Hubbard-Hall
Chemical Services Since 1849

Product Bulletin

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HI-SPEED HUB ETCH

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HI-SPEED HUB ETCH is specifically designed for high volume printed circuit facilities requiring greater throughput improved line width control, elimination of slivering and increasing operating latitude. **HI-SPEED HUB ETCH** is an improved alternate to the Hubetch BLC.

HI-SPEED HUB ETCH provides a consistent high-speed etching rate. For example, at 125F (52°C). An etch rate of 2 mils/min is readily obtainable. Higher speeds can be obtained with an increase in operating temperature. **HI-SPEED HUB ETCH** provides for a reduction in lateral undercut of the copper circuitry. An etch factor of 4 to 1 is obtainable when the system is operating within the standard parameters.

HI-SPEED HUB ETCH has been formulated so that the tin leaf surface can be easily neutralized and brightened when processed through this alkaline etching solution and followed by Hubbard-Hall's Sunbrite 38P or Sunbrite 44 solder cleaning solutions.

RESIST COMPATIBLITY WITH **HI-SPEED HUB ETCH**:

Tin-Lead Solder	Nickel-Gold
Bright Solder	Gold
Tin	Most Dry Films
Bright Tin	
Nickel	

Some alkaline strippable screen resists may be removed or softened in alkaline etchants. However, the relatively low operating pH of the **HI-SPEED HUB ETCH** increases the ability of these resist to withstand the tendency to soften or be removed.

OPERATING PARAMETERS

Solution Makeup:	**HI-SPEED HUB ETCH** starter solution full strength.
Solution Maintenance:	**HI-SPEED HUB ETCH** solution full strength.
Operating Temperature:	120-130F. (125F. Optimum) (52°C).
Operating Specific Gravity at 125F:	22-27 Baume'. (23 Optimum) (SG = 1.188)
Copper Concentration:	18-24 oz/gallon. (20 Optimum)
pH range:	8.2 – 9.0 (8.6 Optimum)
Etch Rate:	1.6 – 2.8 mil/min depending on temperature, type and model of etcher.
Ventilation:	Lip vent preferred.

EQUIPMENT REQUIRED

The **HI-SPEED HUB ETCH** alkaline etchant system is designed for use in conveyorized spray etching equipment, having thermostatic temperature controls and proper ventilation. The venting system must be capable of creating a slight negative pressure in order to confine ammonia fumes to the etch chamber. The usr of a de-mister and a damper valve in the vent stack is recommended to prevent excessive loss of ammonia.

If the alkaline spray etcher is equipped with a recirculating spray rinse or a multiple cascade rinse after the etch chamber, there should not be a vent stack or high volume air knife adjacent to this rinse. The elimination of this vent stack at the recirculating rinse is to prevent ammonia loss,

which could then cause a pH below 8.2 in the mail sump. When venting is properly controlled in the entrance area of the etcher, it is possible to maintain proper operating levels of all components. The function of the replenished rinse is to minimize the copper salts on the circuit area and also reduce the copper concentration of drag-out to the drain. There must be a water rinse after the replenisher rinse and before the use of the Sunbrite 38P or Sunbrite 44 solutions.

Etching equipment should be made of PVC or equivalent material. All metal in direct contact with the etchant solution should be made of titanium, including roller bars, heating and cooling coils. Quartz immersion heaters may also be used. Do not use stainless steel in contact with the **HI-SPEED HUB ETCH** or the Hi-Speed starter solution.

PERIODIC MAINTENANCE:

1. Periodically pump etcher sump into a clean drum and rinse etch chamber with tap water.
2. Fills etch chamber with water and add 5 gallons of technical grade hydrochloric acid.
3. Turn sprays on and allow this solution tool spray for 10 to 15 minutes. Check the spray nozzle for blockage, clean if necessary, clean filter screens and replace. Clean out high-pressure lines to gauges and hydrometer stack.
4. Drain pump and rinse with tap water.
5. Repeat as required.
6. Replace with **HI-SPEED HUB ETCH** starter solution.

OPERATING INSTRUCTIONS

1. Charge etcher with **HI-SPEED HUB ETCH** starter solution.
2. Turn etcher heaters on. Do not turn the etcher sprays on.
3. When the etcher sump reaches operating temperature, turn on the sprays.
4. Turn on power to the control module, and set module switch to automatic.
5. Check the Baume' at 125F. (52°C). If it is in the operating range, you are now ready to etch the etch boards.
6. Turn on exhaust fan and open damper valve in the vent stacks just enough to prevent ammonia fumes from entering the adjacent work area. Do not over-ventilate. Excessive loss of ammonia will cause the pH of etching solution to drop below 8.2, with a resultant decrease in etch rate.

