ELPEPCB®
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TR TECHNICAL REPORT

2-pack solder resists of the series

Elpemer® 2469 SM-HF

- **green transparent**
- suitable for all common application processes
- photoimageable
- highest resolution even of finest details (e.g. 50 µm)
- polyalcohol developable
- halogen-free acc. to JPCA-ES01-2003/IEC 61249-2-21
- excellent permanent temperature resistance at 150 °C [302 °F]
- thermal cycling resistance:
  -40 up to +150 °C [-40 up to 302 °F]
  -65 up to +125 °C [-85 up to 257 °F]
- excellent resistance to galvanic and electroless nickel/gold (ENiG), palladium, silver, tin baths and OSP processes (Organic Solderability Preservative)
- compatible with lead-free soldering processes
- fulfil/exceed among others
  UL 94 V-0, UL File No. E80315
  IPC-SM-840D, Class H and T
  Siemens SN 57030
  Bosch Y 273 R80 029
  NASA outgassing test acc. to ASTM E595

Indices: SM = silk-mat, HF = halogen-free

LP 082910 E-5 / 0246200e.005

Contents

Please read this technical report and the corresponding material safety data sheet, the process data sheet as well as the application information sheet AI 2/1 (see item 3) carefully before using the product.

1. General information

The solder resists of the series **Elpemer® 2469 SM-HF** are solder masks in the sense of VDI/VDE 3710, sheet 4: "Fabrication of printed circuit boards; printing processes". They are permanent solder masks that are applied to those parts of the printed circuit board which are not to be tinned during subsequent soldering processes.

The photoimageable 2-pack solder resists of the series **Elpemer® 2469 SM-HF** are suitable for all common application processes and developed in polyalcohols (butyl carbitol or carbitol).

This report is valid for the following adjustments:

AS 2469 SM-HF	**application by means of conventional and electrostatic spray coating (horizontal and vertical)**
GL 2469 SM-HF	**application by means of curtain coating**
SD 2469 SM-HF	**application by means of screen printing, also by means of double-sided vertical screen printing**

Indices: **AS = air spray**
GL = curtain coating
SD = screen printing
SM = silk-mat
HF = halogen-free

As aqueous-alkaline developable solder resists the 2-pack photoimageable solder resists of the series **Elpemer® 2467** are available. A special report on these products is available upon request. In our report manual this report is filed under group 2. On our report manual CD, technical reports can be accessed in the ”Products” section.

All symbols that are used in this technical data sheet and on our containers, such as , are explained on our website www.peters.de in the section ”Service – Symbols on labels”.

2. Application

On account of their high resolution alongside their excellent dielectric properties the 2-pack solder resists of the series **Elpemer® 2469 SM-HF** are used as insulating coatings for pcbs in fine and superfine line technology, SMD technology as well as for multilayers.

3. Special notes / application information

To complement this technical report you will find product-specific data such as characteristics and recommendations for process parameters in the process data sheets (PD) of each solder resist. Further and detailed general information and notes that need to be observed to achieve an optimum processing result are indicated in the **Application Information** sheet **AI 2/1** ”Processing information for photoimageable **Elpemer®** solder resists.

In our report manual the **Application Information sheet AI 2/1** is filed under group 2. On our report manual CD and on our website you will find application information sheets in the "Service" section. The process data sheets will be supplied together with your initial order.

As an all-round supplier of lacquers for the production of pcbs our product range contains numerous conformal coatings that boast approvals from UL and the automotive industry. Naturally they are also compatible with our **Elpemer®** solder resists as well as our other solder resist systems. By subsequently applying coating materials from our product range your high-quality assemblies can fulfil even higher requirements as regards reliable functioning, service life and quality even under increased climatic stress (moisture, condensation, temperature).

4. Safety recommendations

→ Please read the corresponding material safety data sheet where you will find detailed specifications of safety precautions, environmental protection, waste disposal, storage, handling, transport as well as other characteristics.

→ When using chemicals, the common precautions should be carefully noted.

→ Solvent vapours are heavier than air, thus when planning workplace ventilation arrangements, ensure that extractor units are positioned at worktop height.
→ Please also pay attention to national guidelines or directives concerning the handling of flammable liquids as for example the German TRbF (technical regulations for flammable liquids) or European directives.

5. Characteristics

On account of the different application processes for the solder resists the characteristics vary and are thus indicated in the product-specific process data sheets. We will gladly provide you with the process data sheets upon request.

