HiTech Photopolymere AG

DiaEtch 122

Aqueous processable, liquid, etch resist for Photo Chemical Machining

Processing Guidelines

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General Product Description

DiaEtch 122 is a photosensitive negative working, liquid etch resist specifically designed for roller-coating application. In thin layers it is sensitive to UV light, particularly to radiation of wavelengths from 300 to 450 nm. Depending on applied developing conditions the resist is capable to resolve patterns down to 25 µm (1 mil). The resist coatings can be processed in well established aqueous develop-etch-strip (DES) equipments.

The physically dried material exhibits excellent adhesion to various steel and nickel alloys, as well as copper alloys. It will withstand long etching cycles in common acidic media, such as ferric- or cupric chloride.

DiaEtch 122 is a cost effective alternative to dry film, performing in the same DES equipment using standard wet chemical processes.

Material Properties (typical values)

Property	Unit	Value	Method
Color (unexposed)		Blue	Visual
Color after exposure		Faded blue	Visual
Viscosity 23°C	[s]	160	DIN Cup No 4
Density liquid	[g/cm³]	1.03 (25°C)	Gravimetric
Density dry	[g/cm³]	1.25 (25°C)	Gravimetric
Solid content	[%]	40	Gravimetric
pH value	$-\log[H_3O^+]$	~ 3	1:1 mix in water
Photosensitivity [1]	Δ_{OD}= 0.15	4 – 5 (solid)	150—250 mJ/cm²
Surface		Suited for hard-contact exposure	
Solvent		1-Methoxi-2-propanol acetate (CAS# 108-65-6)	

[1] Heavily depending on applied developing conditions. Quoted step is received with general conditions outlined in this brochure (1% sodium carbonate, 35°C, 45 sec dwell time).

Processing Parameters

The following processing conditions were established in a production environment and therefore may be optimized to match particular needs.

Pre-cleaning

Depending on the material to be etched and the final finish of the goods to be produced various methods may be applied.

The holdtime before coating should be kept as short as possible in order to avoid the surface to become oxidized and contaminated with dust, which may result in coating reduced adhesion.

Coating

The resist is supplied at ready-to-use viscosity (~160 sec DIN Cup 4). The relatively low volatility of the solvent (PMA [2]) enables the use of the resist even without viscosity control for a limited period of time. At this viscosity the resist exhibits a solid content of 40%, which results in dry coatings of about 8 to 10 µm using a 46 TPI applying roll (46 grooves per inch). Such coatings provide sufficient mechanical resistance and allow to take full advantage of the resolution capabilities.

Coating defects due to contamination can be avoided by introducing a 5 to 10 µm filter unit into the resist circulation. This will ensure, that only particle-free resist will be coated onto the clean copper surface.

If solvent has been added for viscosity adjustments, the resist should circulate for at least 30 min before coating of substrates is taken up again. The time mentioned obviously depends on retention time of the liquid in the reservoir. The implementation of a continuous, automated viscosity control unit is recommended.

Drying

After coating, just before being carried into the drying oven, the wet coatings will level out possible defects caused by the applying roller within 10 to 30 seconds. During this time a significant amount of solvent is released from the resist suface, resulting in a coating insensitive to air flows stemming from the coating cabinet or from the oven.

Assuming a through-put of six full size sheets (24x18”), a minimal fresh air supply of 600 m³/hr should be maintained. Depeding on the heat capacity of the sheet, the setting for the heat profile should be chosen to reach a surface temperature of 90 - 110°C. Under optimal conditions a 5 mil steel sheet will dry in a muffle oven [3] within 60 s.

To prevent condensation of water during cooling and provide consistent drying, air of a relative humidity of 45 to 55% should be supplied to the cooling unit.

