TECHNICAL DATA

DuPont

Printed Circuit Materials

Riston® SD200 Series
Data Sheet and Processing Information

Riston® Photopolymer Films

Super Fineline Resist for Copper, Tin & Tin/lead Application

Relative Humidity: 30 - 70%

PRODUCT FEATURES/ APPLICATIONS

- Negative working, aqueous processable dry film photoresist
- Designated for super fineline pattern plating application.
- Featured in wide plating latitude that can be processed at different plating condition without underplating.
- Stripping flake size is 3 mm which can be easily separated when overplated.
- Vivid print out image after exposure for east inspection.
- Available in 30 and 38 micron thickness depend on plating thickness.

STORAGE

Temperature: 5-21°C (40-70°F)

PRODUCT DESCRIPTION (Physical Parameters)

Available Thickness:	**30** µm **38** µm
Unexposed Color in Yellow Light:	Green
Exposed Color in Daylight:	Blue
Exposed Color in Yellow light:	Green
Print-Out (Phototropic) Image:	Strong
Contrast to Copper:	Strong
Odor:	Low

SAFE HANDLING

Note safety and industrial hygiene precautions**.** Consult the Material Safety Data Sheet (MSDS) of any chemical used. MSDS's for Riston® dry film photoresists are available.

This Data Sheet documents specific process information for Riston® SD200. For more background on general Riston® processing see the General Processing Guide.

COPPER SURFACES AND SURFACE PREPARATION

To remove antitarnish, conversion coatings and /or oxidation, it is recommended to precede pumice, aluminum oxide, acid cleaner, sulfuric acid or microetch.

Brush Pumice:
3F or 4F grade, fused, 10-20 % v/v, 8-12 mm (3/8-1/2") brush foot print, fines removal and replenishment per vendor recommendations; high pressure (10 bar) final rinse (pH 6-8); hot air dry.

Jet Pumice:
3F or 4F grade, unfused, 15-20 % v/v, fines removal and replenishment per vendor recommendations; high pressure 10 bar (147 PSI) final rinse (pH 6-8); hot air dry.

Jet or Brush Aluminum Oxide (Al_2O_3):
Follow vendor recommendations. (Generally 20-25%)

Compressed Pad Brushing:
400-1200 grit depend on application; 8-12 mm brush foot print; high pressure (8-10 bar) final rinse (pH 6-8).

Control Tests:
- Water Break Test: ≥30 seconds
- R_a: 0.1-0.3 µm R_z: 2-3 µm

Chemically Cleaned Copper

Alkaline Spray Cleaner (e.g. VersaCLEAN® 415) for removal of organic contaminants followed by a spray microetchant (e.g. SureETCH® 550) for conversion coating (chromate) and/or copper oxide removal (about 2-2.5 µm; 80-100 microinch etch). A 10% sulfuric acid spray may be used between alkaline cleaner and microetchant to help with the conversion coating removal. In this case only 1.5 µm (60 microinch) microetch depth is required. To remove residual salts after microetching from the copper surface, an acid rinse or efficient water spray rinsing have been employed successfully. In-line systems for prelamination cleaning may not require an antitarnish treatment after chemical preclean to preserve the cleaned surface. Non-in-line systems with hold times of several hours will require antitarnish. For antitarnish selection: see “Electroless Copper with Antitarnish”.

Electrochemically Cleaned Copper

Conveyorized systems combining reverse current electrochemical cleaning and microetching are offered to effectively remove chromate conversion coatings with minimal copper removal. The alkaline electrochemical cleaner first removes trace organics and chromates. After a rinse, a microetch removes about 0.8µm (30 microinches) of copper. Following a second rinse antitarnish may be applied.

Double-Treated Copper Surfaces

Normally no prelamination cleaning required; vapor degreasing or chemical cleaning to remove organics is optional. Tacky roller cleaning recommended to remove particles.

LAMINATION

Laminator Conditions for automated cut sheet laminator

- Preheat: 40-70 °C
- Seal Bar Temp.: 50 ± 20°C
- Lam. Roll Pressure: 3.0-5.0 bar (43-72 psig)
- Lamination Temp.: 110 ±15°C
- Seal Time: 1-4 seconds
- Seal Bar Pressure: 3.5-4.5 bar
- Lamination Speed: 1.0-3 m/min
- Board exit temperature: > 50 °C

Post-Lamination Hold Time

- Panels may be exposed immediately after lamination; however, allow enough time for panels to cool to room temperature before lamination (about 15 minutes; use accumulator in in-line systems).

- Minimize hold time for best tenting performance.

- Maximum hold time as a guideline is up to 5 days. From lamination to development within 3 days; from plating to strip within 2 days.

Panel Handling/Racking/ Stacking

Preferred: Vertical racking in slotted racks
Less desirable: Stacking

To minimize adverse effects: stack on edge vertically after cooling; avoid dust and dirt trapping between panels; insert unlaminated panel between stack support and first laminated panel to protect laminated panel. Unlaminated support panel should be at least as big as the laminated panels. Thin flexible innerlayers usually cannot be racked. Preferred techniques: hanging panels vertically or stacking on edge after cool down. If innerlayers are stacked horizontally in trays, the stack height should be limited especially for panels with thin photoresist and fine circuitry.

