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News & VUEs

By Phil Culpovich

VIS-U-ETCH™ 5 MAXIMUM EFFICIENCY!

By now, it's no secret to anyone that the electronics industry is experiencing a severe slowdown. Many companies have already closed and many others have sharply scaled back the size of their operation. Although production will ramp up again (it always does and people are still buying electronic items), it is during these times that companies not only stop buying new equipment but they are also looking for any way possible to save money.

For many years now, a great deal of companies have already been enjoying the cost saving benefits of owning a Vis-U-Etch™ 5 cupric chloride regeneration system. Our effectively zero-free acid system makes cost savings a given, not to mention being the most environmentally friendly, highest quality system on the market. But, unlike many other equipment manufacturers, it is not and has never been our policy to sit back and rely on our current success to carry us into the

Baumé Limiter Front Panel

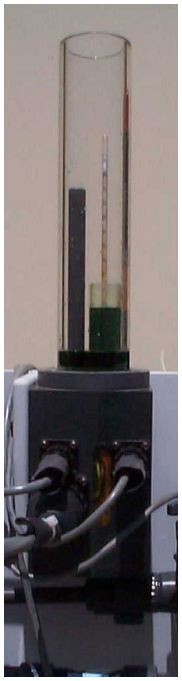
In this issue:

future. We know that we have gained the trust of a large part of the etching community by helping to solve problems and then incorporating these solutions into everything we sell. Today's weak economy is no exception.

It is with great pleasure that we announce the introduction of the latest version of the VUE 5, the Vis-U-Etch™ 5, Maximum Efficiency. This update to our popular system adds on a totally new optical Baumé (Specific Gravity) limiter. If all we were concerned about was the etcher, the current VUE 5s would continue to show just how well cupric chloride can be controlled as it currently is. The reality is that cutting costs demands more.

The addition of the optical Baumé limiter provides two very significant cost cutting features.

First, the Baumé limiter allows you to use the rinse water from your etcher to control the Baumé of the etchant, which can now use a more highly concentrated oxidizer. It costs money to treat the rinse water that goes to waste treatment so any reduction of your waste stream saves money. Depending how much rinse water you use in relation to the amount of copper etched, it is possible to return 100% of the rinse water back into the etcher. Even in cases where a larger volume of rinse water is used, you can expect a reduction of at least 40% of rinse water no longer going to waste treatment. Definitely a viable cost savings.

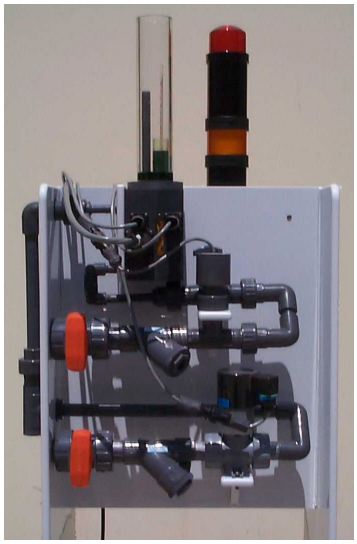


Optical Sensing Chamber

The second significant cost cutting feature is that we can now offer a much more concentrated oxidizer. The cost savings result from reduced freight charges to deliver the oxidizer. This is because the same quantity of oxidizer liquid will etch a great deal more copper, actually about 42% more. That's like etching 42% more copper without paying any additional freight charges to deliver the oxidizer to do it. There is a higher charge per gallon of oxidizer because of the higher raw material cost, but you still pay the same price for the same amount of sodium chlorate. Best of all, you get the extra oxidizer delivered for the same freight charge as the lower concentrated, less efficient version.

The next question that arises is, "Can I use any Baumé controller". Of course the answer is yes but we didn't go through all the trouble to come up with such a great cost cutter just to leave the work to an ordinary controller. Our new $CuCl_2$ Baumé Limiter really raises the bar for controlling Specific Gravity.

