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< Ferric Gum Process

Katharine Thayer

Posted: Mon Nov 22, 2010 4:35 am

quote

Joined: 19 Nov 2010
Posts: 44

pgum wrote:

... I do know that gum has a small amount of protein and perhaps it is just that component that gets hardened with glyoxal

Sorry, I was just re-reading the thread, trying to make some sense of it all, and noticed this. I don't mean always to be shooting down your ideas, Peter; I actually enjoy your agile mind, but it is unlikely that the very small amount of protein in the gum is serving as functional elements. Gum has a complex, high molecular weight (around 2 million, give or take) structure that is about 1% protein and is made up of three discernable components (I'm not sure how they distinguish these component; I'm just quoting sources here). The component that makes up 90% of the gum is globular, compact and highly branched, and contains no amino acids. The component that contains most of the proteins is small, also globular and highly compact, and made up of as much as 50% protein, but cannot be degraded by treating it with proteolytic enzymes, suggesting that the proteins may be buried deep within the globular structure and unavailable either to be attacked by enzymes or to participate in crosslinking. (References here):

<http://www.pacifier.com/~kthayer/html/Gumarabic.html>

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Botanic88

Posted: Mon Nov 22, 2010 11:14 am

quote

Joined: 14 Aug 2010
Posts: 50

Peter

Can I get something clear? There appears to be a contradiction probably resulting from a 'slip of your pen'



You made a chromium sulfate concoction by reducing dichromate with metabisulphite. Then you ...

Quote:

bathed two test prints in this crude bath (of very roughly 1%) for 5 mins. One I rinsed thoroughly, then they were hung to dry for an hour. Once dry, I placed them in the acid bath and then a water soak and after about 16 hours, the image is still very intact.

But in a later reply you said.

Quote:

The print had the iron removed with the bisulfate prior to fixing with the chromium brew. Yes, the chrome fixing left the print intact.

Please tell me that the first version of events is the correct one. Surely you must have fixed the gum with chromium before you removed the iron in the acid bath!

+++++

Katherine

Thanks for your clear evidence that fixing gelatine (at least) using dichromate is very different from fixing it with chromium(III). I am happy to believe that different valencies are involved.

+++++

All

Everything I have read suggests that trivalent metals are often good at fixing colloids like gelatine and gum. I appreciate that the mechanisms may differ with each metal and each colloid, but some kind of fixing often occurs.

It seems reasonable, at least as a starting point, to assume that iron(III) and chromium(III) would fix the gum using the same places in the gum to crosslink it.

Hence my intrigue about both metals being able to crosslink the gum, one after the other. Why wouldn't the places where crosslinking occurs have been already taken by the first metal?

And then there is my second area of intrigue. How can the sodium bisulfate remove all the iron(III) compounds without touching the chromium(III) compounds?

I apologise for going on about these intriguing points (well intriguing to me at least). But I would like to get some 'feel' about what is going on before experimenting with chromium solutions (a double meaning is intended here) 😊

(It's possible that you might find my wanting to get some vague 'feel' for the chemistry somewhat odd Katherine, but humour an oldish non-chemist)!

Michael

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Katharine Thayer

Posted: Mon Nov 22, 2010 2:57 pm

[quote](#)

Botanic88 wrote:

Katherine

Thanks for your clear evidence that fixing gelatine (at least) using dichromate is very different from fixing it with chromium(III). I am happy to believe that different valencies are involved.

You're welcome, except that I don't think I said anything about fixing *gelatin* using dichromate. The colloid I presented evidence for was PVA, which my chemist assured me, when we were investigating this research, is functionally closer to gum than gelatin is. Gelatin has a different mechanism for crosslinking with Cr(VI) than PVA(gum) does, but we don't need to concern ourselves with that here. At any rate, yes, you've got it, that the mechanisms are different for the different oxidation states of Cr and different types of reactions (by definition) and thanks for listening.

Botanic88 wrote:

I apologise for going on about these intriguing points (well intriguing to me at least). But I would like to get some 'feel' about what is going on before experimenting with chromium solutions (a double meaning is intended here) 😊

(It's possible that you might find my wanting to get some vague 'feel' for the chemistry somewhat odd Katherine, but humour an oldish non-chemist)!

Joined: 19 Nov 2010
Posts: 44

Absolutely no need to apologize. This is what forums are for, isn't it, to have dialogue about things, share information, and come to a collective understanding about an issue if possible? Why would I think it odd to want to understand the chemistry? If wanting to understand the chemistry is odd, then obviously I'm odd too, since I've spent a great amount of time trying to understand the chemistry of gum bichromate. I hope I haven't seemed frustrated, but if I have, it's only because I wish we had more perfectly clearcut answers, and because sometimes it seems that the actual scientific evidence doesn't have much chance against 150 years of entrenched misinformation. But no, I don't think it odd to want to understand the chemistry; more power to you.

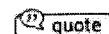
Katharine

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pgum

Posted: Mon Nov 22, 2010 9:44 pm

 [quote](#)

Katherine,

Joined: 19 Oct 2010
Posts: 52

I did grow doubtful of that hypothesis of the protein content of gum being an active component in the process because I could not find any information that supported it (albeit on the public internet) The problem however, is that it is always difficult to find information so specific unless one has access to a host of technical and scientific journals, that is why any insight that can be shared is always appreciated.

Michael,

The first quote you have listed is correct. Thanks for bringing this to my attention. I have now fixed that error in the original post.

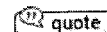
Peter

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Frank Gorga

Posted: Tue Nov 23, 2010 2:05 am

 [quote](#)

Help... I'm barely keeping my head above water you folks are moving so fast!!! Keep it up though... 'tis fascinating. ☺

Joined: 24 Oct 2010
Posts: 4

Where to start?

Glyoxal fixing... I would not rule this out, even if it might be a bit slow. It sounds like it really stabilizes things well.

My comment on the relative rates was not meant as a discouragement, only as advice /explanation for why one might need higher concentrations and/or longer times with gum as compared to gelatin.

Also, one might want to use multiple, freshly prepared, baths if glyoxal is as sensitive to oxidation as Peter suspects it is. I have no information on this sensitivity but I am certain that spreading out a solution in a shallow bath so as to maximize its surface to volume ratio is a good way to maximize the rate of oxidation what ever it is!

Thus, for example, 3 hours exposure to glyoxyl changing to fresh solution every hour is likely to be more effective than 3 hours to a bath without changing (even if you used three times the volume).

I would expect aldehyde (i.e. glyoxal) fixed polymers to be mildly sensitive to both acids and bases as pH extremes will catalyze both the formation and loss of the cross links... which are properly called acetals and hemiacetals. This might not be a practical problem (and indeed it seems not to be) as it would depend on the relative rates of the "unfixing" and the clearing reactions.

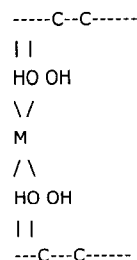
As for a protein "contaminant" being involved, anything is possible but my "gut" says its not likely. If it were one might expect to see batch-to-batch variations in the ability to cross-link (since contaminants tend to vary between batches).

As for the various forms of chromium... Cr(VI) is by far the worst, it is a very potent carcinogen...stay far away! As for the the other oxidation states, I am not by any means an expert, but I will say that what is stable in aqueous solution might not be applicable when things that can bind to the metals are present... such binding may stabilize forms and species that can not exist in "simple" solutions.

As for how metals (iron or chromium, or other transition metals) might form cross-links... there are lots of possibilities and I would expect the mechanism for proteins to be very different that for carbohydrates.

For carbohydrates, I would expect that the metals like make "bridges" between molecules. Carbohydrates contain many vicinal OH groups... that is OH groups on adjacent carbons. The carbohydrates in gum arabic also contain carboxyl groups which bear a negative charge. These structures are particularly good at binding metals with +2 and +3 charges.

Such cross-links would look something like this:



For proteins, one might expect that the metals catalyze the formation of direct cross-links between the chains and the metals would not be part of the product.

Lastly, I do not have any new results to report. Alas, the amount of daylight is short these days and the demands on my time too many. Both have conspired against my desire to make art this past weekend. When I get a chance, I hope to try integrating all of the progress you all have made much as Katherine is doing.

A first draft of a workable process might look like this: acid washing paper, using slightly acidic iron chloride for the photoreaction, applying gum and pigment by brush, fixing with glyoxal and clearing with either acid or bisulfite. Any thoughts?

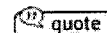
Frank Gorga
www.gorga.org/blog

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pgum

Posted: Tue Nov 23, 2010 3:59 am



Only a few brief comments tonight.

Joined: 19 Oct 2010
Posts: 52

Frank,

While the glyoxal may not produce an image as water and acid resistant as hoped, it is true that it can be sufficient with proper workflow, as the previous glyoxal tests showed. My disappointment with those results was due to glyoxals inability (amidst higher expectations) to keep the gum intact for many hours, which for all practical purposes may be unnecessary for a simple hand print application.

I do believe that Cr3 as a potential hardener is still worth investigating. I have attempted to repeat the original test I did with this material just to confirm that it does in fact work as well as I originally found.

The little information I found regarding Glyoxal stability was the mention of a 6 months shelf life (enclosed) I don't know how that works oxygen free in a bottle but it may be due to some disagreeable yellowing. The other information I found was that it does degrade due to oxidation and that various metals (possibly iron) may catalyze this. It could be tested I suppose, by checking the pH of a bath over time as it acidifies due to oxidation.

Peter

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Botanic88

Posted: Tue Nov 23, 2010 12:07 pm



Peter

Joined: 14 Aug 2010
Posts: 50

Please can you do a test with glyoxal for me? It's the same one you did before but with a small variation. I was going to ask anyway but Frank's latest post makes it seem even more worthwhile.

