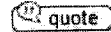


< Ferric Gum Process

Botanic88

Posted: Thu Dec 02, 2010 2:21 pm



Joined: 14 Aug 2010
Posts: 50

Hi all

I would like to join with Peter in thanking you for your contribution to our endeavours, Katherine. As for the final outcome, time will tell ☺

Re. your *in vitro* experiment Peter. I may well do a small variation on it. When gum is 'ferric fixed' on paper it is possible to distinguish between the fixing (which occurs without any colour change if there is plenty of HCL around) and the subsequent colour changes 'within the gum'. So I may do your experiment using some well acidified gum to see whether the separation between the fixing and the colour change occurs spacially across the gum as well as 'across' time.

Re. my attempt to discover whether the sensitiser and the thickness of the relief are in linear proportion or not. The test is difficult to do accurately but the indications are leaning towards the relationship being linear, so far! I am contemplating a parallel *in vitro* test, but you might want to comment on whether you think it would be valid.

My idea is to soak some filter paper in strong ferric chloride solution and cut it into different size pieces; say 1 through to 6. From memory I think ferric chloride has no apparent affect on filter paper. Then I would roll up the pieces of paper and put them into 6 test tubes, followed by liquid gum (might have to weigh the paper down somehow). My hope is that this would model the situation of having different concentrations of ferric chloride on paper, but it would allow me to measure the 'gelled' thicknesses more accurately. It would also let me see better what is happening.

Now to a bigger question. I think it may be appropriate at this point to ask about the natural limitations of Ferric Gum. So here are some of my 'best guesses' based on my experience.

I think that the most general limitation concerns the amount of sensitiser that the paper can hold effectively. This limitation affects both Ferric Gum and any other processes in its family. The term 'effectively' is used here to cover a number of issues.

(1) I think the sensitiser needs to dissolve in the gum fairly quickly in order to be effective. If it dissolves too slowly its concentration is probably too weak to grab the gum immediately over the image. I have seen situations where the gum is fixed in strands beyond the image (in a pattern like ink being dropped into water) and I think these situations all involved weak concentrations.

(2) I think the sensitiser needs to be held within some structure at the surface of the paper; not just on top of some structure. This is an extrapolation from my observation that ferric chloride on glass does not form an image. (But I've never tried ferric chloride with plenty of oxalate. It would be less hygroscopic and so easier to dry).

(3) The sensitiser obviously needs to be accessible to light in order to be effective. Being deep within the paper would make it less effective.

Taken together it seems to me that there must be a natural limit to the amount of sensitiser that can be used in this process. Consequently there must be a natural limit on the maximum thickness of the gum relief. And also on the range of smooth tones that can be achieved in a 'single pass' print. But what is the

actual limit on the maximum thickness of the relief?

Currently we know that certain concentrations of sensitiser result in certain relief thicknesses. But we don't really know why. It may turn out that there is some reason why the current situation has to be as it is. In that case we are already near the maximum relief thickness for our process. On the other hand it may turn out that there is a practical way to make the sensitiser fix greater thicknesses than at present. In that case I think the maximum relief thickness could be increased considerably before the relief becomes too fragile (because of reduced crosslinking).

There is also a further possible limitation on the relief thickness. When thick reliefs are made without any pigment, the gum shrinks on drying and it curls the paper and shows signs of cracking. I have never tested whether unfixed gum does the same or whether this is a consequence of crosslinking the gum.

This shrinkage could be reduced by adding a plasticiser (honey in the old days!) and it might occur less when the gum is well pigmented. But if neither works then this puts a further limitation on the relief thickness.

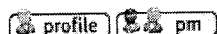
These limitations apply to Ferric Gum for a 'single pass' print. There might be other limitations with 'multiple pass' prints, and they might involve difficulties with adhesion and smearing. But I would like to think that the jury is still out on these difficulties.

I would welcome any comments or additional limitations anyone can see, of course.

Also can people tell me what aspects of our process they want to concentrate on? I am happy to try to help in any direction you choose, but for myself I also want to pursue the question of why a certain amount of sensitiser only fixes the relief thickness it does.

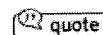
Michael

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Katharine Thayer

Posted: Thu Dec 02, 2010 3:43 pm



Joined: 19 Nov 2010
Posts: 44

Another of the vagaries of my apparent incompatibility with this site is that I can't seem to get unsubscribed from the thread even though I have clicked "stop watching this topic," twice, so I still get an email notice when something is posted. And since there are still apparently misunderstandings involving things I've said, maybe best that I don't disengage entirely until those are cleared up.