The first major deviation from ordinary Baumé limiters is the use of optics through the base of the Baumé hydrometer to determine the position, and therefore the Baumé of the etchant. Existing technology limiters generally use a mechanical scale or proximity detector at the top of a hydrometer to measure Baumé. As long as the mechanics of such sensing devices remains clean and properly maintained, they work fine. The problem is that they don't remain very clean in service. Soon enough they become clogged with copper salt and fail to function, generally resulting in dangerously high Baumé. The placement of optical proximity detection at the bottom of the hydrometer through the etchant, eliminates this problem. The etchant is always flowing and remains a liquid at the bottom. No copper salt forms during operation. Even if the system is shut down for a few days and copper salt does form at the bottom, turning on the system will fill the sensing chamber and quickly dissolve any copper salt, making this system self cleaning under "real world" conditions. This feature alone would make our Baumé limiter superior enough to warrant consideration, but we didn't stop there.



Baumé Limiter Plumbing

We wanted to provide a complete and specialized solution just for your etcher so we included all the extras that don't come with other limiters. As you can see from the pictures, our Baumé limiter comes mounted on a stand and includes all the valves and plumbing necessary to make your connections to the etcher and rinse water pump without the hassle of having to figure it out for yourself and purchase the items separately.

Connections For Water And Etchant

But even that's not enough! We have an easily visible hydrometer location light array that lets you see the current condition from across the room without having to calculate anything. There is also an alarm system that shuts down the limiter in the event of failure, alerting the operator to correct the problem. A remote connection is even available to shut down the Vis-U-Etch™ 5 if desired.

As expected, the $CuCl_2$ Baumé Limiter comes with the complete technical support provided by Oxford V.U.E., Inc.

It is backward compatible with existing Vis-U-Etch™ 5 controllers. We can add this to your existing setup without having to make expensive changes to your Vis-U-Etch™ 5. Sales of new Vis-U-Etch™ 5 systems can be quoted as the original setup using the standard oxidizer or including the $CuCl_2$ Baumé Limiter, ready to use the new more concentrated oxidizer.

For a limited time, we will be offering this new $CuCl_2$ Baumé Limiter at a special introductory price. Be sure to contact Oxford V.U.E., Inc. or your local distributor for all the details.

NEW TECHNOLOGY VALVES AVAILABLE

If I were to ask you what was the weakest link in any chemical control system, probably the first thing that comes to mind would be valves. Over the last few years, we at Oxford V.U.E., Inc. have continuously looked for ways to make a better, longer lasting valve.

Valve Showing Connector And Vent

We started with a basic Hayward Viton® valve and made several improvements. First came the replacement of the Viton® valve core with a custom designed Teflon® valve core. Additional seals were added, Y-Strainers were placed before the valves and the whole valve itself was sealed with Silicone sealer. This configuration resulted in a valve superior to the original Hayward design.

There was one thing, though, that we couldn't change about the original valve. The design of the original actuator piston and solenoid can not be changed and creates an excessive amount of heat

New Valves Installed In VUE 5

inside the valve core during operation. This can reduce valve longevity under heavy use.

We have since worked with another valve manufacturer, Plast-O-Matic, to come up with a custom designed valve, suitable for operation in acid and alkaline solutions. The two main improvements in this valve are the Aflas® seals and the addition of an Oxford V.U.E., Inc. designed control circuit that allows full voltage to open the valve with a reduced voltage to sustain the open valve, allowing a substantial reduction in heat.

The Aflas® seals are one of many newer technologies that allow better, longer lasting operation in more severe operation such as acid and alkaline solutions.

The voltage control circuit is probably the most significant improvement of all because it allows you to have a stronger coil for pulling in the valve and yet reduce the power to keep the valve open without generating much heat. In actual testing at our facility, we kept valves open for several days at a time to see how hot the valves would get in an

Valve Connector With Electronic Control Circuit

enclosed space. At no time did the valves ever feel more than slightly warm to the touch.

But how does heat affect valve life?

When automatic valves of any kind go through duty cycles, heat can be generated, especially in solenoid type valves. This heating and cooling causes an expansion and contraction of all the internal parts. The problem comes from the fact that all the internal parts are made of different materials and these materials expand and contract at different rates. This causes internal sealing surfaces to shift in relation to each other, causing a slight leakage which, over time, results in valve failure. The best way to stop this is to reduce the amount of heating and subsequent cooling of the internal valve components, maintaining a narrower temperature range. The electronic voltage control circuit designed by Oxford V.U.E., Inc. is the major breakthrough that achieves this. Reduced voltage results in less heat to dissipate. The valve itself also has a vented section between the solenoid on top and the liquid chamber on the bottom to help prevent heat transfer.