6. Properties

The photoimageable solder resists of the series **Elpemer® 2469 SM-HF** are distinguished by the following properties:

6.1 General properties

- suitable for all common application processes, as for instance, conventional and electrostatic spraying, curtain coating and screen printing
- high productivity due to short processing times
- a high solids content and an optimum thixotropy enable an excellent conductor edge coverage at a low wet ink weight as well as a favourable ratio of lacquer to pad height
- broad processing window in the process step ”pre-drying”
- low exposure energy, thus short exposure times
- highest resolution: virtually vertical side walls enable the representation of finest details. e.g. 50 µm ink dams between SMD pads
- high pencil hardness and excellent scratch resistance protect against mechanical damage during handling
- excellent resistance to galvanic and electroless nickel/gold (ENiG), palladium, silver, tin baths and OSP processes (Organic Solderability Preservative)
- excellent compatibility with no-clean and water-thinnable fluxing agents
- strongly solder-repellent ink surface thus minimum solder ball adhesion
- with a solder bath resistance of 20 s at 288 °C [550.4 °F] acc. to UL 94 fulfil the required temperature resistance for lead-free soldering
- multiple soldering and lead-free reflow soldering possible
- very low ionic contamination values after HAL
- excellent adhesion of subsequent coatings (marking inks, carbon-conductive inks, conformal coatings and others)
- suitable for laser ablation by means of CO_2 lasers, e.g. to apply AOI legible markings (for instance, data matrix, barcodes), no solder adhesion to ablated areas
- excellent permanent temperature resistance at 150 °C [302 °F]
- thermal cycling resistance: -40 up to +150 °C [-40 up to 302 °F], 2000 cycles, 30 min, shift time < 10 s
- best flame class V-0 according to UL 94, UL File No. E80315, Registered trademark of Underwriters Laboratories Inc.; Northbrook, Illinois 60062
- free of halogenated flame retardants
- halogen-free according to JPCA-ES01-2003 / IEC 61249-2-21
- do not contain substances listed in the RoHS directive 2002/95/EC, EU End-Of-Life Vehicle directive 2000/53/EC and WEEE directive 2002/96/EC
- fulfil, among others, the specifications **IPC-SM-840D** (**Trace Lab Report** on our website www.peters.de in the "Service– Certificates" section), Bosch Y 273 R80 029, Siemens SN 57030 with respect to electro corrosion, and the NASA outgassing test acc. to ASTM E595

6.2 Physical and mechanical properties

Property	Test method	Result
Adhesion	IPC-SM-840D, 3.5.2.1	class H and T
	IPC-SM-840D, 3.5.2.6 (ink on ink)	class H and T
Cross hatch	EN ISO 2409, ISO 2409 on copper on FR 4	 Gt 0 Gt 0
Pencil hardness	IPC-SM-840D, 3.5.1 acc. to Wolff-Wilborn	6 H 6 H
Scratch hardness	Simex scratch resistance test device type RH 3, scoring needle with ball tip (1 mm diameter)	weight load: 1600 g
Resistance to solvents/cleaning agents	IPC-SM-840D, 3.6.1.1 Isopropanol Isopropanol : deionised water (75 : 25) D-Limonene 10% alkaline cleaning agents Monoethanolamine Deionized water	 passed passed passed passed passed passed
Resistance to solvents	test boards, dipped in dichloromethane (60 min at room temperature)	no swelling
Hydrolytic stability	IPC-SM-840D, 3.6.2 28 days/97 ± 2 °C [206.6 ± 35.6 °F] 90 to 98 % rel. humidity	passed
Solder bath resistance	IPC-SM-840D, 3.7.2 IPC-SM-840D, 3.7.3 (lead-free) IPC-TM-650, 2.6.8 UL 94*	20 s at 265 °C [509 °F] 10 s at 260 °C [500 °F] 10 s at 288 °C [550.4 °F] 20 s at 288 °C [550.4 °F]
Simulated lead-free reflow soldering	IPC-SM-840D, 3.7.3.1	5 x 10 s at 260 °C [500 °F]
Thermal shock	IPC-SM-840D, 3.9.3	class H and T
	Bosch Y 273 R80 029, TK6	passed
	Siemens A2C 00042994 AAA, D+	passed
	-40 °C up to +150 °C [-40 up to 302 °F], 2000 cycles, 30 min, shift time < 10 s	passed
Long term temperature resistance	Storage 5000 h at 150 °C [302 °F]	cross hatch Gt 0
Thermal class	based on DIN IEC 60 085	F = 155 °C [311 °F]
TG_5 (5% loss in mass)	TGA (thermo gravimetric analysis)	approx. 370 °C [698 °F]
Resistance to acids	10 % H_2SO_4 at 20°C [68 °F], 30 min	no change
Resistance to alkalis/lyes	10 % NaOH at 20°C [68 °F], 30 min	no change
Ionic contamination	Alpha ionograph M500	< 0.3 µg NaCl/cm²

* With a solder bath resistance of 20 s at 288 °C [550.4 °F] the solder resists of the series **Elpemer® 2469 SM-HF** fulfil the required temperature resistance for lead-free soldering.