Peter, when I have referred to the reflection density range, I'm not talking about DMax, but about the range between DMax and DMin. For your prints, I only estimated density range from the unstained prints, because stain adds a spurious amount of density and makes tonal scale uninterpretable in any meaningful sense, but one of the unstained prints I estimated at 1.10, which is pretty close to your measured 1.15 (which gives me added confidence in my estimates). However, 1.10 or 1.15, that's just the DMax, not the range, and the range I estimated for those two prints (using several digital estimation methods including Photoshop's HSB and K modes, with appropriate conversion charts, and Vuescan's density estimates) was .75 and .65.

The two black portraits I made, one of them had a measured DMax of 1.25 and the other a DMax of 1.40, which are not unusual for that pigment at that concentration (a whole tube of paint in 20 ml gum) for gum bichromate as well as ferric gum. When I say gum bichromate has a short range, I don't mean it is incapable of producing a very dark DMax, only that it has a short range. The print with the 1.25 DMax had a DMin of .45, giving it a range of .80, and the print with the 1.40 DMax had a DMin of .25, giving it a range of 1.15. This, as I said, is a little better than the average one-coat gum at .75-.90, although still nothing to get too excited about, especially with the grittiness, which (at least with gum bichromate) will be more pronounced with a heavy enough pigment mix to produce a dark DMax.

As for the grittiness.... okay, so now it's not acidity it's excess sensitizer? I can't keep up...anyway, when you first said excess sensitizer, I assumed you meant the concentration of the solution; now it seems you mean how much sensitizer is sloshed on the paper, whatever the concentration. If that's what you're saying, then that's surely not the cause in my case. After dipping the brush in the sensitizer, I pressed it against the edge of the saucer to squeeze out most of the sensitizer in the brush before coating the paper; I put only enough sensitizer on the paper to coat the paper evenly, and I went over the coating with a dry brush to lift any

excess liquid, although it's doubtful that there was any, since I'd used a fairly dry brush to coat in the first place.

Another thing I've thought about in the interim is that when I just made ferric chloride marks on paper with the same heavy pigment mix, using a sort of calligraphic motion with a brush to make the marks vary in value (which resulted in a nice gradation of tones in the ferric gum "print") there was no grittiness whatever in the lighter tones. So maybe the grittiness has something to do with the photochemical reaction?

Okay, if I get curious enough I may do some more tests; if I do I'll let you know.

katharine

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Katharine Thayer

Posted: Thu Dec 02, 2010 7:10 pm

 [quote](#)

P.S. On rereading Peter's post, now I'm not sure whether he's arguing that the grittiness is the result of too much sensitizer solution brushed onto the paper, or too high a concentration of sensitizer in the solution; he seems to be arguing both.

Further argument against it being too much sensitizer solution in the paper: remember that I've been printing on paper sized for gum bichromate printing with glycol-hardened gelatin, which makes it even less likely that sensitizer was soaking very much down into the paper.

As for the concentration of the sensitizer being implicated in grittiness, I've never been sure how much is a "normal" amount. I mixed my solution at 25%; is that more than normal, or not? I don't know. It's more than two of the concentrations Frank used in the three experimental prints he posted, less than the third, much less than Peter used in any of the examples he's posted (60% ferric chloride is what he specified in his explanatory post, plus oxalate) so I'm not sure what I'm supposed to make of this. Since all of our prints, at all these different concentrations, featured mottling and/or grittiness of tone, I don't see how this argument makes sense, sorry.

Okay, I'm going now.


Katharine

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pgum

Posted: Fri Dec 03, 2010 3:36 am

 [quote](#)

Hi Katherine,

The grittiness argument is based on too much sensitizer (dried weight) on the paper. It may result from either light brushing with a high sensitizer concentration, or heavy re brushing with a dilute solution, ultimately resulting in an excess on dry down.

The concentration I specified in those early prints was 11% and 12% Ferric Chloride w/v after dilution with water from an initial stock of 60% w/v, with the addition of some ferric ammonium oxalate. You will see this on page 2 of our forum thread. Shortly after that, I settled on a 12% FeCl3 solution as follows:

1ml Ferric Chloride 60% w/v
0.5 ml Ferric Ammonium Oxalate
4 ml distilled water

I duplicated your results of the non-gritty gum image developed on unexposed sensitizer. I tried this with varying concentrations of sensitizer and the shades were varying tones of grey(lamp black) somewhat proportional to the sensitizer concentration on the paper. The concentration was varied by layering the sensitizer by brush. The tones were relatively smooth and no grittiness was apparent. This does support your suggestion that it may be photochemical but I suggest that you try a lower concentration of sensitizer to see if you experience any improvement.