These new valves have been installed at many locations over the last few months without any failures. They are now standard on all new machines sold and there is no longer any difference between the acid/oxidizer vacuum valves and the spent pressure valve.

In keeping with our policy of backward compatibility, we have made kits available to upgrade your existing valve set to the new design. It is best to have the modifications performed at our factory but in-field conversions can be performed by qualified personnel.

These valves can also be used in any number of other locations, besides the Vis-U-Etch™ 5, where acid or alkaline solutions must be controlled. We can provide you with the valves, plumbing fittings and electronic control circuit with connectors for such uses.

Contact Oxford V.U.E., Inc. or your local distributor for details and pricing.

ETCHER CONFIGURATION: HIGH ACID VS. ZERO ACID

Over the course of time, these newsletters have contained many articles covering proper etchant parameters and etcher design. This article will highlight the differences between designing your etcher for high acid versus zero acid cupric chloride systems.

It takes a given amount of time to remove the unwanted copper from a panel or lead-frame, etc. using a chemical etchant. This is referred to as the etch rate and it is predictable when using the same etchant under the same operating conditions. Ideally, the only etching that should occur would be directly under the spray in a conveyorized etching machine. This is because this type of etching is focused downward instead of laterally. In a zero acid cupric chloride system such as the Vis-U-Etch™ 5, this task becomes easier because as soon as the exposed copper is contacted by the etchant from the spray nozzle, the copper is converted to cuprous and the resulting cuprous puddle flows off the material being etched with no further etching from the cuprous puddle. This results in a superior etch factor because lateral etching is minimized while downward etching is maximized. In a high acid cupric chloride system, this becomes a much trickier operation. This is because having excess acid in the etchant allows some regeneration to take place on the surface of the material being etched in the cuprous puddle, including the cuprous in the spaces between traces. Once this regeneration in the cuprous puddle takes place, continued, uncontrolled etching occurs, both downward and laterally. It is this uncontrolled etching that limits the minimum trace and space width possible from a chemical perspective and results in wavy, uneven sidewalls.

Realizing the way the selected chemical etchant performs in relation to the material being etched should be the guide in determining how to design the etch chamber.

In a high acid cupric chloride system, a good set of parameters would be a high quantity of fan type

nozzles with a flow rate of approximately 0.5 GPM, manifold oscillation, pressure around 20 PSI and artwork compensation for acid undercut. An explanation of these parameters is as follows:

· Nozzles: The higher quantity does focus more etchant downward. Fan nozzles spray more closely to the desired 90^o angle to the material. 0.5 GPM nozzles limit the amount of excess etchant sprayed on the material. If too much etchant flows across the material, extra, uncontrolled lateral etching occurs because of excess acid regeneration.

· Manifold oscillation: Also referred to as horizontal reciprocation. This maintains the spray angle at a constant 90^o to the material being etched as opposed to the "swing" type which follows an arc, spraying diagonally on the material. The 90^o manifold type focuses spray downward while swing types spray diagonally causing increased lateral etching.

· 20 PSI pressure: This is very closely related to the need for 0.5 GPM nozzles. With high acid, you don't want too much pressure or volume delivering too much etchant to etch downward. Having the acid in the etchant under higher pressure washes away the cuprous sidewall banking agent that forms when cupric chloride converts to cuprous. ***Remember, cuprous is soluble in hydrochloric acid. It has to be because this is how regeneration works!***

· Artwork compensation: Since it is a given that high acid systems perform with increased undercut (Lateral etching), etch resist must be increased in width to prevent over-etching at the top of the trace before etching is completed at the bottom of the intended space.