6.3 Electrical properties

Property	Test method		Result
Dielectric strength	VDE 0303, part 21 DIN EN 60243-1		175 kV/mm
	IPC-SM-840D, 3.8.1		passed
Surface resistance	VDE 0303, part 30/DIN IEC 60093 IPC-TM-650, 2.5.17.1		3.0×10^{14} Ohm
Specific volume resistivity	VDE 0303, part 30/DIN IEC 60093 IPC-TM-650, 2.5.17.1		2.0×10^{15} Ohm x cm
Insulation resistance	IPC-SM-840D, 3.8.2		class H and T
Moisture and insulation resistance	IPC-SM-840D, 3.9.1		class H and T
Electromigration	IPC-SM-840D, 3.9.2 85 °C [185 °F], 85 % r.h., 168 h, 10 V DC		class H and T
Electrocorrosion	Siemens Norm SN 57 030 40 °C [104 °F], 95 % r.h., 21 d, 100 V DC		passed
Comparative Tracking Index (CTI, Tracking resistance)	DIN EN 60 112		min. CTI 400*
Dielectric constant ε_r	DIN 53483	1 kHz 1 MHz 100 MHz 500 MHz 1 GHz	4.5 3.0 2.8 2.8 2.8
Dielectric loss factor tan δ	DIN 53483	1 kHz 1 MHz 100 MHz 500 MHz 1 GHz	0.011 0.009 0.020 0.023 0.027

* on corresponding base material (The CTI value of the coating also depends on the tracking resistance values of the base material, etc.)

Note: Optimum electrical insulation values can only be achieved when all flux residues are removed thoroughly from the printed circuit boards.

7. Processing

™→ Please observe the product-specific processing parameters recommended in the corresponding process data sheets for each solder resist as well as the **Application Information** sheet **AI 2/1** ”Processing information for photoimageable **Elpemer®** solder resists”.

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. 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 product data specified in the technical reports is based upon standard processing/test conditions of the mentioned norms and must be verified observing suitable test conditions on processed printed circuit boards.

Feel free to contact us if you have any questions or for a consultation with our application technology department.

Protect open containers from UV light

7.1 Auxiliary products

We recommend the following auxiliary products for the **Elpemer®** process:

- **Cleaning and deoxidising agent HP 5625 for conveyorised spraying units**
  for the pre-treatment of Cu pcbs prior to ink/resist application, deoxidises and degreases without copper degradation; minimum foaming.
- **Screen opener HP 5200**
  The screen opener **HP 5200** is a highly active spray for dissolving dried screen printing inks immediately and safely from clogged screens. **HP 5200** is silicone-free and does not contain oils or oily substances, so that no smearing occurs.
- **Anti-Static Spray HP 5500**
  The anti-static spray **HP 5500** prevents and eliminates any static charge that occurs during screen printing. **HP 5500** is silicone- and grease-free.
- **Special stripper HP 5707**
  in its concentrated form **HP 5707** can be used to remove exposed and possibly cured photoimageable solder resists (e.g. in case of mis-exposures); diluted with water it is also suitable for cleaning ink developer and resist stripping units.
- **Touch-up lacquer SD 2369 UV-ABL**
  yellow-green transparent lacquer to touch up small mechanical damages, application by means of screen printing or brushing, UV curing.
- **Cleaning agents R 5899, R 5821 and R 5817**
  The cleaning agent **R 5899** does not have to be marked according to German dangerous goods regulations and can be handled simply and safely. Owing to its high flash point (> 100 °C [> 212 °F]) it is especially suitable for use in screen washing equipment. The cleaning agent **R 5899** is particularly distinguished by a low vapour pressure (< 0.1 hPa at 20 °C [68 °F]) and thus is not affected by the EU-VOC regulation 1999/13/EG which judges solvents by their percentage of volatile organic compounds (VOC = volatile organic compounds).

  Furthermore, the cleaning agent **R 5821** is available which, owing to its high flash point of +32 °C [89.6 °F], is also suitable for use in screen washing equipment as well as for cleaning work tools. For the manual cleaning of screens and tools we recommend our cleaning agent **R 5817** with its fast and thorough cleaning properties.

Do not use cleaning agent as a thinner or for washing hands since solvents remove the natural grease from skin.

Special technical reports for these products are available upon request. Further information regarding the content and consequences of the EU-VOC regulation can be found in our **t**echnical **i**nformation **sheet TI 15/110 E ”EU-VOC regulations – Content and consequences for the PCB industry”**. In our report manual these technical publications are filed under group 5 and 15. On our report manual CD you will find technical reports in the "Products" section and technical information sheets in the "Service" section.

8. Drying/curing

There are 3 drying steps in the standard processing of **Elpemer®** of the **series 2469 SM-HF**:

- Pre-drying – prior to exposure and developing
- Drying of the pcb after developing and rinsing
- Curing as the final process step.

Further information regarding the above mentioned steps can be found in the corresponding process data sheets of each solder resist.

9. Standard packaging

Elpemer® of the **series 2469 SM-HF** are packed for delivery as follows:

	Component A	Component B	Selling unit
AS 2469 SM-HF	1 bucket of 9 kg	1 top container of 1.5 kg	10.5 kg
GL 2469 SM-HF	1 bucket of 9 kg	1 top container of 1.5 kg	10.5 kg
SD 2469 SM-HF	4 buckets of 6 kg	4 tins of 1 kg	28 kg

The corresponding thinner is available in cans of 25 kg or barrels of 170 kg.

Partial lots of the selling units may be ordered, but will entail surcharges to cover repackaging costs.

10. Shelf life and storage conditions

The shelf life / minimum shelf life and storage conditions are indicated in the product-specific product data sheets (PD) and shown on the container labels.

Any questions?

We would be pleased to offer you advice and assistance in solving your problems. Free samples and technical literature are available upon request.

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