SunChemical
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Technical Information Leaflet

Imagecure

XV501T Screen

PRODUCT REFERENCE

Imagecure	XV501T Green (HF) Screen Resist	CAWS2406
Imagecure	XV501T Clear Screen Hardener	CAWS1286

CONTENTS

1. Description
2. Mixing
3. Thinning
4. Pre-clean
5. Application
6. Washing-Up
7. Pre-Dry
8. Exposure
9. Thermal Bump
10. Development
11. UV-Bump
12. Post-Bake
13. Notation / Legend Printing
14. Electroless Nickel Gold / Immersion Tin Processing
15. Storage and Shipping
16. Health & Safety
17. Packaging
18. Film Performance / Technical Specification
19. Disclaimer
20. Support

ISO9001
FM 09568

IPC SM840D Class H Pass   Bellcore Pass

RoHS & WEEE Directive Compliant

Sony Green Partner

ISO14001
EMS 40768

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1) DESCRIPTION

Imagecure AQ XV501T Screen is a two component thermal hardening liquid photoimageable solder resist that dries by solvent evaporation to give a film that can be processed in aqueous potassium or sodium carbonate solution, or solvent.

Imagecure AQ XV501T Screen products have excellent adhesion to all clean copper surfaces, and can be used with reflow tin/lead and electrolytic gold plated conductors.

This Technical Information Leaflet (TIL) and the relevant Material Safety Data Sheet (MSDS) should be read carefully prior to using this product.

2) MIXING

The green resist and clear hardener components must be mixed together in the correct mixing ratio of 2:1 w/w before use. The hardener component must be added to the resist component.

Mechanical mixing is recommended to ensure thorough mixing of the resist and hardener components. Recommended mixers include those with variable speed motors and paddle type mixing blades as well as the shaker or rotating type mixers. The use of such mixers should guarantee a consistent product mix for each mixed pack.

Mixing times will depend on the type of mixer or stirrer used but typical mix times of 10 - 15 minutes with stirrer speeds between 40 - 100 rpm can be expected. Avoid excessively fast speeds as this will entrap large volumes of air into the mixed resist.

It is recommended that attention be paid to ensuring that any resist at the sides of the container and on the bottom is completely mixed into the main body of the resist. After the mixing operation is completed it is recommended to allow the mixed and thinned pack to debubble for ~ 30 min. before use.

Mixed pot life at 23º± 2ºC (70 - 77ºF) will be approximately 3 days. Always ensure the lid is replaced on the container to avoid any contamination and excessive solvent evaporation.

3) THINNING

The product is supplied ready-to-use, and therefore further thinning is not generally required. However, should further thinning be deemed necessary, for example for horizontal screen printing, then a maximum of 2% Imagecure Slow Thinner XZ107 should be used.

4) PRE-CLEAN

Ensure that all copper surfaces are completely clean, tarnish free and dry prior to applying Imagecure. For panels that are badly oxidised and tarnished then a micro-etch prior to mechanical pre-cleaning is recommended. The micro-etch should be capable of removing any oxide or tarnish staining and of thoroughly rinsing and drying the panel before being mechanically cleaned.

Mechanical pre-cleaning is recommended as follows: -

Brushing 280 - 400 grit silicon carbide brushes are recommended having a footprint on the copper of 8 - 15mm. (0.3 - 0.6 in). The water rinse and heater sections should be capable of thoroughly rinsing and drying the panels such that no water is left in the holes or between closely spaced conductors and that moisture or tarnish is not present on the freshly brushed panels.

It is important that each brush is regularly checked and dressed as necessary to ensure optimum efficiency during use.

Please note that Nylon brushes of 600 - 800 grit can also be used.

Pumice Pumice or Aluminium oxide slurry of between 12 - 18% is recommended with an optimum of 15%. The water rinse and heater sections must be capable of rinsing and drying the panels such that residual pumice particles are completely removed and that no water is left in the holes or between closely spaced conductors and that moisture or tarnish is not present on the freshly cleaned panels.