Note: Reduced lamination roll pressure and/or temperature may be required in tenting application.

EXPOSURE

Resolution (Lines & Spaces)

- In Optimized Production Environment(hard contact, high intensity exposure, good development and rinse control): 30 micron (1.0 mil) L/S for 38 um resist.

- In Lab Environment: 25 micron (0.8 mil L/S)

Exposure Intensity

Exposure Energy vs "Steps Held"For Recommended Exposure Range

Riston® SD200	**230 / 238 Optimum**	
mJ/cm^2	**40-100**	**45-110**
mJ/cm^2 to achieve optimum RST	**60**	**70**
RST	**8-16**	**8-16**
SST	**6-9**	**6-9**

- Steps held can vary by +/-1 RST depending on the development breakpoint used.

Vacuum Frame Operation

- Contact Mode:
  Preferred: Hard Contact
- Check for small, immovable Newton's Rings as an indicator of
  good contact between the panel, phototool, and vacuum frame cover
- Use air bleeder veins to channel air to vacuum port and reduce vacuum drawdown time.
- Bleeder Vein Thickness: same as panel

DEVELOPMENT

Chemistries/Make-up

- **Sodium carbonate, anhydrous, (soda ash), Na_2CO_3**
  Working solution: 0.85-1.0 wt%. (Prefer 0.85 wt%) Use 8.5-10.0 g/l (0.071 lb./gal)

- **Sodium carbonate, monohydrate; $Na_2CO_3 \bullet H_2O$**
  Working solution: 1.0-1.1 wt%. (Prefer 1.0 wt%) Use 10-11 g/l

- **Potassium carbonate (potash; K_2CO_3)**
  Working solution: 1.0-1.1 wt%. (Prefer 1.0 wt%) Use 10-11 g/l

Equations to calculate required amounts for desired wt% of working solutions:

- Na_2CO_3:
  kg Na_2CO_3 = wt% x sumpx vol liters x 0.01
  lb. Na_2CO_3 = wt% x sump x vol gallons x 0.083
- K_2CO_3:
  kg K_2CO_3 = wt% x sump vol liters x 0.01
  lb. K_2CO_3 = wt % x sump vol gallons x 0.083

Control Test:
Titration of fresh developer solution (e.g. 25ml), before defoamer addition, with 0.1 N HCl to the Methyl Orange end point.

wt% = N x ml HCl x FFX80 x ml Sample
(N= acid normality; FW = formula weight)

FW of Na_2CO_3	**= 106**
FW of $Na_2CO_3 \bullet H_2O$	**= 124**
FW of K2CO3	**= 138**

Defoamers

Riston® SD200 may require antifoam dependent on water quality, carbonate purity, photoresist loading, and equipment design. If required, add 0.80 ml/liter (3 ml/gallon) of FoamFREE™ 940, or equivalent polyethylene-polypropylene glycol block co-polymer.

- For batch operation: add defoamer during initial make up;
- For automatic replenishment systems: add defoamer directly to the sump in a high turbulence area at a predetermined rate.

Do not add defoamer to the supply tank or to the replenishment solution.

Development conditions

- Spray Pressure: 1.0-2.0 bar (14-30 psig)
- Spray Nozzles: combination of cone and fan nozzles may be preferred if film tent breakage is experienced.
- Chemistry:

Na_2CO_3:	0.85 - 1.0 wt%; 0.85 wt% preferred
$Na_2CO_3 \bullet H_2O$:	1.0 - 1.1 wt%; 1.0 wt% preferred
K_2CO_3:	1.0 - 1.1 wt%; 1.0 wt% preferred

- Temperature: 27-30°C, 28°C preferred

Dwell Time
- Breakpoint: 40-60 %
- Time in Developer (Dwell Time), cone nozzle at 1.4 bar (20 psig) spray pressure, 50% breakpoint. 30°C, fresh developer solution at recommended carbonate concentrations

Riston® SD230 : 32 seconds
Riston® SD238 : 36 seconds

NOTE: Total time in developer = Time to clean divided by Breakpoint
- Time to Clean (time in developer to wash off unexposed resist): 16 seconds for Riston® SD 230 depending on conditions.

- Shorter times to clean are achieved at higher temperatures, higher carbonate concentrations, and higher pressures.

- If developer conveyor speed is too fast for match with other in-line equipment: lower soda ash concentration down as far as 0.5wt%. Consider lowering temperature. Do not lower spray pressure below recommended levels.

Resist Loading

Resist loading : 0-0.3 mil-m^2/l(0-12 mil-ft^2/gal)

Feed and bleed: 0.23 mil- m^2/l(9.2 mil- ft^2/gal)

Note: this range gives a fairly constant time to clean; lower loadings result in shorter time to clean; higher loadings increase the time to clean.