The test is to make two 'ferric fixed' gum images. Then bathe them with glyoxal (2% maybe). Then leave them for some hours. Then bathe one of them with glyoxal again (possibly a fresh solution) and leave for some more hours. Then bathe them both with sodium bisulphate. Then see how long each survives in plain water.

I see this as a proof of concept initially!

+++++

Frank

Thanks for your explanations of crosslinking. I appreciate it when you and the others add to my patchy knowledge of chemistry. But when you cannot I must just make up my own hypotheses, however wrong these may turn out to be. I've still got one foot in the late 19th Century, I think!

In response to your 'first draft':

Quote:

A first draft of a workable process might look like this: acid washing paper, using slightly acidic iron chloride for the photoreaction, applying gum and pigment by brush, fixing with glyoxal and clearing with either acid or bisulfite. Any thoughts?

This seems to be roughly right but I would suggest two modifications 🧐

- (1) The acid pre-treatment of the paper is only necessary if the paper is 'buffered'. This can be tested by putting a spot of dilute ferric chloride on the paper and watching its colour for a few minutes.
- (2) I would recommend adding oxalate to the sensitiser in most cases (the amount is yet to be determined). A tartarate might also do. The result would be less sensitive to light but also less poisonous, I imagine.

+++++

Peter again!

Quote:

My one other concern with the chromium compound is their future availability, especially to those who lack manufacturing facilities which can remove residues. I have heard of some individuals in Europe (I don't recall the country(s), who are unable to obtain any dichromates. I see that day on the horizon!

I live in the UK as you know and it is difficult or impossible to buy dichromates (and glyoxal) unless one has a registered business at a non-residential address.

My simple test of whether a chemical can be bought is to search for it on ebay (UK). It seems to me that what can be bought may depend on whether a chemical is in common use in a hobby or small workshop

context. (Obviously alternative photography is not sufficiently widespread to count as a hobby)! So I can buy ferric chloride and sodium persulfate because they are both used for etching PCB's and I can buy oxalic acid because it is used in some rust clearing applications, I think.

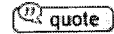
Michael

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Katharine Thayer

Posted: Tue Nov 23, 2010 4:57 pm



pgum wrote:

Joined: 19 Nov 2010
Posts: 44

The little information I found regarding Glyoxal stability was the mention of a 6 months shelf life (enclosed) I don't know how that works oxygen free in a bottle but it may be due to some disagreeable yellowing. The other information I found was that it does degrade due to oxidation and that various metals (possibly iron) may catalyze this. It could be tested I suppose, by checking the pH of a bath over time as it acidifies due to oxidation.

Hi Peter, I stayed up way too late last night searching google scholar for anything about instability of glyoxal or, more to the point, of organic material crosslinked with glyoxal, and didn't find anything, but still thinking about this. As to the hypothesis about whether glyoxal may be crosslinking amine groups in the gum, we may already have ruled that out but the research in gum and in PVA, is clear that glyoxal is using the OH groups for crosslinking.

FWIW, my glyoxal (which I've determined is at least six years old, since it was 2004 when I did those experiments hardening gum for painting with, and 2005 when I used glyoxal to harden gum for sizing) is still crystal clear, and a little open vial of glyoxal, which I left sitting on a workbench to take drops out of for my experiments, has remained crystal clear for a week; in fact the other day when I brushed a band of glyoxal on a ferric gum print and that band of glyoxal protected the gum from acid, that glyoxal had been sitting out in the open air for days.

There is an issue with glyoxal-crosslinked gelatin used for sizing papers; it can turn the paper yellow, or ivory, after a few days, but not always (the presence and degree and reversibility of yellowing seems to be paper-dependent, I discovered when I sized a ragtag lot of assorted leftover papers). One gum expert who uses glyoxal has found that rinsing after sizing prevents the color change from happening, and I've found that with the paper I use, the color change occurs, but completely disappears when the paper goes into the development wash in the gum process, so I don't bother with a post-sizing rinse.

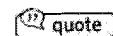
The sun is peeking out for the second time in weeks (the first time lasted for an hour, that's when I did that negative image of the eggs) so I'm going to try to make another image, but first I have to shovel a bunch of snow to get to my workshop. It's something like 17 degrees and I'm a bit concerned about how the process will work in the cold. Will report if I manage to get to the workshop and do the experiment,
Katharine

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pgum

Posted: Tue Nov 23, 2010 11:30 pm



Katherine,

Joined: 19 Oct 2010
Posts: 52

The fact that you could not find any information on this is probably a good thing and your tests with such an old batch, and that one sitting out for a week are encouraging.

I did a little more digging in the patent records and came across a discussion from a company called General Aniline and Film (GAF). Their patent US2671024 mentions the use of glyoxal in an alkaline bath of pH 9-10 in order to accelerate gelatine hardening in silver halide film, and the addition of a stabilizer. In this environment, they claim that the bath life is only 6 hours. Now I don't think that this is something that would affect our process, but it is good to know. The only other information I could find was a brief storage note

from BASF who are big promoters of glyoxal, and a note from Sigma Aldrich suggesting that the 40% solution is a relatively stable configuration.

Quote:

BASF Canada

Storage stability:

Storage duration: 6 Months

May yellow after lengthy storage. During the storage a product characteristic clouding or crystalline

precipitation of the trimeric glyoxal hydrate may occur. The process is reversible if warmed up mild (max. 40°C).

I suspect that the product may go out of spec after this time but that doesn't mean it would have any impact on how we use it.

Another note I found from Sigma Aldrich re 40% solution:

Quote:

"This form of glyoxal is composed of 3 moles of glyoxal and 2 moles of water in a relatively stable configuration"

As a precaution, I have left a small tray of 2% glyoxal soln opened and will check the pH in a day or so to see if it gets acidic. Right now however, I am not too concerned.

Good luck digging out the workshop!

Michael,

I still have several of the 2% glyoxal treated test strip which were not placed in the acid bath, so I can dip one in a second time and see what happens tomorrow.

BTW I checked one of these today for any additional post hardening now that it has sat for days, but there was no increase. I guess the action is complete in a much shorter time.

Peter

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Katharine Thayer

Posted: Wed Nov 24, 2010 12:23 am



Joined: 19 Nov 2010
Posts: 44

Thanks, Peter. Not that I'd advise anyone to leave their glyoxal out like that, but I did, and it doesn't seem to have changed much in a week. But after all this discussion, you can be sure that when I do my next glyoxal test, I'll pour out fresh glyoxal (I mean fresh out of the 6-year old bottle anyway.) But just to be clear, that wasn't a glyoxal bath I was leaving out but some glyoxal stock solution poured into a little vial so I could dip my dropper in there and get drops of glyoxal to mix with gum or with water as the occasion demanded. I haven't dipped samples into glyoxal solution but brushed the glyoxal on.

What I have to report isn't much; I was so tired by the time I got the steps shoveled and sanded (there was a layer of ice under the snow) that I only made two prints, and will put them up when I can, maybe later today or tomorrow morning. I had made a new positive of a different image that had more dark values than the eggs, so I got a better print, but it's still inferior to a gum print made from the same image IMO, and I'm also kind of unhappy that I wasted a lot of pigment by pouring gum/pigment on the image rather than brushing, because though that did eliminate the streakiness it introduced other weirdnesses and I wouldn't recommend doing that. But I wouldn't have known that before I tried it, so I guess it was worth it. I'll show what I mean, later,
Katharine

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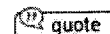
Author

Message

< Ferric Gum Process

Katharine Thayer

Posted: Wed Nov 24, 2010 4:57 am



Joined: 19 Nov 2010
Posts: 44

I added today's two prints to this page, along with the same image printed in gum bichromate (a one-coat gum) for comparison:

<http://www.pacifier.com/~kthayer/html/ferricgum.html>

I usually keep images on my site quite small, since my website and my incoming mail together have to fit into a 10MB space, but I've uploaded these at actual size (actually, slightly enlarged) so you can see the fine details up close. Download times for incoming mail have increased significantly, so I won't be keeping this page up long.

Some thoughts: One of the distinguishing features of the gum dichromate process is the short printing range of the process. As I've demonstrated here:

<http://www.pacifier.com/~kthayer/html/tonality.htm>

a one-coat gum print, can, at most, cover a print density range of about .75 logD. The DMax of a print is a function of the pigment chosen and the pigment concentration of that pigment; the amount of pigment required depends on the pigment. As you can see on the linked page, using enough pigment to produce the darkest DMax possible doesn't increase the tonal range, it just moves the .75 range down the scale. Lamp black and iron oxide black give the darkest DMax possible with gum (1.1 to 1.3 logD); today's ferric prints were made with iron oxide black.

Another distinguishing feature of the gum bichromate process, which I also demonstrate on that same page, is that a print with enough pigment to produce darker tones will unfortunately have very coarse, gritty highlights, and that is another reason why multiple printings work best for gum prints, especially if you want a print tonal range longer than .75 and/or you want dark tones as well as smooth tones in the highlights. I told Michael that if I could be convinced that the ferric gum process produces a longer print tonal range with smooth tones throughout the range, or even the same .75 tonal range with smooth highlights, I'd be on board.

The second ferric print for today did produce a somewhat longer tonal range than is usually seen in one-coat gums, about 1.15, but I'm not pleased with the blocked shadows or with the marked grittiness in the face tones. I suppose the shadows could be opened more with increased exposure, but I don't know how you'd judge the exposure, or how you'd open the shadows by increasing exposure without losing the highlights altogether. The only way I have to judge exposure is when the margins are bleached white, how do other people judge exposure?