Density

Joined: 19 Nov 2010
Posts: 44

Joined: 19 Oct 2010
Posts: 52

I did not mention Dmax, but rather density and that density was measured by comparing the rgb (specifically r only here) median value of a small area of the lightest non-white area and the darkest area, to the rgb (specifically r) levels from a Stouffer 12 step reflective wedge with known density values. I measured the red channel to reduce the effect of stain, which was impacting the blue and green values the most significantly. The two density readings were then subtracted to obtain the final value. I hope this methodology is sound.

Michael,

Your experiment may yield some good information. I think you will have to ensure that all of the ferric chloride has diffused, so I suspect that it may take a few days or more depending on your setup however, I will not be able to provide an opinion on how sound this approach may be other than to caution that any air bubbles trapped in the paper will likely push through and make a mess of the layering; it happened when I did not tap the bubbles out of the sand before adding the gum.

The one other limitation of the ferric gum process that I would like to mention is the relatively long exposure time; one hour versus about 5 minutes for the gum bichromate or chiba type system using casein.

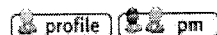
For me at this time, I'm not sure if the process provides enough of an advantage(s) to consider as a practical means of print making, but I think I'll experiment a bit more to see if we can take this a step further (although I see brick walls beyond that). There are lots of opportunities in adjusting the sensitizer and gum/pigment composition. One thing I did find was that there was a dramatic reduction in pigment staining when I added Calcium Chloride to the gum/pigment. By staining, I am referring to the trace of pigment left behind after unexposed gum/pigment is washed off of the paper.

My main objective right now is to find a way to reduce grittiness and mottling, while preserving tonal range and density.

I'll check in at the end of the weekend.

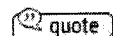
Peter

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Katharine Thayer

Posted: Fri Dec 03, 2010 4:29 pm



Peter,

Joined: 19 Nov 2010
Posts: 44

Amount of sensitizer>grittiness: okay, if the sun ever comes out again, I'll try it with less sensitizer to see if it makes a difference. However, the pigment/gum mixture would have to be held constant to make a viable comparison, and since I used up my PBK11 stock mix pouring pigment/gum over an image (will never do that again!) I would have to repeat the 25% solution with the new mix, for a viable comparison. Also, I'd have to be sure that the exposures were equivalent. I asked a while back if there's another way of determining exposure besides exposing til the margins are bleached white, but no one answered that I'm aware of. Since I don't hang around to watch the margins bleach but just go down and check every 10-15 minutes or so, there's a fairly high probability that the exposures won't be equivalent, which is a problem. But I'll see what I can do.

Density: The use of the single word "density" to designate the density range in a print is not a usage that's familiar to me; I'm used to the word "density" referring to a particular density value, and a phrase like "density range" or "print tonal scale" to designate a range of tones. So when you used the word "density" without "range" or "scale" I assumed you must be referring to one density value, and the only value that made sense in the context would be DMax, especially since the value you gave was about the same as the DMax I had estimated for one of your prints. So we were talking past each other again. It might be helpful if I knew which print you were talking about.

As for the soundness of your method, I can't quite get my head around what you're doing, so maybe I'll pass judgment on that while I think about it. Actually I probably need some clarification on what it is exactly you

are doing. Are you using a densitometer, or are you using a densitometer function in scanner software, or are you using Photoshop, to make the comparisons with the Stouffer reflection stepwedge values?

At any rate, I've been using density range to estimate the print tonal scale of gum prints for several years and have developed a visual sense of what a particular tonal range looks like from experience. As I said, it's not ideal to estimate densities from an electronic reproduction, and most probably the jpeg I see isn't an exact representation of the print you're looking at, but from what I see on the screen, I'm not seeing that wide a range in your prints or stepwedges; the .65-.75 that I estimated feels right to me. I do see (and measure) 1.15 in one of the prints I made, but it has severely blocked shadows and that grittiness, and is more contrasty than I like. But that brings up a question: opening the shadows would require more exposure, yes? but there's already a blown area on the forehead that suggests that more exposure could lose more highlight tones. Well, sometime if I have time and light I'll do one or two more tests.