Rinsing & Drying Recommendations

- Rinse water: hard water (150-250 ppm $CaCO_3$ equivalent). Softer water can be hardened by the addition of calcium chloride or magnesium sulfate. If hard water is not available, a first soft water rinse may be followed by a dilute acid rinse, followed by a water rinse.
- Rinse temperature: 15-25°C (60-80°F)
- Rinse spray pressure: 1.4-2.4 bar (20-35 psig). Use high impact, direct-fan nozzles.
- Effective Rinse Length: 2/3- 1/1 of length of developer chamber; >1/1 preferred.
- Drying: blow dry thoroughly; Hot air is preferred

Controls:

- For batch processing: adjust conveyor speed to maintain desired breakpoint; dump developer solution when development time has become 50% longer than for fresh solution.
- Developer conveyor speed: see "**Dwell Time**".
- Feed & Bleed: to keep loading at about 0.2 mil-m^2 l (8 mil-ft^2/gal), activate addition of fresh developer at pH 10.5; stop addition when pH 10.7 is reached.

Hold Time after Development before etching 0-3 days

Note: minimize white light exposure during post development hold to prevent film embrittlement.

Developer Maintenance

Clean at least once a week to remove resist residue, calcium carbonate (scale), defoamer, and dye from developed resist. Dye build-up can be minimized by the use of anti-foam.

STRIPPING

Aqueous Caustic (NaOH or KOH) Conveyorized Stripping

- Stripper Dwell Times (seconds) at 55°C (130°F), 1.7 kg/cm^2 (25psig), stripping breakpoint at 50%, over recommended exposure range:

	SD 230	SD 238
3.0 wt% NaOH	72 sec	114 sec
Flake size	3-4 mm	3-4 mm
Flake characteristics	Low soluble	Low soluble

Note:

- Dwell Time = 2x Time to strip resist
- High caustic concentrations produce larger skin sizes and higher loading capabilities.
- KOH generally produces smaller skin sizes than NaOH.
- Higher stripping temperature increases the stripping rate.
- Stripping rate can be increased with higher impact sprays. Use higher pressures and/or high-impact spray nozzles. Avoid low impact deflector nozzles.
- Time to strip increases with white light exposure. A 20% increase in strip time over 8 day's exposure is not unusual.
- Higher levels of exposure increase Time-to-Strip: Slightly

Defoamers

Additives for foam control may not be required depending on equipment design and operation. However, if defoamer is needed, use DuPont FoamFREE™ 940 at 0.8 ml/ liter (3 ml/gallon) for resist loading up to 0.6 mil-m^2/liter (25 mil-ft^2/gal).

Controls/ Solution Maintenance:

- Preferred: Continuous replenishment (feed & bleed) using board count.
  Maintain resist loading at ≤ 0.4 mil-m^2/liter (≤ 15 mil-square feet/ gallon).
- Batch: up to 0.5 mil-m^2/liter (20 mil-square feet/ gallon). Maintain breakpoint at ≤50% by lowering conveyor speed or by starting batch stripping with a lower breakpoint and changing the solution once breakpoint moves above 50%. However, low breakpoints can lead to attack of solder on plated work, or cause copper oxidation.

- Filtration Systems

Spray stripping equipment should contain a filtration system to collect and remove resist skins to avoid nozzle clogging, to extend stripper life, and to avoid resist skins from reaching the rinse chamber. The most effective filter systems collect the stripper skins immediately after they were generated, before entering recirculation pumps, and they feature continuous removal of skins from the stripper solution.

Equipment Cleaning

- Cleaning of Equipment Drain and flush with water. Fill unit with 5 wt% KOH or NaOH, heat to 55°C (130°F), and circulate (spray) for 30 minutes to dissolve photoresist particles. Then drain the unit. Repeat procedure if required to remove heavy residues. Remaining blue dye stains on equipment may be removed by circulating 5 vol.% HCl at 55°C (130°F) for 30 minutes (HCl can damage stainless steel). Then drain the unit, fill with water, recirculate for 30 minutes, and drain. There are also proprietary cleaners available which may offer better results.

Proprietary Strippers

Are used for higher strip speed, higher resist loading, to minimize chemical attack on tin or tin/lead, or to reduce copper oxidation, e.g. to facilitate AOI.

Reworking Panels for Re-use

Stripped panels may contain organic residues from photoresist or defoamers. After stripping, regenerate a fresh copper surface as follows, before mechanically cleaning the panels:

- Soak for three minutes in a hot soak cleaner at the recommended temperature.
- Rinse thoroughly.
- Etch 0.13 µm (5 microinches) of copper if panels are deeply oxidized.
- Rinse thoroughly.
- Dip in 5-10% sulfuric acid.
- Rinse thoroughly
- Dry

SAFE LIGHTING

- Protect photoresist through lamination and development steps from UV radiation and visible light up to 450 nm by use of yellow, amber or gold fluorescent “safe lights”.
- High intensity (≤ 70 footcandles) yellow “safe light” causes a change in steps held and should be avoided.

WASTE DISPOSAL

For questions concerning disposal of photoresist waste refer to the latest DuPont literature and Federal, State, and Local Regulations.