Katharine

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Katharine Thayer

Posted: Wed Nov 24, 2010 3:59 pm



To save server space, I replaced the larger pictures with smaller ones and added more descriptive text to compensate for loss of visual information. No new information, just organized more compactly:

Joined: 19 Nov 2010
Posts: 44

<http://www.pacifier.com/~kthayer/html/ferricgum.html>

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pgum

Posted: Wed Nov 24, 2010 11:38 pm



Katherine,

Joined: 19 Oct 2010
Posts: 52

It is good to see that you were able to experiment a little more and post the results. The fact that all of us are using slightly different formulas/processes/technique can make notes hard to compare but at least it will give us a much better understanding of what works and what doesn't

It looks like your getting this process to function. I wouldn't be too concerned with the shortness of scale at this point. I know that it can offer 8-10 steps on a 21 step wedge, with good density, based on some tests I did. I am going to try to make fresh print with a step wedge in place so at least you can see what things look like on my end.

Based on my experience, I believe that the shortness of scale and grittiness is due to too much sensitizer. Try a test with a dilution of 25 or even 50% to see if it helps. The paper coating technique can compensate either way for sensitizer strength so consistency is paramount here. Your exposure time will drop by about that much as well. I coat the paper till it has a slight gloss and the tooth shows through it, then the gloss disappears in a couple of minutes (50% RH@RT).

Another cause of stain may be extra acidity; I can't confirm this yet with the ferric gum process but it impacted another process I was working on in the past. I would consider the sensitizer strength first however. I found that a telltale sign of excess sensitizer is when the paper grabs the brush in unexposed areas even with copious amounts of gum/pigment mix on the brush.

These are just a few possible causes. Take them with a grain of salt because I haven't worked with this process long enough to know for sure, and one cause may masquerade as another in this finicky world of photographic hand printing.

Michael,

I tried a second 2% glyoxal treatment on one of the left over 2% treated strips. It improved the resistance to the acid and wash, but not as much as one may hope. It seems to be not as good as the 4% treated strip. I would have expected it to be at least as good as the 4% treatment!

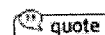
Peter

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Katharine Thayer

Posted: Thu Nov 25, 2010 6:09 am



pgum wrote:

Joined: 19 Nov 2010
Posts: 44

I wouldn't be too concerned with the shortness of scale at this point. I know that it can offer 8-10 steps on a 21 step wedge, with good density, based on some tests I did. I am going to try to make fresh print with a step wedge in place so at least you can see what things look like on my end.

Okay, I think maybe we're talking past each other. 8-10 steps is about the average of what can be expected from a one-coat gum bichromate, in other words, that's what I mean by a short scale when I say gum can only print a short scale. At any rate, steps on a stepwedge don't convey any meaningful information about tonal scale where gum is concerned, so I prefer to express tonal scale in terms of print density rather than steps. For example, here is a fairly typical one-coat gum print:

<http://www.pacifier.com/~kthayer/html/kids.html>

with a print density range of somewhere between .70 and .90, depending on how I measure it, which is in the average range for gum in one coat, given a fairly dark pigment (although the pigment used here, Ivory black, isn't one of the darkest blacks). When you say you've done some tests I wonder if you mean the prints you linked earlier in the thread, on picasaweb. They don't look to me to show any superiority in tonal scale over gum bichromate, so do you have other prints somewhere that do?

I think some of the confusion may stem from misconceptions about the capabilities and character of gum bichromate. I know gum well, and so when someone says another process using gum can print a much longer scale, like carbon (isn't that what it said?) then I'm looking for a scale like carbon. A scale like gum isn't going to make my socks roll up and down.

pgum wrote:

Based on my experience, I believe that the shortness of scale and grittiness is due to too much sensitizer. Try a test with a dilution of 25 or even 50% to see if it helps. The paper coating technique can compensate either way for sensitizer strength so consistency is paramount here. Your exposure time will drop by about that much as well.

Surely you mean that as the sensitizer gets more diluted, the exposure time goes up? Or are you really saying that less concentrated ferric chloride prints faster?

pgum wrote:

Another cause of stain may be extra acidity

I seem to have missed a turn somewhere; when did we shift to stain? I was talking about gritty tones, which is not the same as stain. There are two kinds of stain I've seen in ferric gum prints: iron stain and pigment stain. Your picasa page, and my experience, suggest that extra acidity *prevents* iron stain rather than causing it, so I guess you don't mean iron stain. So maybe you mean pigment stain, but I'd have to see some evidence of that. In gum bichromate, pigment stain is either a result of overpigmentation or of inadequate sizing, or a combination thereof, and my experiments so far seem to indicate that this is true of ferric gum as well as gum bichromate. But that's stain, which is a different issue than what I'm talking about.


Happy Thanksgiving all,
Katharine

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Botanic88

Posted: Thu Nov 25, 2010 2:17 pm

 [quote](#)

Hi all

Joined: 14 Aug 2010
Posts: 50

Thanks for doing the two bath glyoxal test Peter 

Now for something else.

Currently the Dmax and tonal range of the process are not bad, but we would all prefer them to be better!

It is easy to see how the process might be improved in this respect, at least in general terms! Suppose we could make the sensitiser diffuse further into the gum and fix a thicker relief. This would give us darker blacks, a wider tonal range and/or less grainy images.

Making the ferric chloride diffuse further into the gum might also result in a less robust image. But the image is currently very robust, so we can surely exchange some of this robustness for a thicker relief.

So how could we make the ferric chloride fix more gum? Well I don't know at the moment but a solution is surely worth pursuing. I can see two ways forward. One way would be to modify the gum (and/or the sensitiser) by adding all kinds of chemicals to them, and just see what happens. Another way would be to try to understand why the relief in the gum is the thickness it is, and then work out how to change it.

The 'try anything' approach

It is fairly quick to test all kinds of chemicals. In the past I have done this as follows (forgive me for 'teaching my grandmother to suck eggs' but this method is well tried).

- (1) Make a consistent line with ferric chloride solution along the middle of a strip of paper and dry.
- (2) Pour a little gum onto one end of this line and smear it across the line, back and forth. Sweep any excess gum off the edge of the paper after 10 seconds to prevent it running over the rest of the strip. (I do this smearing and sweeping with my finger!)
- (3) Add the test chemical to a small amount of gum and smear it across the line further along.
- (4) Compare the thickness of the relief and proceed to the next chemical.
- (5) Wash away all the soft gum and compare the thickness of all the reliefs again.

I tried this with calcium chloride, table salt and sodium sulfate yesterday. There was some indication that the calcium chloride and table salt increased the thickness of the relief. But they also seemed to stay wet much longer. These salts are hygroscopic of course, so it is possible that water was being pulled into the relief and this might have distorted the results. The sodium sulfate appeared to reduce the thickness of the relief.

The 'understanding why things are as they are' approach

Why does the ferric chloride diffuse into the moving gum and fix the relief in the thickness that it does? Why doesn't it just react with the gum at the point of entry and fix hardly any thickness?

I think we can imagine two possibilities.

Imagine the gum is like a crowd of people, each with two hands free. And imagine the ferric chloride is like a person with a bag full of balls.

Possibility A is that the 'ferric' person moves into the crowd slowly and puts a ball into every hand he comes to before moving further into the crowd.

Possibility B is that the 'ferric' man moves into the crowd quickly and puts the balls into any hand in a random manner.

So what is the point of these imaginings?

If possibility A is true then the way to get a thicker relief in the gum would be to reduce the places where crosslinks can form. This would be the equivalent of getting everyone in the crowd to put one hand in their pocket!

If possibility B is true then the way to get a thicker relief in the gum would be to slow down the rate of crosslink formation. This would be the equivalent of getting the 'ferric' man to hand out his balls more slowly whilst continuing to move through the crowd at the same rate!

And so

No doubt we have numerous chemicals between us if we want to try the first approach and we probably have various pieces of evidence which would lead us to favour one or other of the two possibilities described above if we want to.

Frank and/or Katherine's scientific family might also be able to help us with some ideas about how to reduce the places where crosslinks can form or how to slow down the rate of crosslink formation.

Michael



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Joined: 19 Oct 2010
Posts: 52

Katherine,

I have always found that getting 10 steps out of a gum print while preserving a good density range, challenging. It may be the gum I use, the paper etc. Personally, I find this ferric gum process a little more forgiving in this regard.

In regards to exposure speed, in actual fact, the exposure time does in fact drop when less sensitizer is used or it is diluted. For me, a diluted coating may expose in 30 minutes versus a more heavily applied (or richer sensitizer) taking 60-80 minutes under a UVA lamp set. I suspect that the light just "burns" through the ferric chloride faster because there is less of it to convert to the ferrous form.

As you point out, stain can mean different things so I will be more specific here; I have found the gritty tones to be more prevalent when I acidified the sensitizer with HCl so my suspicion is that it "may" be causing this problem for you as well.

=====

A theory on the density curve in ferric gum, by a thought experiment:

Now I want to throw out a theory based on some observations from one of my step wedge tests. I have it uploaded, so you can view it as print 10.

<http://picasaweb.google.com/pgfriedrichsen/FerricGumProcess#>

First off, I see about 10 steps, but the last two are very close in value and I don't think the scanner can differentiate them very well. Notice how, as each steps gets successively darker from the left, the difference in density becomes less and less until that difference becomes indiscernible for the last 11 steps.

We pretty well know that it is ferric something, lets call these ferric units that make the gum hold pigment and therefore represent density, and ferrous units represent no gum i.e. no density. We will start with 1000 ferric units. I will represent every other step of the step wedge, in the exposure chart below. Every other step= one stop, or 50% reduction in light going from left to right

Based on a linear model assumption of ferrous units= degree of exposure, and ferric units=density, we have the following:

Conditions: 1 on the step wedge = full exposure.

step wedge No.----Ferrous units----Ferric units=Density (linear)----Appearance

1-----	1000-----	0-----	white
3-----	500-----	500-----	grey
5-----	250-----	750-----	
7-----	125-----	875-----	
9-----	62.5-----	937-----	near black
11-----	31.75-----	968-----	
13-----	15.8-----	984-----	
....			