Microetch Where panels have close track/gap configurations, which may not be suitable for mechanical precleaning, the use of a “deep etching“ micro etch chemistry is recommended. It is recommended that each user ensures that the Imagecure product is compatible with the particular micro-etch used and all subsequent metal finishing processes.

Surface roughness figures of :-

Ra 0.2 - 0.4µm.
R delta q 4 - 9º

would be considered to be optimum values for copper surfaces pre-cleaned as above. A minimum Ra of 0.2µm. with an R delta q value of >4º is recommended (optimum R delta q values 7 - 9º).

Please refer to separate technical document on surface roughness for a fuller explanation of the above roughness values.

NOTE. It is recommended that all freshly cleaned panels are coated with Imagecure XV501T within a maximum time of 2 - 4 hours. The actual maximum time will vary depending upon ambient temperature and humidity. Panels left longer than 4 hours before coating should be pre-cleaned again.

5) APPLICATION

The Imagecure XV501T series can be used with all types of vertical screen print units and horizontal screen print machines.

Typical polyester meshes will be 32 – 43T/cm (80TPI – 110TPI), with a 65 – 70^0 shore squeegee with a square edge profile. The optimum mesh for printing is 43T/cm (110TPI) and this will be suitable for most 18µm and 35µm base copper board designs.

For boards with 70µm base copper, or for boards requiring a specific withstand voltage, the use of meshes with lower mesh counts 32 – 36T/cm (80 – 90TPI) may be necessary.

Print tests with subsequent microsections are recommended to ensure adequate track encapsulation.

All screens must be cleaned and thoroughly dried before use, and free from residues of screen cleaner and solder mask residues.

6) WASHING-UP

Screen Cleaner XZ46 is recommended for washing up.

Alternative cleaners and screen washes are available to suit customers' particular requirements. Your local Sun Chemical Circuits representative will be pleased to advise on product selection.

7) PRE-DRY

Good drying of the printed film is important so ovens with good temperature profiles and extraction are necessary. Specific drying parameters (time and temperature) will be dependent upon the specific oven used as well as the thermal mass and quantity of the panels being dried.

It is recommended that printed panels be allowed to debubble for approximately 5 – 10 minutes in still air at ambient temperature prior to being placed in the oven.

Air flow speeds of 1 – 2 m/sec. are recommended to achieve sufficient removal of the solvent. Drying is less efficient as the air velocity drops below 0.5 m/sec.

For vertical screen print systems with a vertical drying oven, a set air temperature of 75 – 80^{0}C (167 – 176^{0}F) for 30 – 50 minutes is recommended. Optimum 80^{0}C (176^{0}F) for 45 minutes. Drying will depend on board thickness and Imagecure thickness as printed, as well as air flow in the oven.

For printing processes that only print one side at a time the following is recommended for box ovens:

Side 1 15 minutes at 80^{0}C (176^{0}F)
Side 2 35 minutes at 80^{0}C (176^{0}F)

The maximum drying time (side 1 + side 2) should not exceed 55 minutes at 80^{0}C 9176^{0}F).

Allow an adequate gap between panels. Spacing of 25 - 40 mm (1 1.6 in.) is recommended to ensure sufficient air flow between panels.

After drying it is recommended that all panels be exposed and developed within 24 hours. The maximum storage time of boards before exposure/development is 72 hours. However it is recommended that boards be stored in yellow light conditions with controlled temperature and humidity. If the humidity increases above 60% RH then the storage time of the dried panels will be reduced.

8) EXPOSURE

All Imagecure XV501T systems are negative working and can be used with all exposure units using ferric doped mercury vapour lamps with UV wavelengths between 300 - 400nm.

Ferric doped lamps with power ratings of 5 - 10kW are recommended. It is recommended that to remove the infra red radiation the unit is either cooled or has an infra red filter to keep the temperature of the artwork < 30ºC (86°F). Optimum working temperature 22 - 25ºC (72 - 77°F).

Exposure readings of 200 - 500 mJ/cm² are typical (exposure readings taken with an IL390B radiometer from the International Light Co. Inc.).

