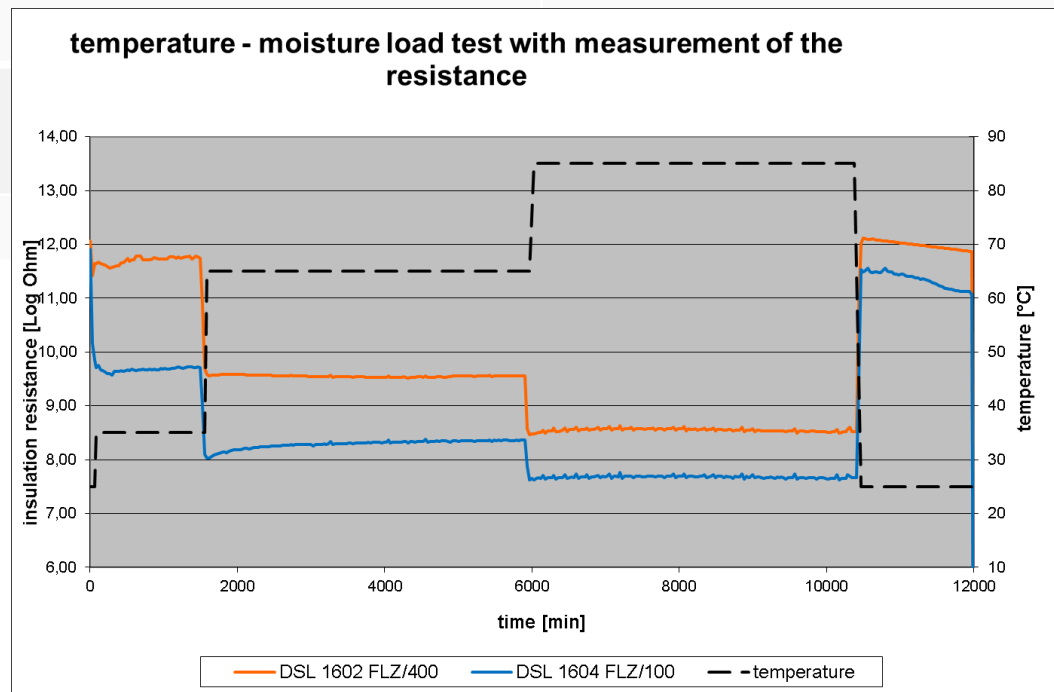
UV-LED Dam Material

- Coming soon

2 of 5 - UV-LED Technology

**ELPEGUARD® Twin-Cure®
DSL 1604 FLZ/100**

**ELPEGUARD® Twin-Cure®
DSL 1602 FLZ/400**



2 of 5 - UV-LED-Technology

ELPEGUARD® Twin-Cure® DSL 1602 FLZ/400

• Viscosity (DIN EN ISO 3219, 20°C)	320 - 450 mPas
• Density (DIN EN ISO 2811-1, 20°C)	1.04 - 1,08 g/cm ³
• Humidity/insulation resistance IPC-CC-830B, 3.7.1 (65 °C/90 % r.F.)	passed
• Humidity/insulation resistance 85/85 Test (3 d, 85 °C, 85 % r. F.)	≥ 3,0 x 10 ⁸ Ohm
• Resistance against condensed water following DIN EN ISO 6270- 2 (BIAS 12 V, 40 °C, 100% r. F.)	≥ 1,0 x 10 ¹⁰ Ohm

For more information please see TDS and ppt (DSL 1602 FLZ 400 klimatische tests 29102019 – engl. pptx)

3 of 5 - 2-Component-Technology - Solvent-Based 2-Component Conformal Coatings

- Defined / stoichiometric cross-linking
- Defined and adjustable cross-linking periods (minutes to hours)
- Addition cross-linking – no elimination products
- Modifications / adjustments according to particular customer requests possible

