

## AUTO / Prep DS-2

### Alkaline Permanganate Desmear Process

#### Product Description

AUTO/Prep DS-2 is the second step in the AUTO/Prep Desmear-Etchback Process and is designed to remove resin smear and expose interconnects, while at the same time optimizing the surface topography of the dielectric for eventual electroless copper deposition. AUTO/Prep DS-2 removes the “softened” dielectric (resulting from AUTO/Prep hole swell treatment) and drill debris by selective oxidation, thus enhancing the uniformity and topography of the hole wall. AUTO/Prep DS-2 features process flexibility (applicable for a variety of resin systems), long solution life (when electrolytically or chemically regenerated), and ease of operation.

#### Performance Features

- AUTO/Prep DS-2 is potassium permanganate-based to reduce the cost for desmear applications.
- AUTO/Prep DS-2 can be used to desmear a variety of resin systems including FR-4 and polyimide.
- AUTO/Prep DS-2 is easy to control, yielding consistent etch rates and reproducible results.
- AUTO/Prep DS-2 can be chemically or electrically regenerated, improving bath life and enhancing etch rate control.
- AUTO/Prep DS-2 in conjunction with AUTO/Prep HS Series increases hole wall topography promoting improved electroless copper coverage and adhesion.

#### Physical Specifications

Physical State	Crystalline Solid
Appearance	Metallic Purple
Odor	Odorless
Stability	Stable
pH	6 - 7
Flash Point	Non-Flammable
Storage Requirements	Oxidizer

#### Equipment Requirements

Tanks: Titanium Or 316 Stainless Steel  
Heaters: Titanium, 316 Stainless Steel, Or Teflon  
Racks: Titanium Or 316 Stainless Steel  
Agitation: Solution Agitation And Work Rod Agitation Required.  
Ventilation: Recommended  
Filtration: Required Periodically

# Technical Data Sheet

## Product Make-Up

AUTO/Prep DS-2 is a two part make-up, the second part being mercury cell grade sodium hydroxide, 50%. The working bath should be prepared as follows:

1. Thoroughly rinse the tank and inspect for cleanliness paying special attention to the heaters and heater sheathings.
2. Fill the tank half full with de-ionized water. Slowly add 55 g/L (7.33 oz/gal) AUTO/Prep DS-2 and mix until the material is nearly dissolved.
3. Add 5% by volume of mercury cell sodium hydroxide, 50%, and mix until uniform. Bring the bath to its final volume with de-ionized water and mix until the solid has completely dissolved.
4. Turn on heaters and verify temperature with a thermometer.

## Operating Parameters

A typical etchback-desmear process line employing the AUTO/Prep process is as follows:

Process	Immersion Time (Minutes)	Temperature (°F)	Agitation
HS110-S <sup>1</sup>	5-15	100-140	Solution
Water Rinse	1-2	Ambient	Air
Water Rinse	1-2	Ambient	Air
DS-2 - 55g/L	15-30	150-180	Solution
Water Rinse	1-2	Ambient	Air
Water Rinse	1-2	Ambient	Air
NU-3 50g/L	4-8	70-130	Solution
Water Rinse	3-5	Ambient	Air
GE-4 - 50g/L <sup>2</sup>	2-4	70-90	Solution
Water Rinse	1-2	Ambient	Solution
Sulfuric Acid Dip 10%	2-5	Ambient	Solution

Perform a final rinse prior to electroless processing.

NOTE 1. When using HS-110S at full strength, you should not exceed process times of 15 minutes. General rule of thumb is 5 minutes immersion when operating HS-110S at full strength and 10 minutes when at 50%.

NOTE 2. AUTO/Prep GE-4 can be incorporated directly into the NU-3 bath thus reducing the number of steps in the process line.

Due to the many dielectrics employed and variance in processing, parameters must be optimized for each type of resin and the desired rate of etchback and/or desmear. It is not uncommon for resin etch rates to vary from vendor to vendor and even lot to lot. It is advisable to periodically observe the topography of the sidewall via SEM photography and measure the etch rate in the permanganate of random samples to ensure proper processing.

## Technical Data Sheet

### Control and Replenishment

It is necessary to monitor the concentration of DS-2 periodically to ensure the bath is within accepted strength parameters. It is also recommended the DS-2 rate be monitored periodically to ensure consistent processing.