Stouffer values of 8 - 11 (solid resist) using a 21 step wedge are typical. For selective Ni/ Au and or immersion Sn exposure levels of 10/11 (solid resist) are recommended. Where panels are to be developed using solvent, a minimum Stouffer value of 10 should be considered.

The artwork should have a Dmax > 4.0 and a Dmin < 0.15.

9) THERMAL BUMP

If panels are to be developed in solvent, a thermal bump immediately after exposure may be necessary.
Recommended conditions are 100°C (212°F) for 100 seconds.
Discussion with your Imagecure® partner is recommended in order to obtain optimum results.

10) DEVELOPMENT

Aqueous Developing

Imagecure XV501T will readily develop in either potassium or sodium carbonate solutions. The recommended carbonate concentration is 10 ± 2g./lit. The working pH range is 11.3 to 10.8 for aqueous carbonate solutions. To ensure the quality of development it is recommended that the pH of the developer solution does not drop below 10.8. At a pH <10.6 the efficiency of the developer solution may drop due to the increased loading of photopolymer.

Recommended temperature range is 30 - 40ºC (86 - 104°F), optimum 35 - 38ºC (95 - 100°F).

Spray pressures between 2 - 4 bar (30 - 60 PSI), optimum 2.5 bar (37.5 PSI).

Dwell times in the developing chambers of 45 - 80 seconds, optimum 60 seconds. For boards with small via holes (0.2 - 0.4mm) or with laminate thickness > 3mm, longer dwell times may be necessary to ensure complete development of the holes.

Water rinse pressures to be 2 -3 bar (30 - 45 PSI), with operating temperatures 15 - 30ºC (59 - 86°F).

It is recommended that hard water (~200 ppm dissolved ions) be used where possible to give good rinsing, followed by a final rinse in deionised water.

Anti-foams will need to be added to the aqueous developing chambers to avoid foaming. The amount of anti-foam to be added may vary depending upon the type of anti-foam used, the size and number of developing chambers and spray bars, spray pressures and the loading of developed resist. In all cases it is recommended that the minimum amount of anti-foam be added.

Solvent Developing

Imagecure XV501T will also develop in solvent (BDG, EDG or BLO). The developer temperature should be 30 ±2ºC (82 - 90°F), with a dwell time between 120 and 160 seconds. Spray pressures of 4 - 5 bar (60 - 75 PSI) are normal. Optimum conditions will include a dwell of 150 seconds @ 30°C (86°F) with spray pressures of 4 - 5 bar.

It should be noted that Imagecure® films needing to be removed can be stripped by dipping in either a proprietary solder mask stripper or 5% sodium hydroxide solution at 50 - 70°C (122 - 158°F).

11) UV BUMP

Generally Imagecure does not require a UV bump. However there may be certain customer processes or requirements that render the use of a UV bump desirable or necessary.

If a UV bump is required then it is recommended that it be carried prior to post bake, and that a multi lamp double sided UV cure unit be used. Recommended UV energy is 1000 - 1500mJ/cm².

A UV bump can also be carried out after post bake, recommended energy of 2500 - 3000mJ/cm².

A UV bump will improve surface hardness, reduce volatile emissions, reduce ionic contamination and give increased resistance to OEM assembly cleaning processes.

12) POST BAKE

It is important to ensure that all ovens have an independent thermal profile taken, as the set air temperature is not always reliable and the air flow in the oven or the door seals may give rise to either hot or cold spots.

The recommended bake cycle is 140 - 150ºC (284 - 302°F) for 60 - 90 min. Optimum is 150ºC for 60 min. Bake times should be taken when oven temperature reaches the pre-set point. Where a ramped post-bake is necessary, the recommended cycle is 80^{0}C/60 minutes + 120^{0}C/30 minutes + 150^{0}C/60 minutes.

Sufficient air flow is necessary to ensure a consistent temperature gradient in the oven as well as a uniform degree of cure for the solder resist.

With respect to batch ovens boards should be racked 25 - 40mm. (1.0 - 1.6 in.) apart.

All exhaust ducting and extraction fans should be adequately insulated to avoid any volatile emissions condensing around the oven area.