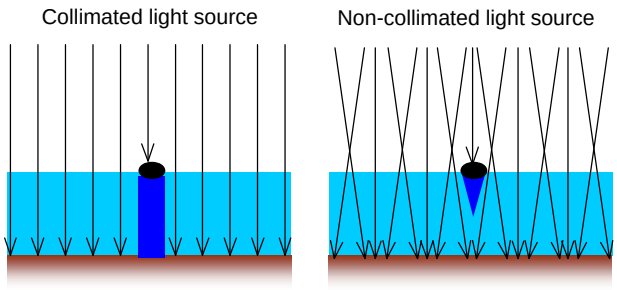
[2] PMA = **P**ropylene glycol **m**ethyl ether **a**cetate (Arcosolve PMA, Dowanol PMA)

[3] Probimage®RC- and Systronic®RC HTDC-systems

The board can immediately be processed after drying/cooling. No specific holdtime is required. If there is a need to store coated boards, they should be kept in yellow light under cleanroom conditions. **DiaEtch 122** is tack-free after drying, allowing hard contact printing. However, as with other liquid photoresists, the coating will tend to fuse when stacked under pressure over time. Therefore an **in-line fabrication process** is recommended to achieve highest yields. If in-line production is not possible, introduction of plastic slip sheets is strongly recommended.

Exposure

Using a non-collimated light source, the resolution capability under hard contact exposure conditions exceeds 25 µm after developing. It could be shown, that yield dramatically suffers, when exposure is done with a collimated printer. The resist layer below a particle is not exposed and subsequently will develop, resulting in a pin hole. Whereas non-collimated light also will cure the resist layer below a small particle (see schematic on the right).



DiaEtch 122 requires an exposure energy of about 150 to 250 mJ/cm². This will result in a step wedge reading of approximately 5 to 7 solid [4].

There is no particular exposure unit to be recommended. However, high power printers not only will reduce required exposure times, but also provide more constant temperature within the frame. Temperatures above 30°C should be avoided. At this point the uncured resist will tend to become tacky and stick to the artwork.

Both silver halide and diazo film can be used as long as the optical density in the range of 300 to 400 nm does prevent the resist from being cured.

Developing

Unexposed areas of resist readily dissolve in aqueous sodium carbonate at elevated temperature. Most commonly used parameters for standard developing equipment are:

aq. Na_2CO_3 concentration	0.8 – 1.2 %
Temperature	20 – 30°C
Spray pressure	1 – 2 bar
Dwell time	30 – 60 s

Applying above settings will result in a breakpoint of about 20 to 50% of the developing chamber length.

Though the resist pattern exhibits good mechanical stability, it remains susceptible to damages caused by manual handling. Therefore care should be taken, when moving boards from one place to another.

Etching

The resist has performed well in commonly used etching chemistries such as acidic ferric- and cupric chloride. This includes “high”-temperature etching (up to 65°C). The resist has successfully been used for etching 1 mm stainless steel (402).

Generally, proper etching conditions must be optimized for specific metal quality, thickness’ and pattern geometry.

[4] As mentioned beforehand, the step wedge reading heavily depends on applied developing conditions (see also next paragraph)

Stripping

A typical stripping medium consists of 3 to 5% aqueous potassium hydroxide. When exposed to such a solution at elevated temperature (>50°C) the resist will readily peel off in flakes. The flake size depends on temperature, KOH concentration and mechanical impingement of the solution onto the resist layer aswell as additives added to the stripping solution (amines, organic solvents etc.).

For aluminium qualified proprietary stripping chemistry can be used or Gamma-butyro lactone at elevated temperatures.

Handling and storage conditions

In order to avoid evaporation of solvent and premature curing by UV light, keep containers closed and shelter from direct exposure to day light. Wear gloves and eye protection when pouring resist. Observe respective information outlined in the Material Safety Data Sheet (MSDS) provided with each resist delivery.

When stored at ambient temperature (between 8 and 25°C) in the original sealed containers the resist is expected to perform as described above for at least one year after manufacturing date. Once opened the containers should be used on a first-in – first-out basis.

Technical Customer Service

For further information and advice please contact:

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