In a zero acid cupric chloride system, a good set of parameters would be a high quantity of fan type nozzles with a flow rate of approximately 1.5 GPM, manifold oscillation, pressure around 45 PSI and no artwork compensation until etched material thickness increases above two-ounces (70 microns). An explanation of these parameters is as follows:

· Nozzles: Like high acid systems, the higher quantity does focus more etchant downward and fan nozzles spray more closely to the desired 90^o angle to the material. However, we want 1.5 GPM nozzles to spray a greater volume of etchant on the material. This is because without excess acid, extra, uncontrolled lateral etching due to acid regeneration does not occur.

· Manifold oscillation: This follows the exact same reasoning for manifold oscillation in a high acid system. This maintains the spray angle at a constant 90^o to the material being etched as opposed to the "swing" type which follows an arc, spraying diagonally on the material. The 90^o manifold type focuses spray downward while swing types spray diagonally causing increased lateral etching.

· 45 PSI pressure: This is very closely related to the desire for 1.5 GPM nozzles. Without high acid, you want more pressure and volume delivering more etchant to etch downward. Since there is no excess acid in the etchant, there is no removal of the cuprous sidewall banking agent by acid. Therefore, we can deliver a greater pressure and volume of etchant to the material without the quality problems caused by acid undercut.

· Artwork compensation: Since there is no acid undercut (lateral etching), etch resist should not be increased in width to prevent over-etching at the top of the trace before etching is completed at the bottom of the intended space unless the thickness of the copper exceeds two-ounces (70 microns). In any case, artwork compensation is definitely reduced.

Even though both high and zero acid systems can be optimized for best performance, the zero acid system will always have the quality advantage because the drawback of acid undercut doesn't exist. And this does not even take into consideration the other negatives of less stable etchant with high acid and the poor environmental conditions that are present.

But what about the drawbacks of zero acid?

The main drawback to zero acid for most is that they think they have to give up speed in order to gain quality. In our last newsletter, we displayed a table showing the differences between different etchers and etching parameters. This clearly identified that high acid was not the main answer to the speed issue. Proper etcher design is the key. And this brings me to my next point. Since our last newsletter, we have seen the results of the newest etcher design to come from Integrated Process Systems/Western Technology Associates in conjunction with Vis-U-Etch™ 5 etchant control (See updated table included with this newsletter). This new etcher follows all the principles of optimization for a zero acid system and as a result, it is now the fastest etcher we've seen. Regarding the quality, the new etcher is running 3 mil. trace/space on one-ounce copper in continuous production and 2 Core 2 mil. trace/space in continuous production with excellent results. Now of course you could use the etcher with higher acid but why? Once you have the speed, quality, running cost, environmental safety and reliability issues maximized, why would you want to ruin it with high acid?

To find out more about the new "Euro-21" Etch Series from Integrated Process Systems/Western Technology Associates, please contact:

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THE HIGH TECH MOUSETRAP

Let's imagine that we find evidence of a mouse in our house. Naturally we want to get rid of this pest so we set about to build a device to trap this creature. First, we start by building a large cage with an automatic front door. We don't want to have any false triggering of the front door so we install an elaborate set of laser detectors capable of discerning the difference between a mouse and insects, cats or any other moving item that isn't a mouse. Of course we'll need to have some cheese but we must include a device to prevent any other creatures from smelling the cheese and stealing it. To make this all work, we'll need a Programmable Logic Controller (PLC).

Now that we have constructed our trap we wait for the mouse. Oh no! There is an error signal from the PLC! Since we haven't used the diagnostic portion of the PLC since we first installed it we'll have to find the instruction manual or try to navigate the diagnostic screens and figure it out as we go along.

Success! And it only took one hour to figure it out!

This may sound a little silly but how many of us buy over complicated control systems to operate machines that can be operated very simply with a few lights and switches? In the case of the mousetrap, all we really need is a piece of wood with a spring on it. Add some cheese and we catch the mouse. Simple to operate, simple to diagnose.

If I were having surgery, of course I would want to have very sophisticated, computer controlled equipment to monitor and guide the surgeon. But when it comes to operating an etcher, most PLCs become the forgotten stepchild and end up being nothing more than a glorified speed controller that no one knows how to fix when something goes wrong. PLCs are not a bad thing and everything has its place but when it comes to a simple task, I'll take the piece of wood with a spring on it…

Footnotes:

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