3 of 5 - 2-Component-Technology

ELPEGUARD® SL 9400 FLZ

2-Component solvent-based Polyurethane system

• Mixing ratio	2 : 1
• Mixing viscosity (20 °C, flow time acc. to DIN 53211, 4 mm DIN flow cup)	13 ± 2 s
• Pot life/Viscosity doubling	appr. 15 h
• Solids content	44 ± 2 weight %
• Humidity/insulation resistance IPC-CC-830B, 3.7.1 (65 °C/90 % r.F.)	passed
• Humidity/insulation resistance 85/85 Test (3 d, 85 °C, 85 % r. F.)	1,0 x 10 ⁹ Ohm
• Resistance against condensed water following DIN EN ISO 6270-2 (BIAS 12 V, 40 °C, 100% r. F.)	1,0 x 10 ¹⁰ Ohm
• Drying	at room temperature
• Curing	thermal (laboured)

3 of 5 - 2-Component-Technology Series

ELPEGUARD® SL 9407 FLZ

- ELPEGUARD® SL 9407 FLZ/730
 - > Viscosity of mixture 670 mPas (DIN EN ISO 3219)
 - > Solid content of mixture approx. 95 %
 - > Application by spraying
- ELPEGUARD® SL 9407 FLZ/45
 - > Viscosity of mixture 90 mPas (DIN EN ISO 3219) or 23 sec. 4mm DIN flow cup (DIN 53211)
 - > Solid content of mixture approx. 75 %
 - > Application by spraying or filmcoater
- Defined / stoichiometric cross-linking
- Defined and adjustable cross-linking times
- Addition cross-linking – no decomposition products
- Modifications / adjustments to specific customer demands possible

3 of 5 - 2-Component-Technology Series ELPEGUARD® SL 9407 FLZ

• Solids content	> 75 %
• Thermal cycle test -65 °C/125 °C, 1,000 cycles	Passed incl. high layers (approx. 1 mm)
• Climatic resistances (1,000h 85°C/85%r.h.)	> 100 MOhm
• Drying	at room temperature
• Curing	thermal (laboured)
• Passed noxious gas test	class GX

For more information please see TDS and ppt (SL 9407 FLZ Reihe klimatische tests 25092020 - engl.pptx)