13) NOTATION / LEGEND PRINTING

All Imagecure XV501T products are compatible with a wide range of Sun Chemical UV curing, thermal curing and photoimageable notation inks.

Thermal curing inks can be applied prior to post bake to increase productivity.

14) ELECTROLESS NICKEL / GOLD OR IMMERSION TIN PROCESSING

There are a number of competing chemistries available, each with a differing aggressiveness towards the solder resist. The following guidelines are given to help Imagecure users avoid some of the problems associated with solder resists and these alternative solderable finishes :-

Pre-clean: Either silicon carbide brushing, pumice scrubbing or the use of a deep etch copper microetchant. The copper must be clean, tarnish free and with a good micro topography.

Application: Ensure that the tracks have sufficient solder mask. A minimum of 8 - 10µm. (0.32 - 0.4mil.) is recommended.

Pre-dry: Insufficient pre-dry can lead to a lowering of the cured film's resistance to either Ni/Au or immersion tin as well as increasing the degree of undercut on development. The pre-dry should be carried out at 75 - 80°C (167 - 176°F). It is recommended that oven thermal profiling be carried out to achieve optimum results.

Exposure: To achieve straight side walls with minimal undercut on development a Stouffer reading of 10 - 11 (solid resist) is recommended.

Thermal Bump May be necessary for panels developed in solvent, but should not be required for aqueous development. 100°C (212°F) for 100 seconds is recommended.

Development: Extended dwell times, high developing temperatures and high spray pressures should be avoided otherwise excessive undercut will take place. To achieve optimum results the developed edges should be straight with minimal undercut.

UV Bump: Can be used before post bake to eliminate film discoloration after metallisation. 1000 - 1500 mJ/cm² is recommended.

Post bake: Avoid excessive temperatures during post bake as these can lead to oxidation of the copper surfaces. Recommended process temperature 140 - 150ºC (284 - 302°F) with a maximum dwell of 60 minutes. Bake times should be taken when board temperature reaches the pre-set point.

Micro-etch: Only 1.0µm. etching should be necessary to remove the oxide layer when processing through metallisation. Excessive micro-etching (> 2.0µm) can lead to under plating and edge lifting of the solder resist film. Ensure that the micro-etch process is controlled and consistent across the panel.

Tape test: Panels should be tape tested a minimum of one hour after metallization.

15) STORAGE AND SHIPPING

When stored in sealed containers, in a cool place (20ºC / 68ºF), away from sources of direct heat and sunlight, Imagecure XV501T resist and hardener have a shelf life of 12 months.

Imagecure XV501T can withstand higher temperatures (40 - 60ºC / 104 - 140ºF), whilst in transit for up to periods of 1 month without any detrimental effect on its performance.

16) HEALTH AND SAFETY

Detailed material safety data sheets will be supplied by your local Sun Chemical Circuits representative.

The products detailed hereon have been tested in accordance with, and meet the requirements of, the RoHS Directive 2002/96/EC and the European Directive 2003/11/EC, regarding the presence of the metals - Pb (Lead / Lead compounds), Hexavalent Chromium, Cd (Cadmium), Hg (Mercury), and Poly Brominated Flame Retardants.

Conforms to Regulation (EC) No. 1907/2006 (REACH), Annex II – Europe.

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- Sony Green Book Number **I8880002**

As the world's foremost producer of inks, pigments and colour technology, Sun Chemical is leading our industry in developing and producing products which minimise our impact – and our customers' impact – on the environment and striving to maximise the use of renewable resources. We consider it our responsibility to be involved in the communities in which we live and work and to offer direction in meeting today's needs without compromising the ability of future generations to meet theirs.

