



PHOTOMER[®] 4173

Acid Functional Mono Acrylate

Product Data Sheet

General Information

PHOTOMER[®] 4173 is a proprietary UV/EB curable acrylate oligomer of low functionality and low viscosity. Designed primarily for use in etch-resist inks for printed circuit board manufacture, it can be readily formulated into a UV curable screen ink which exhibits good scratch resistance and improved stripping characteristics.

Specification

Appearance	Visual	Clear to hazy, pale yellow liquid
Viscosity @ 25 °C	Brookfield, ISO 2555	2,000 - 6,000 mPa.s
Colour (Gardner)	ISO 4630	≤ 1
Acid Value	ISO 660	170 - 210 mg KOH/g

Additional Data

Specific Gravity @ 25 °C	1.300 g/cm ³
Weight/Gallon @ 25 °C	10.5 lbs
Inhibitor, 1000 ppm	p-Methoxyphenol

Application

PHOTOMER[®] 4173 is recommended in radiation curable electronic coatings and inks, such as etch resists and plate resists, and UV/EB pressure sensitive and laminating adhesives. It can be formulated with other PHOTOMER monomers and oligomers to create desirable coatings for a variety of applications.

PHOTOMER[®] 4173 enhances the adhesion, flow and leveling characteristics of UV/EB curable coatings and inks. Studies of EB cured neat films of PHOTOMER[®] 4173 paralleled the results obtained from UV cure. Glossy, hard films with excellent adhesion to copper and aluminum were generated upon EB curing. Neat films of PHOTOMER[®] 4173 on selected metal substrates are characterized by outstanding adhesion, good scuff resistance and high gloss.

Features & Benefits

Film Studies	Aluminum	Tin-Steel	Copper
Scuff Resistance	Good	Good	Good
Gloss 60°	Good	Good	Good
Adhesion (#600 Cellotape)	Excellent	Good	Excellent
Pencil Hardness	6H	5H	6H
Solvent Resistance (MEK Double Rubs)	5	8	12

Cure Conditions: RDS Coating Rod #3;
 0.27 mil wet film thickness;
 4% Omnirad® BDK;
 100 ft/min; 3 passes,
 one 300 watt/inch UV lamp.

PHOTOMER® 4173 Alkaline Strippability Profile ¹

Formulation composition is critical in the development of an effective etch-resist, particularly with respect to both adhesion and alkali-stripping characteristics. Monomer selection can have a significant effect on these properties since they become part of the final coating on radiation cure. UV cured copper panel coatings based on PHOTOMER® 4173 with various reactive monomers, such as the PHOTOMER® 4000 series, were tested for alkali-strippability. Mono-functional types were found most effective in promoting adhesion and coating removal. Di- and Trifunctional types cured faster, but generated coatings that were more alkali-resistant.

Monomer	Cure Speed (ft/min)	Adhesion ²	Alkali Strip ³
PHOTOMER® 4006	100	Fair	25 %
PHOTOMER® 4039	25	Excellent	100 %
PHOTOMER® 4050	75	Fair	50 %
PHOTOMER® 4061	33	Fair	90 %
PHOTOMER® 4072	100	Fair	50 %
PHOTOMER® 4127	25	Good	95 %
HEMA	10	Excellent	100 %

¹ Copper panel coatings based on 60 % PHOTOMER® 4173 and 40 % Acrylate Monomer

² Cellotape #600 crosshatch test.

³ Percent cured film removed, 4 % NaOH @ 25 °C, 45 seconds.

Cure Conditions: RDS Rod #3;
 0.27 mils wet film thickness;
 4 % Omnirad® 73
 one 300 watt/inch UV lamp.

Adhesion Promotion

EB cured neat coatings of PHOTOMER® 4173 exhibited excellent adhesion to a variety of substrates suggesting its utility as an adhesion promoter. This product characteristic is especially useful where intercoat adhesion and delamination are a problem.

PHOTOMER® 4173 is recommended in EB applications as a primary oligomer in adhesives, inks and elastomers where its low modulus (e.g. 10² psi) and elongation (e.g. 88 %) may contribute to final product requirements. For UV systems, however, the adhesion promotion characteristics of PHOTOMER® 4173 were only found effective at low line speeds (i.e. less than 30 ft./min./lamp.). Accordingly, it is suggested as a secondary oligomer for UV - curable coatings. Following are the EB cured film properties of PHOTOMER® 4173:

Substrate	Gloss	Scuff	Cross-Hatch Adhesion	Pencil Hardness	MEK Double Rubs
Copper	100	Fair	Excellent	4H	3
Aluminum	100	Fair	Excellent	5H	4
Tin-Steel	100	Fair	Excellent	5H	3
Acrylic	100	Fair	Excellent	5H	2
Polycarbonate	100	Fair	Good	5H	3
Paper	100	Fair	Excellent	4H	2

Cure Conditions: Electrocurtain (Energy Sciences Corp);
165 Voltage; 3 Megarads,
0.27 mils wet film thickness;
< 500 ppm oxygen; 100 ft/min.

Formulation Suggestions for PHOTOMER® 4173

Excellent adhesion to cleaned metallic substrates, good scuff resistance, good cure response and alkali strippability underscores the utility of PHOTOMER® 4173 in printed circuit applications. This low viscosity oligomer can be readily formulated into a screen printable 100 % solids, solventless UV curable etch-resist for PCB fabrication. PHOTOMER® 4173 based etch-resists cure to a glossy smooth transparent finish with excellent resolution qualities and improved stripping characteristics over those of commercially available systems. The following summarizes the results of etch-resist inks that have not been optimized and are suggested as starting points for further modification.

UV Curable Etch-Resists	A	B
PHOTOMER® 4173	43.0	43.0
PHOTOMER® 4039	16.0	---
PHOTOMER® 4072	2.5	2.5
Sipomer HEM ¹	---	16.0
Desmophen 1100 ²	16.0	16.0
Omnirad BDK	4.0	4.0
Talc	16.0	16.0
Pigment	1.0	1.0
Bentone 38 ³	1.0	1.0
PERENOL® F-40 (Cognis)	0.5	0.5

Properties

Viscosity @ 25 °C, mPa.s	1600	1520
Pencil Hardness	6H	6H
Solvent Resistance (MEK Double Rubs)	3	4
Adhesion (#600 Cellotape) ⁴	100 %	100 %
Strippability @ 25 °C, (4% NaOH)	30 – 40 sec	35 – 45 sec

¹ Trademark of Alcolac, Inc.

² Trademark of Miles

³ Trademark of N.L. Chemicals

⁴ Substrate, abraded copper panels

Cure Conditions:

RDS Rod #3;
0.27 mils wet film thickness;
20 ft/min;
one 300 watt/inch UV lamp.

Storage & Handling

Storage must be in a cool, shaded, well ventilated and dry area away from direct sources of heat and sunlight. PHOTOMER® 4173 may congeal or stratify and become hazy if subjected to cold or freezing conditions. Allow to warm to room temperature and mix well before using.

Subject to appropriate storage under the usual storage and temperature conditions, our products are durable for at least 12 months.

PHOTOMER® 4173 should be handled in accordance with good industrial practice. Further information is provided in the material safety data sheet which is available on request.

Regulatory Status

TSCA (USA), EINECS (Europe), IECSC (China), DSL (Canada), PICCS (Philippines), AICS (Australia), NZIoC (New Zealand), ENCS (Japan), Taiwan

Packaging

PHOTOMER® 4173 is available in 55 gallon (200 liter) lined tighthead steel drums.

Disclaimer

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