Katharine

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Katharine Thayer

Posted: Sat Dec 04, 2010 3:44 am

[quote](#)

Okay, the sun came out and I did three prints, one with 25% ferric chloride, one with 18% and one with 12%.

Joined: 19 Nov 2010
Posts: 44

The first big difference I noticed from the last set I did was that this time, I got significant iron stain, whereas last time I got none. The only difference I can see in the conditions between the two times was that it was quite cold (17 degrees F) last time, and more moderate (in the 40s) today. The consensus before seemed to be that I wasn't getting stain because my sensitizer was on the acid side, but I'm using the same sensitizer solution as before; would the acidity lessen over a few days, standing in a tightly-stoppered brown plastic bottle? I don't have anything on hand to test pH with.

As for the question of the day, whether diluting the sensitizer had any effect on grittiness of tone, I can't shed much light, since the iron stain and the dilution of the sensitizer introduced other problems that interfered with evaluating that question.

How I'd judged exposure before was to expose til the margins bleached white; this time, because of the stain, that was more difficult. For the 25% solution, the ferric chloride did bleach in the margins, although not entirely to white as before, but since with the 25% solution the image formed under the positive is very distinct: bright yellow ferric chloride against white exposed areas, it was fairly easy to tell when the image had been properly exposed, with some detail in the shadow areas, by peeking under the film. The exposure time was 39 minutes and a reasonable image formed when I coated the gum/pigment, though quite gritty in the highlights.

The 18% dilution, the margins never did bleach at all, so I judged entirely by looking under the film. I was watching for some evidence of detail in the shadows and never did see it, so I ended the exposure at 39 minutes, the same as the other one. The print was light and fragile; it seemed to be darker at first but then the image seemed to wash off; I can't be sure if that was due to overexposure making the gum not stick, or to a less sturdy bond with the more diluted ferric chloride making it more susceptible to the rather vigorous rubbing and scrubbing I've been used to doing with this process, which doesn't seem to hurt an image made with the 25% ferric chloride.

The third one, at 12%, the sensitizer took on a dull brown color as soon as it was coated on the paper which persisted throughout; no discernible image formed during exposure, and when I ended the exposure at 28 minutes and coated with gum/pigment, none of the gum/pigment stuck to the paper; there was no image whatever.

I was wishing I hadn't used so much of my favorite black (PBk11) on these experiments, so I switched to lamp black, which I have extra of and hardly ever use in my own work. I didn't bother to maximize the pigment load because my goal here wasn't to see how dark a black I could make, but to judge the relative grittiness of tone in the three prints using the same pigment mix with different sensitizer concentrations, so the DMax of the one good print is considerably less than the DMax of the ones I did last week with PBk11 (1.12 vs 1.25 and 1.40), but the density range isn't bad at .88.

The other print, at 18%, there is very little tone in the highlights, but where there is tone, such as in the shadow areas at the sides of the face, the tone is gritty. It's really too small an amount of data to make anything of, but I'm not (fingers crossed) going to do this again. I thought I was done here before, but it seemed reasonable to answer Peter's question. Unfortunately my test seems to have raised new questions rather than answering the question on the table. It still looks to me like the grittiness is more likely a function of pigmentation, perhaps in some combination with the effects of the photochemical reaction, but I could be wrong.

I stuck these two at the bottom of that other page:

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

Katharine


Last edited by Katharine Thayer on Sat Dec 04, 2010 1:28 pm; edited 1 time in total

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Botanic88

Posted: Sat Dec 04, 2010 1:25 pm

 [quote](#)

Frank

Joined: 14 Aug 2010
Posts: 50

(and anyone else out there who has any idea about what might happen when ferric chloride reacts with gum arabic or similar colloids)

Currently this thread seems to be largely concerned with density range, grittiness and such like. These issues are very important but they might be less pressing if the thickness of the gum relief could be increased substantially. With this in mind I would really appreciate it if you can answer some of the following questions



We know that ferric chloride diffuses into liquid gum and fixes a certain thickness of it depending on the amount of ferric chloride. We don't know why a given amount of ferric chloride only fixes a certain thickness of gum. We are fairly sure that the ferric ions fix the gum by forming some kind of 'bridges' between the OH groups in neighbouring gum molecules.

Question 1.

If one wanted to reduce the 'density' of the crosslinks in the hope that the ferric chloride would diffuse further into the gum and fix more of it, how might this be done? (For example could other ions be added to the gum in order to 'block' some of the crosslinking sites?)