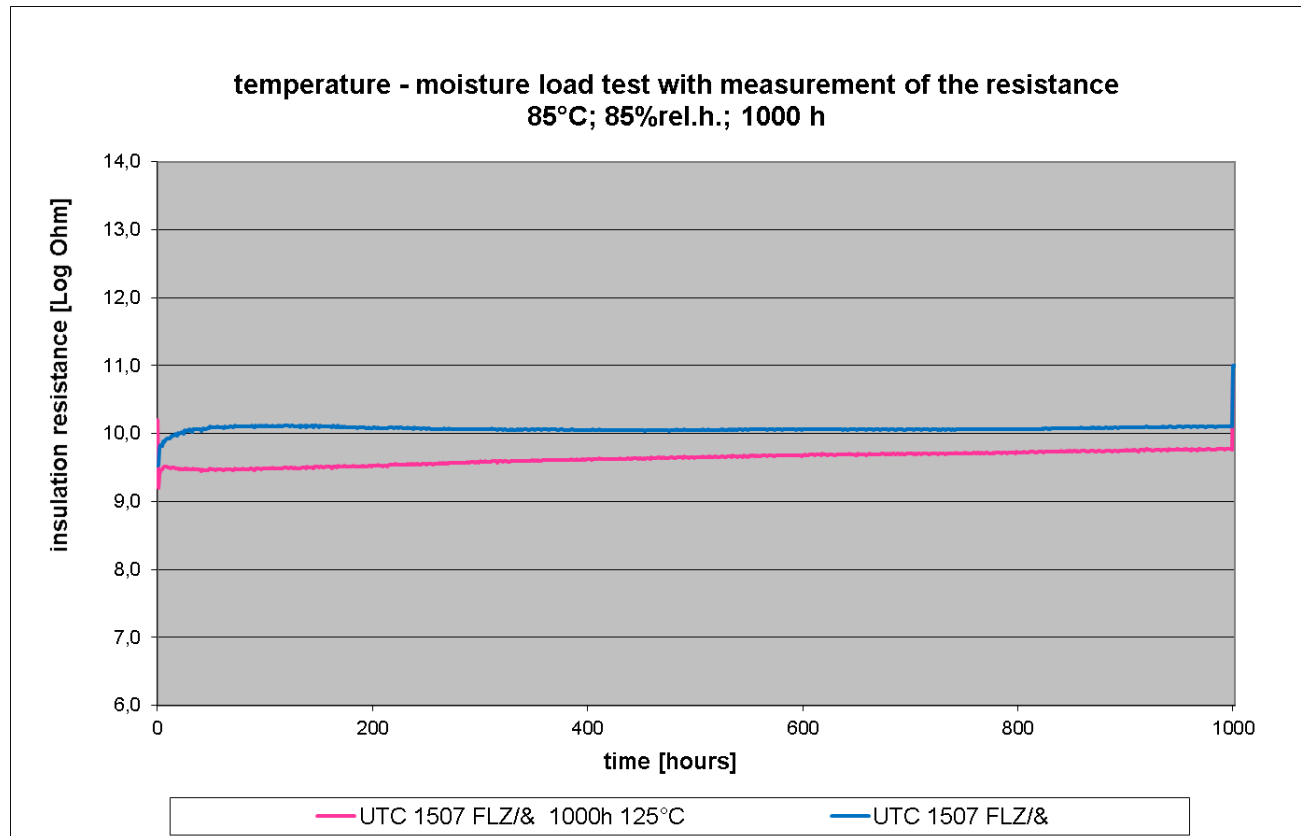
4 of 5 - Synthetic Rubber ELPEGUARD® UTC 1507 FLZ

- Basis: Synthetic Rubber
- Solvents free from aromatics
- Excellent resistance against cracks in thermal cycle test from -65 to +150 °C
- High insulation resistance under high temperatures and high shares of humidity

4 of 5 - Thin-Film Systems Synthetic Rubber / UTC

	UTC 1507 FLZ/70	UTC 1507 FLZ/850	UTC 1507 FLZ/260
Viscosity at 20 °C (Flow time acc. to DIN EN ISO 2431, 4 mm ISO flow cup)	approx. 61 s	—	—
Viscosity at 20 °C (Flow time acc. to DIN 53211, 4 mm DIN flow cup)	approx. 23 s	—	—
Viscosity* at 20 °C, DIN EN ISO 3219	approx. 70 mPas	approx. 850 mPas	approx. 260 mPas
Solids content, DIN EN ISO 3251, % by weight	approx 11 %	approx. 18 %	approx. 15 %
Density at 20°C, DIN EN ISO 2811-1	approx. 0.80 g/cm ³	approx. 0.81 g/cm ³	0.81 g/ cm ³
Moisture and insulation resistance, IPC-CC-830B, 3.7.1, (65 °C [149 °F]/90 % R.H.)	passed		
Moisture and insulation resistance, 85/85 test (85 °C [185 °F], 85 % RH)	≥ 1.0 x 10 ¹⁰ Ohm		
Resistance to condensation, based on DIN EN ISO 6270-2 (BIAS 12 V, 40 °C, 100% R.H.)	≥ 8.0 x 10 ⁸ Ohm		

4 of 5 - Synthetic Rubber - 1000 h 125°C, 1000h 85/85 Test



For more information please see TDS and ppt (UTC 1507 FLZ klimatische tests 28092020 - engl.pptx)