What I think is happening is the scale is getting severely compressed. For instance, jumping from step 9 to 11 should yield a percent change of 50% in terms of density but in fact we get only a change of about 10%. Now, if I were to plot the exposure curve, it would start as a straight line going up and to the right in a typical graph where (Y) is density, and (x) is exposure time, then tail off in a quasi-logarithmic fashion. I would also expect that the relief of the gum layer would also follow a similar shape if we could actually see it.

I think it is an outcome of our particular process. In fact, it makes sense that any process that has the non-

light affected units doing the work of image creation will suffer from this as these units start to outnumber the light affecting units in less exposed areas and I can't see a way around it right now other than curve compensation in a positive film. In the carbon process, all non-light affecting units get washed off of the image in development so they would not affect the exposure curve.

I suspect that a compensating curve could be done in software.

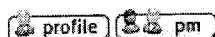
I know that one critical requirement that must be met in order to make a compensating curve work properly is that the exposure must be precise otherwise the curve of the transparency and that of the process will be shifted "out of alignment" Fortunately with this process, we can judge exposure as it goes, a luxury not afforded to the gum bichromate process.

Any thoughts on this? On curve compensation?

Ill revisit Micheal's ideas in his last post but I think we need to understand what is happening first.

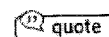
Peter

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Botanic88

Posted: Fri Nov 26, 2010 10:49 am



Hi all

Joined: 14 Aug 2010
Posts: 50

Re. the question about whether less sensitiser requires a shorter or longer exposure. Remember this is a positive working process, so the exposure needs to be just sufficient to convert all (or most) of the sensitiser in the highlights. It seems obvious that a large amount of sensitiser would require a long exposure.

Re. one kind of stain.

Quote:

As you point out, stain can mean different things so I will be more specific here; I have found the gritty tones to be more prevalent when I acidified the sensitizer with HCl so my suspicion is that it "may" be causing this problem for you as well.

I think Katherine sizes her paper and this could make a difference. I have found that too much HCL damages the paper surface somewhat, so this might account for grittiness in Peter's prints.

Re. some possible misunderstandings in your thought experiment, Peter.

Quote:

We pretty well know that it is ferric something, lets call these ferric units that make the gum hold pigment and therefore represent density ...

In Gum Bichromate the gum is made to hold more or less pigment depending on the exposure (I have recently been led to believe). But the situation is quite different with Ferric Gum. In this process the ferric chloride rises up through the moving gum, forming a fixed relief as it goes. You might not notice this relief if you use lots of pigment, but it is there! This doesn't invalidate the thought experiment but I think we need to understand this difference in order to develop the process successfully.

Quote:

Conditions: 1 on the step wedge = full exposure.

step wedge No.----Ferrous units----Ferric units=Density (linear)----Appearance

1	-----1000	-----0	-----white
3	-----500	-----500	-----grey
5	-----250	-----750	
7	-----125	-----875	
9	-----62.5	-----937	-----near black

11-----31.75-----968
 13-----15.8-----984

I imagine these figures would be correct for a negative working process, provided the reservoir of sensitizer remains fairly constant. In that case doubling the exposure would double the amount of chemical produced.

But the situation is more complicated with positive working processes I think. Surely the rate of the photo-reaction depends on the amount of sensitizer present, as well as on the exposure. Less sensitizer would give a lower reaction rate. At the extreme where most of the sensitizer has been converted the reaction rate would be fairly low.

Also your thought experiment assumes that the visual density is in linear proportion to the amount of ferric units. This assumes in turn that the amount of fixed 'gum and pigment' is in linear proportion to the amount of ferric units, and it may assume other things as well. These assumptions may be invalid, especially since the diffusion of the sensitizer through the gum is involved and goodness knows what else besides!

All the same I am very much in favour of thought experiments. So it would be worthwhile to take account of the reducing amount of sensitizer. Then it would be interesting to see what discrepancies remained between the model and your actual prints.

I look forward to your thoughts about my earlier thought experiment, Peter.

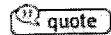
Michael

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pgum

Posted: Fri Nov 26, 2010 6:08 pm



Another long post!...

Joined: 19 Oct 2010
 Posts: 52

I thought that I would spend an hour to plot out how the relief would look for both the ferric gum and carbon processes, given the assumption that density is proportional to the relief thickness, that is, doubling the relief thickness doubles the density of the image. It also assumes that the relief thickness is proportional to the amount of unexposed ferric salt, and in the case of carbon, to the amount of exposed dichromate.

You can look at my plots under Print 11:
<http://picasaweb.google.com/pgfriedrichsen/FerricGumProcess#>

Note: Pigment thickness on the Y axis should read Gum thickness (the relief)

Plot 1

In the carbon process, the relief thickness falls off exponentially with the reduction in light based on the number of stops. If the relief thickness axis was changed to logarithmic density, the line would go straight, which is typical of a carbon print if we ignore the end points where there will be a toe and shoulder in the real world. The effect is to provide a fairly long scale that is relatively "linear" to the eye's logarithmic scale.

Gum Bichromates produce the same relief, but after the development in water, all havoc breaks loose because the relief is inverted, and water undercuts the bottom of the relief which results in a much shorter scale.

Plot 2, 3

The hardened gum due to ferric dominates the scale as we go to the right and essentially wipes out any effect that the ferrous (light exposed) has on affecting the density. The result, if we flip the relief back on its head (Plot 3) is a scale that is logarithmic. If we now applied a log density scale, it would show even more compression resulting in a very compressed curve going to the right.

I hope that helps to convey what I think is going on.

Michael,

Yes, the ferric is diffusing up through the gum, but after the diffusion is complete, the relief thickness should be a fairly linear function of the ferric concentration I would think. If it is not, then it will likely act to compress the scale further as I can't see it actually going in the other direction to expand it because then, it would not be self limiting. Regarding relief; I have seen relief, especially when wet. On a couple of my prints, I attempted multiple coats and the relief, when the gum was wet and swollen was dramatic- I am guessing about 0.25 mm. If it were metal, I could have used it as a stamp!

Your quote:

Quote:

I imagine these figures would be correct for a negative working process, provided the reservoir of sensitizer remains fairly constant. In that case doubling the exposure would double the amount of chemical produced.

But the situation is more complicated with positive working processes I think. Surely the rate of the photo-reaction depends on the amount of sensitizer present, as well as on the exposure. Less sensitizer would give a lower reaction rate. At the extreme where most of the sensitizer has been converted the reaction rate would be fairly low.

I believe that the effect of light on the sensitizer should be the same for both a negative and positive process. Your point regarding the more sensitizer that gets converted, the slower it will go may be true but remember that although it is slower, there is also less of it left to convert. Regardless, the effect of something like this slowing down would only help us in the highlights. I don't see this effect coming into play on the right side of the scale (less exposed) because there is a surplus of ferric chloride and all of the light will be doing work until it gets near exhaustion.

Regarding your earlier post:

I found that a heavier relief is directly related to the amount of ferric chloride on the paper. In a test, I applied a heavy coat and exposed it for about 50% longer than my usual time. I then submerged the test strip in gum/pigment for about a minute (probably excessive). The result was that the darker regions were very dense and black from the lampblack pigment, and the relief was easy to see when wet but unfortunately just a slightly shorter scale. I haven't given much thought as to why that may be. The scale also suffered from heavy compression in dark areas, as suspected based on what I believe is going on.

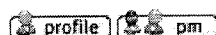
Re Calcium Chloride

I found that it did intensify my test strips somewhat. It also seems to reduce staining of the paper when I have a high pigment load in the gum but I have no idea how it is doing any of this.

FYI I was able to make a three colour print using this process. I didn't turn out too badly for an early attempt. Sometime I will post it, with some notes on what worked and what did not, but for now, time has run out.

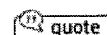
Peter

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Botanic88

Posted: Sat Nov 27, 2010 12:10 pm



Hi Peter

Thanks for doing your plots.

Joined: 14 Aug 2010

Posts: 50

Part of me thinks our process has too many variables to calculate properly. So we should just do the process and see what the tonal ranges actually look like. But another part of me likes playing with numbers, so I shall indulge this second part today!

Re. my idea that the reduced amount of sensitiser would slow the reaction down, especially in the highlights. I made a fairly complex spreadsheet to show the situation, at least approximately (I used 1/4 stops to make it fairly accurate).

I assumed that all the light would be effective down to 293 'ferric units' and that below this figure the effective light would be reduced by the number of 'ferric units' divided by 293 (some light would go right through the sensitiser). I also assumed that the print would be 'fully exposed' when there were only 6 'ferric units' left.

The results showed pretty much what you said they would, especially in all the dark stops. However they also showed that the exposure would need to be doubled (two more stops) to reduce the 'ferric units' down to 6.

In effect the table is the same as yours, except that it starts at stop 15 instead of 13. Then stop 5 corresponds to 500 'ferric units'. Stop 3 corresponds to 95 'ferric units' and stop 1 corresponds to 6 'ferric units'.

This doesn't alter your main conclusions, but I enjoyed doing the work 😊

Quote:

... plot out how the relief would look for both the ferric gum and carbon processes, given the assumption that density is proportional to the relief thickness, that is, doubling the relief thickness doubles the density of the image. It also assumes that the relief thickness is proportional to the amount of unexposed ferric salt, and in the case of carbon, to the amount of exposed dichromate.

Okay, I have a problem with your assumptions here but, given that your conclusions about the carbon process match mine, there may just be a misunderstanding!