17) PACKAGING

Imagecure	XV501T	Green (HF) Screen Resist	2.00 kg.	CAWS2406
Imagecure	XV501T	Clear Screen Hardener	1.00 kg.	CAWS1286
Imagecure	XZ107	Slow Thinner	5.00 L.	CDSN4059

18) FILM PERFORMANCE / TECHNICAL SPECIFICATION

PHYSICAL PROPERTIES OF Imagecure XV501T SCREEN

Pack Code	Viscosity (PaS)*	S.G.	Flash point	Non volatile content
CAWS2406	12 - 22	1.28	>70°C (158°F)	67.9%
CAWS1286	11 - 17	1.20	>70°C (158°F)	79.8%

*Viscosity measured at 25°C (77°F). Please note viscosity can vary greatly depending on ink temperature, volume of ink tested, type of viscometer used and the test method.

Volatile Organic Content (VOC) 400 - 430g/L

PHYSICAL & CHEMICAL PROPERTIES OF Imagecure XV501T CURED FILM

Property	Test	Result
Solder Resistance	MILP55110 IPC SM840D	30 secs @ 288°C (550°F) 10 secs @ 260°C (500°F)
Resistance to Solder Leveling		> 5 passes
Electroless Ni/Au Plating		Pass
Resistance to Fluxes	IPC SM840D	Pass
Hydrolytic Stability	IPC SM840D Class H	Pass
Solvent, Cleaning Agent, & Flux Resistance	IPC SM840D Class H	Pass
Fungal Resistance	IPC SM840D Class H	Pass
Thermal Shock	IPC SM840D Class H MIL 551100 MIL STD202E BS6096 Tests	Pass Pass Pass Pass
Chemical Resistance	IPA 1,1,1 Trichloroethane MEK Methylene Chloride Alkaline Detergent Fluxes	>1 hour >1 hour >1 hour >1 hour >1 hour >1 hour
Abrasion Pencil Hardness	IPC SM840D Class H	Pass
Adhesion (Copper) **(Tin Lead)**	IPC SM840D Class H IPC SM840D Class H	Pass Pass
Flammability	UL 94V0 Rating	File No. E83564
Ionic Contamination	MILP55110D	<0.3µg. NaCl/cm² Using Alpha Ionograph 500M

18) FILM PERFORMANCE / TECHNICAL SPECIFICATION (cont.)

ELECTRICAL PROPERTIES OF Imagecure XV501T CURED FILM

Property	Test / Condition	Result
Bellcore	TR-NWT000078	Pass
Insulation Resistance	IPC SM840D Classes T and H	Pass
Moisture & Insulation Resistance	IPC SM840D Classes T and H	Pass
Electromigration	IPC SM840D Classes T and H	Pass
Comparative Tracking Index	IEC 112	>325
Siemens E-Corrosion Test	SN 57030	Pass
Dielectric Strength (50 Hz.) 20-S-Value	IPC SM840D Class H DIN53481	150kV/mm.
Surface Resistance	IEC167	
	Initial Value	1.6×10^{12} Ω
	24 Hours H_2O @ 23°C	4.1×10^{14} Ω
	96 Hours @ 35°C/90% R.H.	1.3×10^{11} Ω
Volume Resistivity	IEC93	
	Initial Value	>5.4×10^{17} Ω
	24 Hours H_2O @ 23°C	1.3×10^{15} Ω
	96 Hours @ 35°C/90% R.H.	2.4×10^{14} Ω
Dielectric Constant Er @ 1 MHz.	Initial Value	4.55 +/- 0.35
	24 Hours H_2O @ 23°C	5.45 +/- 0.45
	96 Hours @ 35°C/90% R.H.	4.75 +/- 0.70
Dielectric Loss Factor tang. @ 102 Hz. - 106Hz.		0.01

19) DISCLAIMER

This information has been carefully compiled from experience gained in field conditions and extensive laboratory testing. However the products' performance and its' suitability for the customers' purpose depend on the particular conditions of use and the material being printed. We recommend that customers satisfy themselves that each product meets their requirements in all respects before commencing a production run. Since we cannot anticipate or control the conditions under which our products are used, it is impossible to guarantee their performance. All sales are also subject to our standard terms and conditions.

20) SUPPORT

Sun Chemical Circuits are an international company, and as such can offer technical, engineering and sales support to our customers worldwide. If you require more information regarding this product, or any of our extensive range of materials for PCB fabrication, please contact our local sales offices.