CONTINUOUS OPERATION

1. Set conveyor speed control for the thickness of copper being etched.
2. Continue processing panels.
3. Periodically check:
   A. The replenisher source to prevent it from going dry.
   B. The spent storage drum to prevent overfill and spillage.
   C. The specific gravity at operating temperature.

TEMPORARY SHUTDOWN

1. Turn off etcher spray pumps when boards are not being etched.
2. Switch control module to "OFF".

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OVERNIGHT SHUTDOWN

1. Turn off etcher spray pumps.
2. Turn off **HI-SPEED HUB ETCH** control module.
3. Turn off heaters.

DAILY MAINTENANCE

1. Check specific gravity and copper concentration. Samples to check for specific gravity and/or copper can be obtained by inserting a clear plastic tube into the module overflow pipe, which is located at the right side of the unit.
2. Check pH (8.2 to 9.0 at 125F) (52°C) during installation of the **HI-SPEED HUB ETCH**, the operating pH will stabilize and should remain somewhat constant. However, changes in venting can dramatically change the pH. The pH should be checked daily; refer to troubleshooting guide. When checking the pH of the solution, it is very important that the pH meter and electrodes be accurate and standardized before use. Buffer the pH meter with a pH 7.0 buffer and crosscheck with a pH 10.0 buffer.

ANALYTICAL CONTROL FOR HI-SPEED HUBETCH: (OPTIONAL)

EQUIPMENT AND REAGENTS:

100 ml volumetric flask	2 ml pipette
10 ml pipette	5% sodium chromate indicator
5 ml pipette	10% acetic acid solution
3 ml pipette	
250 ml Erlenmeyer flask	0.1 N silver nitrate
Methanol	Methyl orange indicator
Ammonium Hydroxide	
Pan indicator	

DETERMINATION OF COPPER IN HUBETCH:

1. Pipette a 10-ml sample into a 100-ml volumetric flask. Fill to the line with DI water, stopper and shake.
2. Pipette a 5-ml aliquot into a 250-ml Erlenmeyer flask.
3. Add 50 ml of DI water.
4. Add 15 ml of Ammonium Hydroxide.
5. Add 50 ml of Methanol.
6. Add 8-10 drops of pan indicator.
7. Titrate with 0.0575 M EDTA to a blue-green endpoint.

CALCULATIONS:

A. (MLS EDTA) (M EDTA) (127) = CU, G/L.
B. (MLS EDTA) (M EDTA) (16.96) = CU OZ/GAL

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DETERMINATION OF CHLORIDES IN HUBETCH:

1. Pipette 10 ml of the working bath into a 100-ml volumetric flask. Add 2-3 ml of ammonium hydroxide and dilute to mark with deionized water.
2. Pipette 3.0 ml of this solution into a 250 ml Erlenmeyer flask and add 50 ml of deionized water.
3. Add 2-3 ml of 5% sodium chromate indicator solution.
4. Add 10% acetic acid dropwise until the solution turns clear/yellow.
5. Titrate with 0.1 N silver nitrate until solution turns light brown in color.

CHLORIDE MOLARITY = (ML AgNO3) (N o AgNO3) (3.33)

HI-SPEED HUB ETCH OPERATING RANGES

The **HI-SPEED HUB ETCH** system is best operated under the following parameter ranges:

Baume':	22 – 27 (@125 F.)(52°C)
Copper:	18 – 24 OZ/GAL
Chloride:	5.0 – 5.8 M
pH:	8.2 – 9.0

TROUBLESHOOTING GUIDE:

The Hubetch system is designed to work within certain balance limits of copper, chloride, ammonia (pH) and specific gravity (Baume'). Since most shops do not have the facilities to run a complete analysis, they operate on gravity and pH alone. What follows is intended to be a quick trouble-shooting guide for such operations. Extended problems would require both complete analysis and assistance from Hubbard-Hall service personnel.

The most frequent problems are slow rate, sludging, dark solder, and silvering or undercut and copper crystallization.

SLOW RATE

Seen, as the normal conveyor speed will not allow for total removal of the copper.

POSSIBLE CAUSES	POSSIBLE SOLUTIONS
1. Conveyor speed set too high.	1. Check and adjust (if necessary).
2. Temperature of Etch too low.	2. Check manually (I.E. pull sample from sump thermometers in the etcher. Maintain at 120F. minimum.
3. Copper content on etch too low.	3. Check Baume' unit and adjust if necessary. Better to do copper analysis if possible. If low, get copper up by etching scrap laminate with replenisher pumps shut off.
4. Solution sludging out	4. Please refer to the section on sludging.

SLUDGING:
This type of sludge is a light, powder-blue color that is very fine. Sludging often goes hand in hand with slow rate.