Assume we measure the exposures such that each unit represents double the previous exposure (logarithmic). Also assume that we measure the relief thickness in units such that a relief of 'unit thickness' would exactly halve any light transmitted through it. (In practice the light is reflected back from the paper but I want to ignore this complexity!)

It seems clear to me that the exposure scale would be logarithmic but the thickness scale would be linear (each unit of thickness would be the same number of microns). Fortunately the situation is reversed when light is projected through the finished relief. Each extra unit of thickness would halve the light transmitted through the relief. So one extra (linear) unit of thickness would correspond to one less (logarithmic) unit of light.

As I say there may just be a misunderstanding here. This may be what you are actually saying!

However you also assume that the relief thickness is proportional to the amount of unexposed ferric salt. I think the truth of this assumption depends very much on how the ferric salt diffuses through the gum.

Suppose the salt diffuses slowly, making every crosslink with the gum it can. In this case the amount of ferric salt and the thickness of the relief would be in linear proportion to each other. Twice as much salt would fix twice as much thickness, etc. This matches your assumption I think. But it doesn't match my picture of the carbon relief, where one scale is logarithmic and the other is linear.

But suppose the salt diffuses through the gum in a 'concentration gradient'. So there would be (nearly) no salt at the furthest point; the full concentration at the paper surface; and half the concentration half way between.

This would certainly give different results. I think it might result in a logarithmic scale for the amounts of ferric salt and a linear scale for the thickness of the relief.

Correction

No this isn't right! I'm not sure what the scales would be with a 'concentration gradient' but they certainly wouldn't be linear. I'll have to think about it.


Michael

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pgum

Posted: Mon Nov 29, 2010 3:29 am

 [quote](#)

Michael,



Joined: 19 Oct 2010
Posts: 52

The suggestion that the thickness of the relief affects the reflected light level in a logarithmic fashion makes some sense. It has been described as Beer's law and it is a log function of the path length of light (again ignoring reflection). Regardless of it being log or linear, the practical problem remains in getting better shadow detail as I think that the earlier analysis holds up irrespective of these other assumptions.

It would be nice to understand all that is going on and I think we have some good ideas but perhaps a move back to some practical tests may show that a solution can be offered through curve compensation or at the minimum, provide some valuable feedback from the results.

Peter

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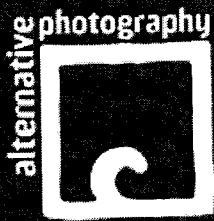
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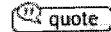
Author

Message

< Ferric Gum Process

Botanic88

Posted: Mon Nov 29, 2010 12:47 pm



Joined: 14 Aug 2010
Posts: 50

Peter

Thanks for pointing out Beer's Law. It seems I worked it out essentially for myself. Once one knows that a filter reduces light by a fraction, rather than by an absolute amount, it is easy to work out!

I agree with your thoughts about doing practical work to get better shadow separation. And as you said before, the problem exists for any positive working process, not just Ferric Gum.

Meanwhile I want to do some practical work on the relationship between the amount of ferric chloride and the relief thickness. I hope the results will give us a clue about the dynamics of the relief formation.

I intend to make two series of ferric chloride patches on two strips of paper, each patch having a different concentration. One set will increase in a linear manner and the other set will increase logarithmically. I will brush pigmented gum over each set. Hopefully I will see which set produces the most even tonal changes (as viewed by humans), and therefore which set varies most logarithmically (in physical terms).

If one set does vary in this manner, we may conclude that the changes in relief thickness for that set are linear!

Another matter that may prove to be very practical for us:

In my 1983 article I mentioned that bathing the prints in aluminium chloride solution, after washing, certainly improved them. What it actually did was to stiffen the gum relief which could be quite fragile in water if plenty of oxalate had been used.

This came to mind the other day when I was using some aluminium chloride in a test. So let me tell you how this chemical behaves with gum.

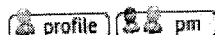
If you add a little aluminium chloride to some gum it behaves somewhat like ferric chloride. However it doesn't fix the gum anywhere near as quickly; the fixing takes seconds to start and minutes to complete. The fixed gum is washable up to a point but not indefinitely.

One thing to try with this chemical might be to use it together with (or following) glyoxal fixing. It might even resist the 'acid removal of ferric compounds' as 'chromium fixing' seemed to do, or it might not.

Also note that when I say 'aluminium chloride' what I mean is a concoction that results when bits of aluminium are left in hydrochloric acid for a few days or weeks. When the result is diluted it tends to be a somewhat milky solution!

Michael

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Katharine Thayer

Posted: Mon Nov 29, 2010 2:53 pm



Question for Peter (and for Frank too):

Joined: 19 Nov 2010
Posts: 44

For the tests you've posted, have you been using a stock mixture of gum with pigment mixed in, so that all the tests are done with the same pigment/gum ratio, or are you mixing the gum/pigment for each test individually?

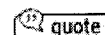
Katharine

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Katharine Thayer

Posted: Mon Nov 29, 2010 5:28 pm



Joined: 19 Nov 2010
Posts: 44

After my holiday company left yesterday, I printed out this thread (a big stack of paper!) and poured a cup of tea and settled down with my feet up to read through it. A few comments, in no particular order except as they come to mind:

Compensation Curve: Yes, of course you can redistribute the tones within the range of your particular process by using a curve. I recommend ChartThrob for generating curves; I don't have a link but I expect you could find it by googling ChartThrob. The software builds a curve from a positive 100-step chart, printed in your process; I'm unsure if it would work the same for a positive process or whether you'd need to invert it, but no doubt you can figure that out.

Stain: From the ensuing comments, I would say I've not been able to make myself clear about stain. Yes, stain can mean different things, but none of the meanings of stain include a gritty texture in tonal areas. The way you can tell the difference is, pigment stain covers the entire area that was coated with gum/pigment, including places that should be paper white in the image. The grittiness of tone I'm talking about only appears where there *should* be tone and doesn't occur where the image calls for a white or near-white tone; in other words unlike stain, it appears only in areas where there is tone in the original image; it's a function of image formation, which stain is not.

Stain: some illustrative examples: Peter's Print 5, on untreated Fabriano, has both pigment stain and iron stain. Peter's print 6, on acid-treated Fabriano, has only pigment stain. The prints on Arches Aquarelle have iron stain except where they are treated to remove the iron stain, but none of these prints (at least as discernable from the electronic reproduction) have pigment stain. They do, however, have some mottling in the tonal areas (the fact that there is no mottling on Step 1 precludes labeling this "stain.") Of the portraits I posted, the one on the left may possibly have some pigment stain, maybe because of the exceptional length of time it took (about 45 minutes) to wash the very deep layer of heavily pigmented gum off the print, although the white of her eye still looks pretty clear. The print in the middle is a better one to judge by, since a more typical layer of gum/pigment was used (the pigment concentration per unit gum was the same in both cases). On that one, there is definitely no pigment stain, but a serious grittiness in the tones, especially apparent in the lighter tones, but nonexistent in the areas where the image calls for white. The pictures Frank posted, there's a mottling in the skin tones, but that may be at least partly, if not wholly, the texture of the paper showing in the print (I take it your Arches Aquarelle is cold pressed or rough, not hot pressed.)

Glyoxal hardening: Both Peter and I demonstrated that if a ferric gum image is coated with glyoxal (which is allowed to "cure" overnight) then briefly treated with acid and rinsed, the ferric gum is protected from being dissolved by the acid. Peter demonstrated that at the same time, iron stain was removed by the acid, but since I didn't have any iron stain, I couldn't test that part, I could only demonstrate that where the glyoxal was absent, the acid completely dissolved the gum; where the glyoxal was present, the gum was left intact. I think these tests are quite promising for the use of glyoxal to protect the gum while removing the iron stain. There was a lot of speculation about the glyoxal-crosslinked gum becoming unstable as a result of acidity in the glyoxal, or some such, but I'm inclined to think that was a red herring because I haven't been able to find anything in the literature to indicate that it's a legitimate concern.

Peter also demonstrated that if the glyoxal-treated ferric gum image is left in the acid for longer periods of time, the image eventually dissolves, the length of time to dissolution depending on the strength of the glyoxal solution, but since these durations of acid treatment are many multiples of the short time required to remove the iron stain, I don't understand why it's necessary or useful to test these extended times. If you leave almost anything in acid for a long time, the acid will affect it; extended treatment in acid is surely going to compromise the permanence of the paper. and I guess I'm not sure what the point is in risking that.

Peter also tested treating the gum with acid and then putting it in water, but it's not clear how long the gum was treated with the acid, nor how much the acid was rinsed off, if at all, before being put in the water. So I'm not sure what to make of that condition; on one hand it does seem a bit troubling that being put in water seems to make the gum dissolve faster after acid treatment than just being left in acid for long periods of time, but on the other hand the times are all well beyond the amount of time you'd need to acid-treat the stain and rinse the acid out well, so again, I'm not understanding the rationale for this part.

Guess that's all the thoughts I have time for just now, but there's more coming.
Katharine


Last edited by Katharine Thayer on Mon Nov 29, 2010 7:48 pm; edited 3 times in total

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Katharine Thayer

□ Posted: Mon Nov 29, 2010 6:12 pm

 [quote](#)

Ferric chloride concentration and speed:

Joined: 19 Nov 2010
Posts: 44

Yesterday when the sun came out for a bit I diluted a bit of ferric chloride to see if it bleaches faster diluted (I was fairly well convinced by the arguments but I always have to see a thing for myself) but as soon as I coated some paper with it the sun went behind a heavy cloud and stayed there, so I couldn't compare the times. However, Frank's pictures tell the story. It looks like 1M is about right at one hour but an hour is way too long for .5M, which made the print too light, and an hour is too short for 2M, making it much too dark. So okay, I'm on board with that point.


