ELPEGUARD®
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TR TECHNICAL REPORT

ELPEGUARD® thick film coating Twin-Cure® DSL 1602 FLZ/400

The **ELPEGUARD®** thick film coating **Twin-Cure® DSL 1602 FLZ/400** is used to protect and insulate electronic assemblies so that they can fulfil higher requirements regarding reliability and service life. Owing to their very good resistance against moisture and condensation an excellent protection against corrosion (such as electro corrosion and migration) is possible even under harsh climatic conditions.

- basis: copolymer of polyurethane (UR) and polyacrylate (AR)
- solvent-free
- UV LED curing at a wavelength of 395 nm, or UV curing in common UV curing units
- powerful protection through electrical insulation properties directly after UV curing
- chemical cross-linking reaction in shadow zones
- excellent mechanical and chemical resistance
- UL Recognised Component: best flame class V-0 acc. to UL 94 (UL file no. E80315)
- compliant with China standard GB 30981-2020
- temperature range of -65 to +130 °C [-85 to 266 °F]
- depending on the coating thickness also suitable for coating flexible circuits (“flex-to-install”, bend stress during assembly only)
- excellent edge coverage, wetting and underfilling of components (“micro-casting”), very good capillar-active behaviour, yet not suitable as underfill material for BGA’s
- excellent adhesion
- when applied in thick layers, components may be fixed to protect against vibration
- can be mechanically stripped for repair purposes (blasting method)
- possibility of touch-up and repair coatings as well as double coating

Characteristics

Colour/ appearance	colourless, fluorescent
Solids content	100 %
Viscosity* at 20 °C [68 °F], ISO 3219	400 ± 100 mPas
Density at 20 °C [68 °F], ISO 2811-1	1.06 ± 0.05 g/cm³

* measured with Haake RS 600, C 35/1°, D = 100 s^{-1}
viscosity measuring unit supplied by Thermo Fisher Scientific, www.thermofisher.com

Indices: DSL = thick film coating, FLZ = fluorescent, /400 = viscosity of 400 mPas

LP 232510 E-4 / 301399e_004

Physical and mechanical properties

These values are achieved after UV LED curing and 14 days‘ storage at room temperature.

Property	Test method	Result
Adhesion	IPC-TM-650, 2.4.28.1	passed
Flexibility	IPC-CC-830C, 3.5.5	passed
Glass transition temperature Tg	TMA	≈ 40 °C
Coefficient of thermal expansion (CTE)	TMA	≈ 140 ppm/°C < Tg ≈ 275 ppm/°C > Tg

Electrical properties

These values are achieved after UV LED curing and 14 days‘ storage at room temperature.

Property	Test method	Result
Dielectric strength	IPC-TM-650, 2.5.6.1	≥ 50 kV/mm
	IPC-CC-830C, 3.6.1	passed
Specific volume resistivity	DIN EN 62631-3-1	≥ 1.0 x 10^{14} Ohm x cm
Surface resistance	DIN EN 62631-3-2	≥ 1 x 10^{14} Ohm
Moisture and insulation resistance	IPC-CC-830C, 3.7.1 (65 °C [149 °F]/90 % r.h.)	passed
	85/85 test (3 d, 85 °C, 85 % r. F.)	≥ 3.0 x 10^{8} Ohm
Thermal shock resistance	IPC-CC-830C, 3.7.2 -65 to +125 °C [-85 to 257 °F]	passed (< 100 µm)
	1000 cycles -40 °C [-40 °F] to +125 °C [257 °F]. dwell time 30 min transfer time < 10 s	No cracks or delamination
Comparative Tracking Index (CTI, tracking resistance)	DIN EN 60 112, on base material with CTI of 275	CTI ≥ 600
Resistance to condensation	based on ISO 6270-2 (BIAS 12 V, 40 °C [104 °F], 100% r. F.)	≥ 1.0 x 10^{10} Ohm
Permittivity ε_r	Determination with a Balanced Circular Disk Resonator	67 GHz: ≈ 2.695 78 GHz: ≈ 2.735
	VDE 0303, part 4	100 kHz: ≈ 4.0 1 MHz: ≈ 3.7 1 GHz: ≈ 3.4
Dielectric loss factor tan δ	Determination with a Balanced Circular Disk Resonator	67 GHz: ≈ 0.012 78 GHz: ≈ 0.016
	VDE 0303, part 4	100 kHz: ≈ 0.0114 1 MHz: ≈ 0.016 1 GHz: ≈ 0.0432
TI (temperature index)	DIN EN 60216 (IEC 60216) issue 2001	132 °C [269.6 F] (20 000 h)* 147 °C [296.6 F] (5 000 h)*

* can be used in a temperature range **of -65 to at least +130 °C [-85 to at least 266 °F]**. Both at the lower and upper ends of this range the performance and reliability of the material can be negatively affected in some applications. In such cases, additional pre-trials and tests are required. For determining the TI, a loss in mass and/or dielectric strength of 50 % compared to the initial values has been fixed as a limit.