### Determination of AUTO/Prep DS-2 Concentration

Equipment Required	Reagents Required
Beaker, 50 ml and 250 ml	Barium Hydroxide - 12.9 pH And Saturated
Buchner Funnel, 12.5 cm	Nitric Acid - 20% V/V
Buret, 50 ml	Starch Indicator
Erlenmeyer Flask, 250 ml	Potassium Iodide 10% V/V
Filter Paper, 12.5 cm Whatman 934AH	Sodium Thiosulfate .10N – Standardized
Graduated Cylinder, 100 ml	
Vacuum Filtration Flask, 500 ml	
Pipet, 2 ml	

### Procedure

1. Pipette 2 ml of hot working bath into a 50 ml beaker containing 10 ml of barium hydroxide, saturated. Mix well and allow to stand for 3 – 5 minutes.
2. Connect the vacuum filtration flask to the water or air filtration source and moisten the filter paper with 12.9 pH barium hydroxide. Using a glass stir rod to aid in the transfer of the sample, transfer the contents of the 50 ml beaker into the Buchner funnel. Take care not to let any liquid reach the edge of the filter. Rinse the precipitate in the filter with pH 12.9 barium hydroxide until no purple color remains visible on the filter paper. (The precipitate will turn gray in color after complete rinsing).
3. Label the solution in the filter flask as "A". Carefully transfer the precipitate and the filter paper to the 250 ml beaker and label as "B".
4. To each of the samples A and B, add 20 ml of dilute nitric acid and 20 ml of potassium iodide solution. Take care to ensure the precipitate on the filter paper is completely dissolved before proceeding. (It may help to pulverize the filter in the beaker after adding the dilute nitric acid).
5. Titrate each sample with standardized sodium thiosulfate to a straw yellow color. Add 5 ml of starch indicator to each sample and continue the titration until the color changes from deep purple to a clear endpoint. Record the number of ml required for each sample.

## Technical Data Sheet

### Calculations

$$A \times 1.57 = \text{concentration of DS-2 in g/L}$$

Where A = ml to titrate sample A

$$B \times 2.46 = \text{g/L residue}$$

Where B = ml to titrate sample B

The concentration of DS-2 should be maintained between 45 – 60 g/L.

### Determination Of Weight Loss During Desmear-Etchback

Equipment Required	Reagents Required
None	None

### Procedure

1. Thoroughly clean and dry a laminate coupon of known surface area and measure the weight. Record the weight as A. (The weight should be measured to the nearest 0.0001 g and the surface area to the nearest 0.01 cm).
2. Process the coupon through the hold conditioner and permanganate lines. Ensure you know the exact concentration of DS-2 and the permanganate, and have recorded the process times and temperatures.
3. After the coupon has been processed, thoroughly rinse and dry the sample. Measure the weight after etching and record as B.

### Calculations

$$\frac{(A - B) \times 400}{C \times D} = \text{mls of etchback}$$

Where A = Weight before etching in grams

B = Weight after etching in grams

C = Density of resin in g/cm<sup>3</sup>

D = Surface area of coupon in cm<sup>2</sup>

Record the weight loss of the coupon and visually examine the topography and interconnect exposure of work processed at the time the coupon was processed. Record the observations and vary process parameters as necessary. If processed work is acceptable, the consistency of future work can be maintained by periodically measuring the etch rate.

## Technical Data Sheet

### Determination Of Percent Solids In The DS-2 Working Bath

Equipment Required	Reagents Required
Analytical Balance	None
Evaporating Dish Pyrex. 6" Diameter	
Pipet, 25 ml	

#### Procedure

1. Weigh the evaporating dish and record the weight as A. While the evaporating dish is still on the balance, transfer by pipet, 25 ml of working bath onto the evaporating dish. Record the weight of the evaporating dish and working bath as B.
2. Transfer the evaporating dish into an oven heated to approximately 180°F and allow to evaporate to dryness. Once evaporated to dryness, allow the evaporating dish to cool and weigh. Record the weight as C.

#### Calculations

$$\frac{(C - A) \times 100}{(B - A)} = \% \text{ by weight solids}$$

Where A = Weight of evaporating dish in grams  
B = Weight of evaporating dish and 25 ml sample in g.  
C = Weight of evaporating dish and dry sample

#### Safety and Handling

Read and understand this products MSDS before handling.

#### Waste Treatment

Individual users should verify the nature of spent solutions to assure compliance with local, state, and federal regulations. Contact Seacole for specific details and/or further waste treatment recommendations.

#### Ordering Information

AUTO/Prep DS-2 is available in 50# steel pails and 510# steel drums.

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