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POSSIBLE CAUSES	POSSIBLE SOLUTIONS
1. Dilution of sump with water. (May result from leaks in cooling coils, excessive water on boards coming into etch or a crack in a common wall between etching and rinsing.	1. Make sure no leaks are present. Try to introduce "dry" boards to etch – add ammonia to the sump to solubilize the sludge.
2. High copper concentration. Too much Copper being carried for corresponding Ammonia and chloride levels.	2. Lower the Baume' control set point.
3. pH of etch too low. (I.E. 8.2 or lower).	3. pH should be increased by: A. Adding replenisher solution B. Adding ammonia C. Dampering the exhaust

DARK SOLDER

Usually first noticed in ground plane or thief areas. A darkening of the usually light deposit. Amy appears light in the area adjacent to the dry film, darker as you move from this area.

POSSIBLE CAUSES	POSSIBLE SOLUTIONS
1. High chloride levels in the etch. (may come from the concentration effect or counter drag-in and neutralization of solders brightener hydrochloric acid.)	1. Reduce chloride level by: A. Dampering exhaust B. Adding ammonia C. Adding replenisher solution
2. pH of etch too low (I.E. 8.2 or lower).	2. pH should be increased by: A. Adding replenisher solution B. Adding ammonia C. Dampering the exhaust
3. High copper, Low pH.	3. Adjust copper by lowering Baume' while raising pH by adding the replenisher solution. (run on manual control).
4. High chloride, Low pH	4. Raise the pH by adding ammonia this will lower chlorides by the dilution effect. (run on manual control).
5.Poor rinsing of etch. (can be due to poor spray pressure or lack of enough ammonia in etch.	5. Make sure water pressure and flow through nozzles are okay. If boards show evidence of the light, powderblue color – add ammonia to flood rinse or sump.

UNDERCUT

First noticed when boards fail tape adhesion testing. In the extreme, areas of circuitry are wiped out in etching.

POSSIBLE CAUSES	POSSIBLE SOLUTIONS
1. High pH	1. Lower pH by opening the ventilation, increasing temperature or raising the copper level.
2. Overetching	2. Speed up the conveyor.

3. High pressure spray	3. Lower the spray pressure.
4. High chloride level in the etch	4. Decrease ventilation, raise copper.

COPPER CRYSTALLIZATION

This differs from sludging in that the crystals are hard, deep blue in color and often plugs the spray nozzles.

POSSIBLE CAUSES	POSSIBLE SOLUTIONS
1. pH of etch too low (I.E. 8.2 or lower).	1. pH should be increased by: A. Adding replenisher solution B. Lowering copper set point C. Dampering the exhaust
2. High chloride level in the etch.	2. Add ammonia
3. High copper level in the etch.	3. Lower the copper level by lowering the copper set point on the controller.

A FEW ITEMS OF NOTE

1. When making additions – particularly ammonia – the controller should be shut off. Ammonia will lower the Baume drastically and will signal for replenisher if the controller is still on.
2. Additions of any component should always be made gradually - so as not to shock the system totally out of balance.
3. The relationship between Baume' and specific gravity is as follows:

$$\text{Baume'} = 145 - \frac{145}{\text{Spec. Grav.}}$$

(Therefore a liquid with a specific gravity of 1.000 has a Baume' of 0.00)

4. The specific gravity of aqueous ammonia (26 Be') is 0.897.Baume' for liquids of density less than 1.000 is calculated as:

$$\text{Degree Baume'} = \frac{140}{\text{Spec. Grav.}} - 130$$

CAUTION

Adequate ventilation must be provided on the etching equipment in which **HI-SPEED HUB ETCH** starter and replenisher solutions are used. A strong ammonia odor is released when either of the solutions are agitated. General room ventilation is also recommended. Avoid contact of the **HI-SPEED HUB ETCH** starter, replenisher, Sunbrite 38P or 44 solutions with eyes and skin. Safety goggles and protective clothing should be worn when handling the products. If contact should occur, apply copious amounts of cold water to the effected area and get medical attention. Any spillage of these materials should be washed with large amounts of water.

PACKAGING AND STORAGE

HI-SPEED HUB ETCH starter and replenisher solutions are available in 55 gallon drums. **HI-SPEED HUB ETCH** replenisher solution is also available in bulk tank wagon shipments. These

chemical products can be stored over extended periods of time in their original drums if placed in a protected area with a temperature range between 40-90F.

WARRANTY

THE QUALITY OF THIS PRODUCT IS GUARANTEED ON SHIPMENT FROM OUR PLANT. IF THE USE RECOMMENDATIONS ARE FOLLOWED, DESIRED RESULTS WILL BE OBTAINED. SINCE THE USE OF OUR PRODUCTS IS BEYOND OUR CONTROL, NO GUARANTEE EXPRESSED OR IMPLIED IS MADE AS TO THE EFFECTS OF SUCH USE, OR THE RESULTS TO BE OBTAINED.