Electrical properties immediately after UV curing

After UV curing, electrically insulating properties are already present; however, they may not yet reach the values stated above. Please consider this when performing functional tests directly after UV curing where the electrical values of the thick film coating **Twin-Cure®** are demanded. The final properties are only achieved after about 8-14 days.

Properties after curing with mercury/gallium lamps

The physical, mechanical and electrical properties reached after curing by means of mercury/ gallium lamps may vary from the results listed above. For further information, you may refer to our test report DA 2019-296 provided upon request.

Processing

	Please read this technical report and the publications listed below carefully before using the product. These sheets are enclosed with the first shipment of product or sample
MSDS	The corresponding material safety data sheet contains detailed information and characteristics on safety precautions, environmental protection, transport, storage, handling and waste disposal.
AI	Application information AI 1/2 ”Processing instructions for the ELPEGUARD® thick film coatings of the series Twin-Cure®“
TI	Technical information TI 15/3 “Protective measures when using chemicals including lacquers, casting compounds, thinners, cleaning agents“

The thick film coating **Twin-Cure® DSL 1602 FLZ/400** can be applied by automatic selective spray coating, by brushing or by means of dispensing.

Protect from UV light


Protect against humidity

Since the many different permutations make it impossible to evaluate the whole spectrum (parameters, reactions with materials used, chemical processes and machines) of processes and subsequent processes in all their variations, the parameters we recommend are to be viewed as guidelines only that were determined in laboratory conditions. We advise you to determine the exact process limitations within your production environment, in particular as regards compatibility with your specific follow-up processes, in order to ensure a stable fabrication process and products of the highest possible quality.

The specified product data is based upon standard processing conditions/test conditions of the mentioned norms and must be verified if necessary while observing suitable test conditions on processed products.

Feel free to contact our application technology department (ATD) if you have any questions or for a consultation.

Auxiliary products recommended

- ELPESPEC® cleaning agent R 5817 and reactive thinner VR 1600
  For cleaning work place and tools we recommend our cleaning agent **R 5817.** Clean equipment with **R 5817** and then rinse with reactive thinner **VR 1600**. Please see also our application information sheet **AI 1/2**, item “Cleaning equipment”.
- ELPESPEC® cleaning agent R 5888
  water-soluble, biodegradable cleaning agent for product carriers and tools

Drying/Curing

The curing process is based on two complementary chemical cross-linking mechanisms of different time lengths: UV curing and humidity curing.

UV curing with suitable lamps is mandatory. The specified final properties cannot be achieved by humidity curing alone.

The assemblies can already be packed or encapsulated 1-3 h after UV curing.

UV LED curing

Curing is effected in UV LED curing units at a wavelength of 395 nm.

➔ Cure the **ELPEGUARD®** thick film coating **Twin-Cure®** by applying an **energy of 1500 ± 500 mJ/cm² and an energy output of 1500 ± 500 mW/cm²**. The distance between lamp and assembly should be as low as possible.

UV curing with mercury/gallium lamps

Curing can be effected in common UV curing units.

➔ Determine the optimum energy level by performing pretrials.

For further information, you may refer to our test report DA 2019-296 provided upon request.

Humidity curing

In shadow zones, the coating will cure by reacting with atmospheric humidity. Depending on the layout and assembly of the printed circuit board, this reaction is completed after 8-14 days. Only after this time the final properties are achieved.

Packaging

The packing units available are indicated in our offer which we will send you upon request.

Shelf life and storage conditions


Shelf life: In sealed original containers at least 6 months

Storage conditions: +5 °C to +25 °C [+41 °F to +77 °F]

Protect from UV light


Protect against humidity

For warehousing reasons, isolated cases may occur where the shelf life upon shipment is less than the shelf life indicated in this technical report. However, it is ensured that our products have **at least** two-thirds of their shelf life remaining when they leave our company. Labels on containers show shelf life and storage conditions.

Disclaimer

All descriptions and images of our goods and products contained in our technical literature, catalogues, flyers, circular letters, advertisements, price lists, websites, data sheets and brochures, and in particular the information given in this literature are non-binding unless expressly stated otherwise in the Agreement. This shall also include the property rights of third parties if applicable.

The products are exclusively intended for the applications indicated in the corresponding technical data sheets. The advisory service does not exempt you from performing your own assessments, in particular as regards their suitability for the applications intended. The application, use and processing of our products and of the products manufactured by you based on the advice given by our Application Technology Department are beyond our control and thus entirely your responsibility. The sale of our products is effected in accordance with our current terms of sale and delivery.

Any questions? We would be pleased to offer you advice and assistance in solving your problems. Samples and technical literature are available upon request.

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