Katharine

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Katharine Thayer

□ Posted: Mon Nov 29, 2010 7:34 pm

 [quote](#)

Botanic88 wrote:

Joined: 19 Nov 2010
Posts: 44

In Gum Bichromate the gum is made to hold more or less pigment depending on the exposure (I have recently been led to believe).

Well, yes and no. I'd say it a different way. With more exposure (to a point), more gum is hardened; if more gum is hardened, the amount of pigment suspended in that extra gum is trapped when the gum is crosslinked. So the important fact here is that more exposure (to a point) hardens more gum, and that additional gum happens, incidentally, to have pigment in it. Which isn't the same as "the gum is made to hold more...pigment;" I may be misreading but that seems to be saying that by exposing it more, a given amount of gum somehow is "made to hold more pigment" which is not what's happening. Hope that makes sense,

Katharine

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pgum

□ Posted: Tue Nov 30, 2010 12:10 am

 [quote](#)

All,

Joined: 19 Oct 2010
Posts: 52

First I want to pass on a little test I did re the gelling of the gum with ferric chloride.

In a small glass container I placed about 1 cm of silica sand in the bottom, then saturated it with ferric chloride (66% w/v) but not enough to puddle- just enough to fill the voids. I then poured about a 5 cm depth of 30% w/v gum arabic solution over top and left it from last Friday until today (2.5 days). The sand is there to keep the ferric chloride from mixing due to convection and in the pouring of the gum solution.

On Saturday, the gel layer was about 5mm thick, and this morning it was up to about 12 mm. The colour

was darkest at the interface and was lighter, the further away and un-gelled gum remained closer to the top.

I think this demonstrates that the diffusion is rapid for the thicknesses we are dealing with.

Katherine,

The tests I have been doing have all used the same gum solution strength but the pigment strength may vary somewhat. I do not measure the pigments, but rather I will lay a brush mark on a white ceramic counter top for judgment. I don't have a weigh scale that goes down to milligrams, so that is out, and I don't find volume measurements to be too repeatable in the small quantities that I mix up. The pigment I have been using is lamp black and it is in the form of a dry pigment with very neutral shades. I find that with this particular pigment, the pigment load can not be too excessive or the paper will stain.

Quote:

Peter also tested treating the gum with acid and then putting it in water, but it's not clear how long the gum was treated with the acid, nor how much the acid was rinsed off, if at all, before being put in the water.

In the test you refer to, the strips were placed in the acid bath of 1% bisulfate w/v for 5 minutes, then rinsed under running water for about a 30 seconds, then placed into plain tap water.

Re. glyoxal

I tend to agree with. Yes, there is sufficient time to clear the print with a bath concentration of 2% or more. I haven't tested to see if the "brush on" approach that you use will be sufficient but I hope so as it will certainly use less of the glyoxal.

FYI I attempted a tricolour print, and used the 2% glyoxal bath treatment. It was sufficient for the iron clearing (5 mins) and rinse (5 mins) that followed, as I hope you will see (for comment) in a future post.

Thanks for mentioning Chartthrob. I have the plugin working, so it is something else to try.

Michael,

Re the patch test:



Watch out for buffers in the paper however small. The Arches watercolour hot pressed that I am using has a small amount of buffer, so I have discovered. It is much less than the Fabriano hot pressed paper but it may be enough to neutralize some of the ferric chloride when a low concentration is applied. This of course may not apply to the paper you are using.

Re aluminum chloride:

I think it is still worth looking into as an alternative to the other hardeners, so I am all for a little experimentation.


Peter

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Katharine Thayer

Posted: Tue Nov 30, 2010 1:14 am

 [quote](#)

This thread reminds me of the old story about the blind men and the elephant. We've each got hold of a different piece of this elephant and trying to figure out what it is.

Joined: 19 Nov 2010
Posts: 44

Thanks Peter, that's as I thought; the tests wouldn't have made sense to me otherwise. Mixing by eye is a good way to mix gum and pigment; it's the way I do it after all, and I agree that you're more likely to get wide variations by trying to measure very small amounts precisely, than by just going by the color. However, blacks can be tricky, especially a strong pigment like lamp black which doesn't take much pigment to make a good black; a difference that's indistinguishable in the mix can show up in the printing. It's not material to the discussion, but it helps me understand what I'm looking at, thanks.

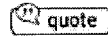
katharine

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pgum

Posted: Tue Nov 30, 2010 3:57 am



I don't mean to be jumping ahead here doing multiple layers but the reasoning is this: Multiple layer capability is important to me and it is one of the criteria that this process must pass if I am to consider using this for print making. I will pass on what worked and what didn't. The good news is that it can be done. ☺

Joined: 19 Oct 2010
Posts: 52

Attempt #1

Print layer order MYC (print not shown)

Problems with first print:

1- sensitizer caused smearing of first layer

The sensitizer brushed on quite nicely but once I got back to the top of the print to smooth it out, pigment streaks started to show up in the margins. It appears that the sensitizer was dissolving some of the first layer. I remedied this later by brushing on a 2% glyoxal sol., letting it dry for an hour and then applying the sensitizer after which there was no noticeable streaking.

2 -third (top layer) wouldn't adhere

I think the lower gum layers were too thick. The surface was glossy by the second layer, and when wet, the relief was so significant that it looked like a metal stamp. The paper fibers looked to be buried. When I applied the gum/pigment, it beaded on the surface so I washed it off and then wrapped the print in a moist cloth for about 15 minutes and tried again. It coated smoothly this time but washed off in development. Can gum stick to itself without paper tooth?

Attempt #2

Print layer order CYM

Both Prints are 4" x 4"

Print 13 -Indian Paintbrush-iron stain still in paper

Print 14- Indian Paintbrush-iron stain removed and final glyoxal treatment applied

Link:

<http://picasaweb.google.com/pgfriedrichsen/FerricGumProcess#>

In order to reduce the gum thickness, I decided to reduce the amount of sensitizer by about 30%. I did this by diluting the sensitizer with additional water. I didn't want to mess with the gum/pigment mix I had made for the first attempt.

I applied glyoxal after the first layer but only left it for 30 minutes. I found some slight smearing, so one hour drying @2% is sufficient. After the second layer, the glyoxal was left on for an hour and there was no pigment streaking.

The third layer went on without any adhesion problems, and the total gum thickness was much less than with the first print. There appeared to be some speckling of the magenta pigment on this top coat-perhaps Katherine has seen this with gum bichromate. The paper when dried has a very slight gloss and the paper fibers are still visible on the surface.

After the print was fully dried, I bathed it in 2% glyoxal for about 2 minutes and hung it up to dry. I considered brushing the glyoxal on but wasn't sure if it would be effective enough for the acid bath; I was playing it safe to ensure that the print would survive. The next day I did the 5 and 5 acid/rinse and it dried down without damage.

Generally I think it turned out reasonably well for a second attempt. Surprisingly I prefer the iron stained print #13 over #14 because of its warm cast, and in actual fact, I brushed a weak orange wash over it after missing the warm look. I didn't scan the final print but it looks now to be somewhere in between the two in terms of this warm cast.


Peter

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Katharine Thayer

📅 Posted: Tue Nov 30, 2010 5:13 am

 [quote](#)

Wow, Peter. Frankly I wasn't expecting much from a first attempt at a tricolor print using a process none of us have managed to print a very great monochrome with yet, but you've knocked my socks off. I wouldn't compare it to a tricolor gum print, but it's not a tricolor gum print, it's its own thing and has its own charms.

Joined: 19 Nov 2010
Posts: 44

And I'm with you, I kind of like the more muted one as well.

As to magenta being difficult to coat, I've heard a lot of talk in gum circles about this but have never experienced it myself. I don't know if that's because I apply YMC instead of CMY as many do. What most people complain of is what we call "fish eyes" where the gum/pigment seems to pull away from the underlying layer. Usually brushing vigorously until it smooths out does the job. Here of course I'm talking about the gum bichromate process; whether it works the same way here I couldn't say.

Can gum stick to itself without any tooth to hang onto? I've never seen it to be so. For example, when I've printed on glass or yupo (a plastic sheet coated for painting) I've never been able to print more than one layer, or two at the most, and two only when the layers deposit in different areas of the print so that there's only one layer over most of the print, though that layer is different colors in different parts.

I'm tired tonight but will look over your post more carefully in the morning and maybe make another brief comment or two then. Meantime, Kudos!


Katharine

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Botanic88

📅 Posted: Tue Nov 30, 2010 2:06 pm

 [quote](#)

Hi all

Joined: 14 Aug 2010
Posts: 50

Peter said

Quote:

Generally I think it turned out reasonably well for a second attempt. Surprisingly I prefer the iron stained print #13 over #14 because of its warm cast

Yes it did turn out reasonably well, and then some! So you have made the first tricolour prints with Ferric Gum 🧐

A word of caution: the iron stained print will almost certainly look much more rusty after a year or five. It may be possible to prevent this happening by very thorough washing but I wouldn't put money on it.

Re. the second application of sensitiser smearing the first layer of gum. This is likely to happen because the acid level necessary to keep the ferric chloride okay is likely to be enough to undo the 'ferric fixing' of the first layer.

The 'additional fixing' method you have used makes sense. You could try an additional fixing with aluminium chloride instead of glyoxal (it would be much quicker if it works). Another solution might be to apply the

sensitiser in a different way; spraying might be possible but questionable when oxalates are involved. A third solution might be to rely on the acid concentration of the sensitiser being slightly less when it's wet than when it's dry. This might be possible but it seems precarious!

Re. gum sticking to gum. Katherine's experience is far greater than mine here, but let me say a couple of things anyway.