+++++

It has been observed that different events occur in a certain order when ferric chloride diffuses into gum. First the gum gets fixed and this occurs without any colour change. Then the 'ferric and gum mixture' changes colour. Starting from lemon yellow it turns light brown, then it darkens and ends up as a rich slightly orange brown. These events appear to happen all at once unless the gum is previously acidified with HCL. If plenty of acid is present the colour may not reach the final stage, but it does so later if the gum is washed in water.

Question 2.

Is it likely that the ferric ions which are forming the 'bridges' in the gum are the same ones that are involved in the subsequent colour changes? Or is it more likely that some extra ferric ions are causing the colour changes? If the latter is true then why do the extra ferric ions get stuck in the fixed gum instead of diffusing further into the gum to crosslink more of it?

+++++


Sometimes we add oxalate to the ferric chloride solution and presumably this produces 'ferric oxalate' type complexes. Adding plenty of oxalate results in the gum being fixed less robustly, especially if the ferric chloride and oxalate solution is also acidified.

Question 3.

Are the 'ferric oxalate' type complexes likely to crosslink the gum, as the ferric ions do?



Question 4.

Can we add something to the gum that would release ferric ions from the 'ferric oxalate' type complexes?
(Something that would break down the oxalate component, for example)

I hope it will be possible to suggest some possible answers to these questions 


Michael

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pgum

Posted: Mon Dec 06, 2010 8:06 pm

 [quote](#)

Hi Katherine,

Print density

Joined: 19 Oct 2010
Posts: 52

The density estimate is based on comparing only the red binary values with those of the Stouffer step wedge of 0.15 density increments and this is done in photoshop by browsing pixels. The image I used is labeled print 3a and can be found here:

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

Binary values of red channel

The whitest area in the sky on the left side and about 1/2 way up gives me a value of 225. The first shades (lightest greys) above the left side of the roof give me 221, and the darkest shades just under the eaves troughs gives me 42, now I get:

image area-----pixel value-----step wedge # at this value

lightest greys-----221-----less than 2 (use two as conservative)
darkest greys-----42-----10

difference density=10-2=8

now I multiply 8.0 by the step density difference value of 0.15 per step=1.2

I get a density of 1.2.



Is this a sound technique for a density measurement?

Sensitizer concentration

I have no idea why your sensitizer seems to function more effectively at about twice the concentration of mine, but that aside, it does appear that the grittiness improvement is minimal at your higher dilution rates. The grittiness is harder to spot in the more diluted print but it sounds like you can still see it although it is of a lighter shade. I am not sure why there would be differences in our results but it now appears that this problem may have another unknown cause and now at least we can look elsewhere for that.

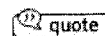
Peter

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Botanic88

Posted: Tue Dec 07, 2010 3:06 pm



Hi all

Joined: 14 Aug 2010
Posts: 50

Re. the question of density range. I am staying out of this one for the time being. If we can achieve thicker reliefs then the question will evaporate or at least become less urgent.

Re, the question of grittiness in the tones, as opposed to pigment stain. It appears to me that you are making progress here.

Both Peter and Katherine seem to agree that the problem is caused (at least partly) during the exposure.

Katherine wrote:

... when I just made ferric chloride marks on paper with the same heavy pigment mix, using a sort of calligraphic motion with a brush to make the marks vary in value (which resulted in a nice gradation of tones in the ferric gum "print") there was no grittiness whatever in the lighter tones. So maybe the grittiness has something to do with the photochemical reaction?

Peter wrote:

... The concentration was varied by layering the sensitizer by brush. The tones were relatively smooth and no grittiness was apparent. This does support your suggestion that it may be photochemical

Peter wrote:

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 the problem occurs during the exposure (and it seems certain that it does) then it ought to appear even when the gum is lightly pigmented.

My own hunch is that it may be caused by lengthy exposures together with excess acidity that seems to occur when large amounts of ferric chloride are reduced. I assume it is acidity but in any case it used to affect my thin writing paper in the past. It could make the paper go somewhat transparent. This extra acidity is probably highly concentrated because it is produced locally in the surface of the paper.

Katherine also seems to think that the grittiness in the tones may be a characteristic of gum.

Katherine wrote:

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) 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.

However this doesn't seem to fit with her results when she just made marks with ferric chloride and brushed a heavy pigment mix over them (see the first quote above).

It is possible that the grittiness has two causes: one occurring during the exposure and the other being the result of heavily pigmented gum. But I rather hope that the grittiness in Ferric Gum and in Gum Bichromate have different causes.