5 of 5 - Silicones - Current Conformal Coating Systems

- **Systems on Silicone Basis**

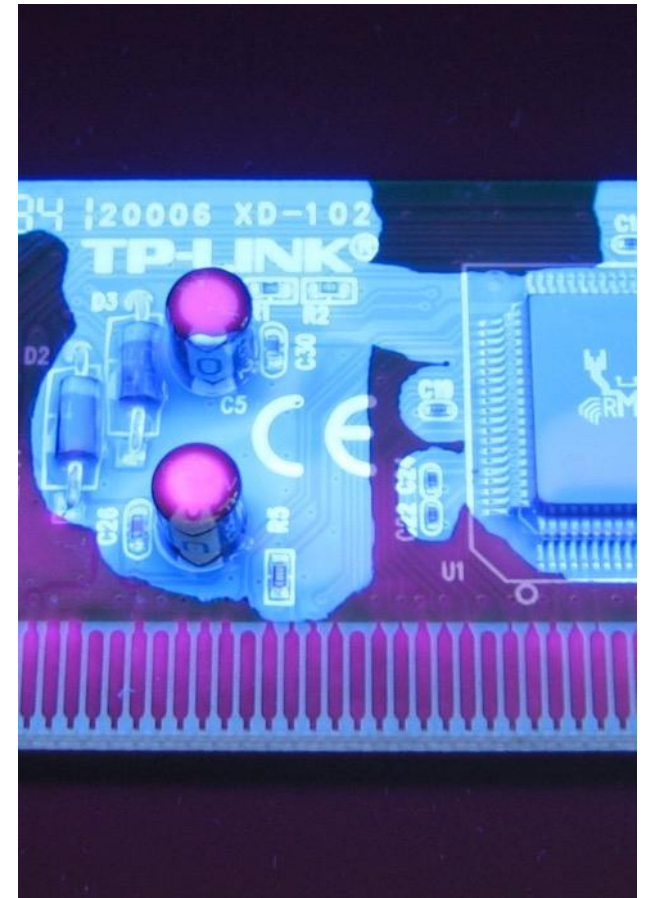
- > Thick-film Coating ELPEGUARD® **DSL 1705 FLZ**
- > Thick-film Coating series ELPEGUARD® **DSL 1706 FLZ**
- > Thick-film Coating ELPEGUARD® Twin-Cure® **DSL 1707 FLZ**

+ Excellent final properties under very high and very low temperatures	- Possible contaminations by silicone during application/production
+ Solvent-free, applicable in high layer thicknesses	- Silicones are not always requested/approved
	- Expensive

5 of 5 - Silicones and UV-Technology

ELPEGUARD® Twin-Cure® DSL 1707 FLZ

- Solvent-free silicone thick-film coating
- Twin-Cure® curing mechanism: Fast UV curing, combined with humidity reaction in shadow areas
- Dispenser application
- High thermal/thermal shock resistance
- Temperature range from -65 to +200 °C
- Excellent chemical resistance
- Approved according to UL 746E



For more information please see TDS and ppt (DSL 1707 FLZ klimatische tests 29102019 - engl.pptx)

5 of 5 - ELPEGUARD® Silicones

- Unrest in the market due to competitor's delivery problems
- Higher demand because of rising (permanent) temperature stress
- More R & D activities for
 - > UV curing systems
 - > RTV systems
 - > 2-component systems

Summary of CC for Reliable Electronics

- Conformal coatings should have positive influence on reliability and durability of electronic products.
- Performance of our conformal coatings shows that the functionality of electrical assemblies is secured also under high moisture stress and temporary dewing conditions.
- It is necessary to verify compatibility of earlier processes and their residues with conformal coating in advance, taking into consideration expected stress factors.
- Only the right selection of a suitable ink system combined with an optimum processing can guarantee this.

Conformal Coatings of the Future - Conclusion

- Requirements to conformal coating systems will increase.
- Solvent-free conformal coatings will become more significant.
- UV (LED) curing conformal coatings will become more important.
- Further rising temperature stress will make silicones more relevant.
- More importance of 2-component conformal coating systems.

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peters
Coating Innovations
for Electronics

Thank you for your attention.