The gum certainly sticks to a smooth coat of gelatine on glass (no tooth involved). I thought it stuck to a smooth coat of gum on glass, but I'm not certain now.

One factor that is different from 'dichromate fixing' in our process is that the sensitiser can unfix the surface of the lower layer of gum, as you have discovered. Obviously we don't want this to occur too much, but a little unfixing might be just enough to allow the second layer of gum to meld with the first (making tooth unnecessary).

+++++

Quote:

On Saturday, the gel layer was about 5mm thick, and this morning it was up to about 12 mm. The colour was darkest at the interface and was lighter, the further away and un-gelled gum remained closer to the top.

I think this demonstrates that the diffusion is rapid for the thicknesses we are dealing with.
Nice experiment Peter!

I think it has other things to say as well. E.g. it suggests that there is a 'concentration gradient' of iron compounds as one would expect. But if the fixing turns out to be linear (therefore even throughout the depth of the relief) then there will be some things to explain!

I imagine the height of the 'fixed gum' corresponded with the height of the colour change. However it might not have done. If there is enough acid around I have often seen fixing occur before any changes in colour. Do you remember how high the fixing reached, Peter?

Re. my patch tests and 'buffer' in the paper. I am still using my 25 year old paper, so this is probably not an issue.

Some of the ferric chloride will be lost in stain in the paper surface anyway (it tends to be more as the concentration increases). I hope the results will be sufficiently unambiguous to tell us what is going on despite this. There will also be some iron stain in the gum layer itself but this should be the same in all parts of the gum (given that we are dealing with thin layers) so this stain should just add to the pigment.

I did a first test yesterday but there was too much pigment to see what had happened. It was the first time I have added pigment to the gum in years.

Michael

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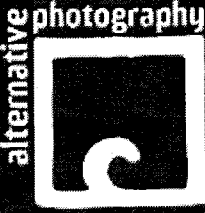


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< Ferric Gum Process	
Katharine Thayer Joined: 19 Nov 2010 Posts: 44	<div>Posted: Tue Nov 30, 2010 3:40 pm</div> <div>quote</div> <p>[Rant about gum sticking to gelatin removed as a distraction , since it was based on a misunderstanding; I was talking about gum bichromate and Michael was talking about ferric gum.]</p> <p><i>Last edited by Katharine Thayer on Tue Nov 30, 2010 4:54 pm; edited 1 time in total</i></p> <div>Back to top</div> <div>profile pm www</div>
Botanic88 Joined: 14 Aug 2010 Posts: 50	<div>Posted: Tue Nov 30, 2010 4:25 pm</div> <div>quote</div> <p>Katherine</p> <p>Okay, I'll rephrase what I meant about gum sticking to a gelatine coat on glass. I was speaking in the context of the Ferric Gum process, not in the context of Gum Bichromate. Clearly what sticks in one process may not stick in another.</p> <p>Gelatine was coated on glass (the gelatine was probably hardened using dichromate to withstand the acid level that would be required). Then acidified ferric chloride (plus oxalate probably) was applied to the gelatine and dried. This sensitised gelatine was exposed. Then pigmented gum was brushed over the gelatine. The unhardened gum was washed off and the resulting print was allowed to dry. It was not a very good print and it was heavily stained. Nevertheless the gum stuck to the gelatine!</p> <p>Please forgive me when I say 'probably' but I cannot remember every detail after 25 years.</p> <p>There is a remote possibilty that my memory is so faulty that it didn't work with gelatine coated on glass, but in that case it certainly worked with gum coated on glass. I tried both at the time and it certainly worked with one of them if not both! So the gum either stuck to gelatine without any tooth or it stuck to gum without any tooth.</p> <p>Michael</p> <div>Back to top</div> <div>profile pm</div>
Katharine Thayer Joined: 19 Nov 2010 Posts: 44	<div>Posted: Tue Nov 30, 2010 4:52 pm</div> <div>quote</div> <p>Botanic88 wrote:</p> <p>Katherine</p> <p>Okay, I'll rephrase what I meant about gum sticking to a gelatine coat on glass. I was speaking in the context of the Ferric Gum process, not in the context of Gum Bichromate. Clearly what sticks in one process may not stick in another.</p> <p>Okay, fair enough. But you were responding to my comments, where I was answering Peter's question addressed to me, and it was clear that the question was asked and answered in the context of gum</p>


bichromate (and I even said in that post that I couldn't say whether my observations would be relevant to ferric gum). You didn't mention in your response that you were speaking of ferric gum, not gum bichromate; it would have been helpful to do so. I'm quite willing to believe that ferric-fixed gum sticks to gelatin, but you just said "gum" not ferric-fixed gum, which is a different animal as far as I'm concerned. I apologize for the rant, and may even remove it, since it's a distraction.
Katharine

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pgum

Posted: Wed Dec 01, 2010 1:04 am

 [quote](#)

Joined: 19 Oct 2010
Posts: 52

Gum over gum that has been glyoxal hardened will not adhere in the ferric gum system as it currently exists, and Katherine points out that this problem also plagues gum bichromate. I am comfortable with these "facts". Michael, it seems like you observed some adhesion but as you say, you are not sure if it was gelatine or gum. I think it may be safest to assume no adhesion until it can be checked once again.

Now that we are on the topic of adhesion, I was thinking that there may be an outside chance that shellac may work as an intermediate. I mean it is one of the best primers for water based paints. I am also thinking of this as a potential sealer prior to applying the sensitizer and the idea here is to immobilize the gum instead of having to fix it with glyoxal on each layer. Katherine, did you ever have a chance to try shellac in your search for gum adhesion promoters in gum-on-gum or gum-on-glass, in the gum bichromate process? I don't want to waste time on this if you already know that it will fail.

There is one issues that I failed to mention in the tricolour print process. Upon brushing on glyoxal to harden a layer before re-sensitizing for the next layer, I noticed that some of the pigment and perhaps gum with it, would end up on the brush and leave streaks. The streaking is light, but potentially visible in the highlights. BTW It is not nearly as significant as the streaking caused by the sensitizer before glyoxal hardening. I still find it annoying however, so this question goes out to Katherine. Has this ever been an issue for you in the gum bichromate process?

Quote:



Do you remember how high the fixing reached, Peter?

Michael,

The 12 mm (Friday-Monday) I referred to was the thickness of the gelation zone. There was liquid gum above this.


Peter

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Botanic88

Posted: Wed Dec 01, 2010 11:41 am

 [quote](#)

Hi all

Joined: 14 Aug 2010
Posts: 50

I am not very familiar with posting on forums, so please let me try to clear up a misunderstanding that seems to be happening.

Katherine said

Quote:

Okay, fair enough. But you were responding to my comments, where I was answering Peter's question addressed to me, and it was clear that the question was asked and answered in the context of gum bichromate

Well no, there is only one 'post reply' button on the thread and I thought I was replying to Peter's question directly. Also Peter didn't appear to say his question was addressed to Katherine unless one assumes that every post is a reply to the one immediately before it. So perhaps I am getting something wrong. Is there

some forum etiquette I don't know about?

It also seems to me that we have a number of resources to help us develop this process. Clearly Katherine has by far the greatest experience of gum, paper and science in the Gum Bichromate context, and this will often be relevant. I have several years experience trying to make Ferric Gum (and its 'cousins') do certain things. But my experience was slow-going and it relies on 25 year old memories. Frank's experience and knowledge is largely in biochemistry. Then we have our practical experiments and Peter is being very proactive here. Obviously each of us will pay whatever attention we choose to each other's experiences but I think it would be a shame to ignore or devalue any one of them.

Now to questions about gum adhesion.

Peter said

Quote:

Michael, it seems like you observed some adhesion but as you say, you are not sure if it was gelatine or gum. I think it may be safest to assume no adhesion until it can be checked once again.

Okay, but I wouldn't hurry to rule out the possibility of gum/gelatine or gum/gum adhesion with Ferric Gum. One of my prints on glass was kicking around in the cellar for a decade or more.

Peter said

Quote:

Now that we are on the topic of adhesion, I was thinking that there may be an outside chance that shellac may work as an intermediate. I mean it is one of the best primers for water based paints. I am also thinking of this as a potential sealer prior to applying the sensitizer and the idea here is to immobilize the gum instead of having to fix it with glyoxal on each layer. Katherine, did you ever have a chance to try shellac in your search for gum adhesion promoters in gum-on-gum or gum-on-glass, in the gum bichromate process? I don't want to waste time on this if you already know that it will fail.

Okay, I appreciate that this question is addressed to Katherine. But I do have something to say that could save you some time Peter.

I am almost certain that I tried shellac when I was trying to print on glass. I certainly had a bottle to hand and I also tried things like acrylic medium. None of them worked at the time and my explanation for this was as follows.

The mechanism underlying Ferric Gum involves the water in the gum being able to dissolve the sensitizer rapidly, so that it can diffuse into the gum in a substantial concentration. If the sensitizer is held in a layer of shellac, etc. then I think it won't dissolve rapidly enough for the mechanism to work.

Still on the subject of adhesion, I noticed a paragraph in the article about The Whatmans and Wove Paper that you gave us a link to many posts ago, Peter.

Quote:

Alum would not have become an established component of gelatine size had it not served a very definite function. It was obvious that it had a mordant-like action in bonding the gelatine to the paper (see Note 17);

I appreciate that the context referred to here is very different from ours but the idea that alum and other chemicals involving trivalent metal ions might crosslink from one material to another is interesting. I imagine that this is the kind of thing that may occur with mordanting.

And finally I didn't make myself clear when I asked about your *in vitro* experiment, Peter. Something I particularly wanted to know was whether the height of the fixed gelatine was the same as the height of the colour change.

Michael

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Katharine Thayer

Posted: Wed Dec 01, 2010 1:50 pm



Michael, I don't think there's any issue of forum etiquette here, it was just a complete misunderstanding, for which I take full responsibility. I assumed from this

Joined: 19 Nov 2010
Posts: 44

Botanic88 wrote:

Re. gum sticking to gum. Katherine's experience is far greater than mine here, but let me say a couple of things anyway.

The gum certainly sticks to a smooth coat of gelatine on glass (no tooth involved). I thought it stuck to a smooth coat of gum on glass, but I'm not certain now.

that you were responding to and disagreeing with what I'd said about gum sticking to gum, and I assumed you were responding in the context of gum bichromate. I was certainly wrong on the second point, for which I have already apologized, and it now seems I was wrong on the first point as well, for which I apologize now.

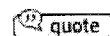
Throughout this discussion, in the essays on this site about ferric gum, and in our private conversation before, a lot of well-worn and long-discredited myths about gum bichromate have been repeated as fact, and since this is a myth that a lot of people who know a little bit about gum bichromate believe, that gum sticks to gum or that gum sticks to gelatin, it looked to me that this was another instance where that myth was being repeated, and I overreacted. I told you once privately that there's a good reason why my website is titled "In Defense of Gum Bichromate": I'm a one-woman public defender's office for my process. In this case, I was wrong; I thought gum bichromate was being falsely accused when it wasn't. I am very very sorry for the disruption caused by the misunderstanding on my part. Okay? Can we be done with this now?

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Botanic88

Posted: Wed Dec 01, 2010 3:16 pm



Katherine

Joined: 14 Aug 2010
Posts: 50

All apologies accepted - no problem 😊

And let me also repeat the apology I made to you privately. Namely that I failed to understand the underlying mechanism of Gum Bichromate when I wrote the articles.

Since making that apology I have tried not to be certain about anything concerning Gum Bichromate. I may hazard a guess at appropriate moments but I am more than happy to be corrected by you!

Furthermore I am trying to be more careful in what I say about Ferric Gum!

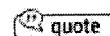
Michael

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Katharine Thayer

Posted: Wed Dec 01, 2010 4:44 pm



Hi All,

Joined: 19 Nov 2010
Posts: 44

I was interested in this process because it was advertised as being able to print a much wider tonal scale than gum bichromate. Since gum bichromate does have a problem of a short range, I had to check it out. Any time anyone says they've found a way to extend gum's short scale without multiple printing, I'm always interested, and so far I've always been disappointed.

So I got interested, and I tried some prints, and I do find the process intriguing, but so far I see no evidence of any wider tonal scale than gum bichromate, and I suspect (here I go again) that the discrepancy between the promise and the actuality may lie in myths about what gum will and will not do. A one-coat gum print,

with the right choice of pigment and pigment concentration, can achieve a print density range of .75-.90 without much trouble, but with little tonal separation or smoothness of gradation in the highlights, and with some grittiness of tone if a very dark pigment and/or heavily pigmented mix is used.

So if this new process could even achieve the same tonal scale as a one-coat gum without the grittiness, I'd be quite interested, and I'd be *really* interested if the process actually achieved a wider scale.

Top-down hardening: I believe that in one or both of the essays, it was suggested that since the ferric gum process works from the bottom up, like carbon, rather from the top down, like gum, it should have the same tonal scale as carbon (around 1.5ish). Michael and I had quite a discussion by email about the conventional wisdom that gum hardens from the top down. This is a matter of controversy in gum circles; a well-respected personage in the alt process world has speculated that gum hardens starting at the paper surface, and others have accepted that speculation as fact, so there are important people in the gum world who think the top-down idea about gum may not be an accurate picture. I don't necessarily agree with them about this, but I think it's important to be aware that it's not universally accepted that gum bichromate hardens from the top down, leaving unhardened gum between the hardened gum and the paper, so I'd caution against starting with this assumption when comparing gum bichromate to ferric gum.

I personally have seen things that support both hypotheses, and though I don't think we'll ever know for sure until/unless someone does some very sophisticated lab analyses, my personal tentative hypothesis is that gum bichromate hardens throughout the layer at random, the photons going down through the layer and activating whatever chromium ions they happen to strike on the way through, wherever they happen to be situated in the gum layer, and then those ions react with whatever gum molecules are nearby. But this is just speculation; as I said, none of us really know. But it fits the seemingly contradictory evidence that (1) a gum bichromate print exposed from the back has a wider and smoother tonal scale, especially smoother tones and better tonal gradation in the highlights, than a gum bichromate print with similar DMax exposed from the front:

<http://www.pacifier.com/~kthayer/html/Marek.html>

and that (2) a gum bichromate print so underexposed that the entire gum layer dissolves in the water still has enough hardened gum at the paper surface to serve as a resist to repel pigment stain:

<http://www.pacifier.com/~kthayer/html/tonalinversion.html>

(the evidence I'm referring to is seen in the left print of the side x side images below the step wedge).

Tonal scale in ferric gum: I realize that estimating reflection densities from electronic reproductions is not ideal, but the numbers I get correspond to what the images look like to me visually, and the similarity to the numbers I get measuring the reflection density ranges from my own ferric gum prints gives me confidence that all these print tonal scales are well within the expected range for one-coat gum bichromate, most of them between .50 and .75.

Grittiness of tone: The widest range I saw was in one of the prints I made, about 1.1, but there was significant grittiness of tone in this print, similar to the grittiness of tone in a gum bichromate using the same pigment in the same concentration, although more pronounced in the ferric gum. There was some question about whether this grittiness was caused by the acidity of my ferric chloride solution, and I'm still not sure if that is a valid explanation or not; the explanation seemed to be based on the mistaken idea that this was stain and that the stain Peter got when he acidified his paper was the same thing, which I don't agree with. I don't find that explanation persuasive, given that the Fabriano paper had pigment stain whether it was acidified or not; the stain on the acidified paper was darker, but it looks to me that that difference is a function of slightly different levels of pigmentation in the two prints; darker pigment makes darker (more noticeable) stain, but the stain is just as much there in the non-acidified print. And this is consistent with my own experience, that the Fabriano paper stains if printed (with gum bichromate) unsized.

My own hunch, that comes from my own experience with gum bichromate, is that this may be a characteristic problem with gum whatever process is used: dark and heavy pigment mixes will result in gritty tones in mid and highlights (probably also in shadows, but you don't see that) and that's why it's always been found that a better print, giving good separation and smooth tones throughout a good range, can be made through multiple printing with gum, than will ever be achieved in one-coat printing. Since all the ferric

gum prints I've seen have some grittiness or mottling in the tonal areas, I'm inclined to think that this is a feature of gum that can't be overcome by switching processes. I will, however, be happy to be proved wrong about this.

I also suspect that it's the gum, not the ferrous ion, that's the limiting factor in the reaction (this is just a suspicion not an observation). Again, I'd be happy to be proved wrong about this.

Having satisfied my initial curiosity about the claim that ferric gum will produce a wider tonal scale than gum (no immediately available evidence to support this claim) I will be on my way, and wish you all well. Just, please, be careful what you say about gum bichromate, or I'll have to be back here defending gum again



I wish you all the best; I'm quite impressed with the thinking and the progress you've made in advancing the progress of the process, and if you ever do manage to achieve a significantly wider tonal scale (say 1.35 or more) with smooth tones and nice gradations throughout, I'd like to hear about it. You guys know where to find me. Adios for now,

Katharine

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Katharine Thayer

Posted: Wed Dec 01, 2010 5:23 pm

[quote](#)

Joined: 19 Nov 2010
Posts: 44

Just a quick clarification: When I posted my last, long post, I hadn't seen Michael's gracious post in between, and nothing in my last should be taken as a response to it, or an inability to quit beating a dead horse. I repeated some of the things I'd said in our private conversation before about top-down hardening, because it seemed that others may be operating from some of the same assumptions, and I wanted to be sure everyone was aware of how that looks to me at this point. As far as I'm concerned, all is well, and best wishes for developing this intriguing process.

Katharine

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pgum

Posted: Thu Dec 02, 2010 4:01 am

[quote](#)

Joined: 19 Oct 2010
Posts: 52

Katherine,

Glad you could join us and participate in this "little" endeavour. As you point out, there appears to be some similarities in the limitations of both gum bichromate, and ferric gum. The Fabriano paper for instance seems to suffer similar problems in both process.

Grittiness

While I suspect that acidity may play a factor in the grittiness, I am now considering it as being more directly related to too much sensitizer. When applied in excess I believe that it forms small pools between the fibers. In other words, the amount is beyond that which the paper fibers can hold (saturation). The pools are concentrated areas that do not expose out as fast as fibers that are closer to the surface and grit forms where these pools of dense sensitizer exist.

I coated a paper with 4x the normal sensitizer concentration and it produced a very gritty print. The grit was apparent even before I applied the pigment, and appeared as darker less exposed orange speckles.

If this is actually what is going on, then I would think that a higher sensitizer load may be tolerated by a more absorbent paper. The Fabriano paper is even more prone to this and I suspect that is due to the AKD size which is very water resistant and limits absorption of the sensitizer. -it is just a hunch.

Density

From tests I have made with my scanner and a stouffer reflective wedge, I have measured densities up to 1.15 on one of my test prints. At that level, the tonal scale is acceptably smooth, but still not something to jump for joy about. I hope we can improve all of this somewhat with some good ideas, but time will tell.



Best of luck!

Michael,

The discolouration of the gum is apparent beyond the gelled zone, but it is much milder of course. It may be that there is some weak crosslinking (or whatever the reason is) and the gel point remains above room temperature but quite possibly still less than where there is no ferric chloride at all.

Peter

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