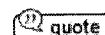
Michael

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pgum

Posted: Tue Dec 07, 2010 5:44 pm



More on Grittiness:

Joined: 19 Oct 2010
Posts: 52

Hi All,

I did a little experiment: I exposed a test strip, then scanned it without adding any gum or pigment. To show the sensitizer better, I extracted the blue channel. The grittiness is apparent from the sensitizer alone.

My first thought is that the paper fibers may be covering areas of the sensitizer and causing a range of exposure values in more exposed areas. Those areas obscured by the fibers would be less exposed and therefore hold more of the gum/pigment. The other possibility is that pooled areas of heavier sensitizer (in the paper wells between fibers), may have a surplus of ferric chloride and act to cause the gum/pigment to adhere more in those areas.

<http://picasaweb.google.com/pgfriedrichsen/FerricGumProcess#>
see print 15: sensitizer

It may be that in a positive process, the blocked areas show up as dark grit, whereas with a negative process such as gum bichromate, these blocked areas would be less exposed and cause no image so the grit would be "white" and perhaps less obvious.

I think one way to test this idea would be to try to use a different substrate, i.e. one that is free of fibers.

Peter

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< Ferric Gum Process

pgum

Posted: Tue Dec 07, 2010 7:45 pm

quote

OK I tried another substrate.

Joined: 19 Oct 2010
Posts: 52

I dipped an inkjet transparency (it has a receptive ceramic coating) into the sensitizer and wiped it dry, exposed it, then applied a gum/pigment. Before applying the gum/pigment I checked the sensitizer for that gritty yellow that is apparent in the exposed paper prints, but I could not see any. I then laid the gum/pigment over it and rinsed it. The final print shows no grittiness. I think this is pretty strong evidence that the paper fibers are the cause of the grittiness due to blocking or something else.

The final transparency print can be viewed at:

<http://picasaweb.google.com/pgfriedrichsen/FerricGumProcess#underprint16>

Peter

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profile pm

Botanic88

Posted: Wed Dec 08, 2010 11:30 am

quote

Peter

Joined: 14 Aug 2010
Posts: 50

Re. Grittiness

Peter wrote:

My first thought is that the paper fibers may be covering areas of the sensitizer and causing a range of exposure values in more exposed areas. Those areas obscured by the fibers would be less exposed and therefore hold more of the gum/pigment. The other possibility is that pooled areas of heavier sensitizer (in the paper wells between fibers), may have a surplus of ferric chloride and act to cause the gum/pigment to adhere more in those areas.

Can you examine the exposed paper with a strong lens to see where the 'specks' of strong ferric chloride are in the grain of the paper?

Your hypotheses suggest that the sensitiser is behind or between the fibres. In one case the fibres would be hiding the sensitiser from the light, whilst in the other case there would just be more sensitiser in some places than in others.

However your second hypothesis suggests that there would be some grittiness if pigmented gum was applied without any exposure (the contrast between grit and non-grit might be less obvious).

I am still inclined to think that high acid levels are produced locally by the exposure (and this might cause the grittiness somehow). Something like acid is surely produced, because ferric chloride on paper remains photo-sensitive much longer when it is exposed to low level light than when it is kept in the dark. And we know that adding acid also 'revives' ferric chloride when it starts to hydrolyse.

It would be difficult to test my hypothesis. However if it was true then the each bit of grit could extend

beyond any individual fibres. The excess acid might affect the peaks and troughs of the paper differently. This might happen especially if the sensitiser becomes damp during a lengthy exposure and I think this does occur to some extent.

Also if my hypothesis was true then adding a buffer to the sensitiser should decrease the grittiness. Normally oxalates and acid would act as a buffer of course, but this may not happen when the oxalates form complexes with the iron. Another buffer solution could be added; one that is not affected by the chemicals already in the sensitiser.

Michael

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pgum

Posted: Wed Dec 08, 2010 11:04 pm



Michael,

Joined: 19 Oct 2010
Posts: 52

I was able to positively confirm that the pigment grit is occurring pretty well 1:1 with the locations of the darker patches of yellow sensitizer (sensitizer grit). This was done by scanning an unpigmented print, then applying the gum/pigment, and scanning it once more, then comparing the two images as overlays.

Re second hypothesis:

In the unexposed tests Katherine and I did, we applied thinner amounts of sensitizer to those areas that produced a lighter shade. In my case, the lightest shades were made by one light sweep of the brush. This method would produce such a thin film that I don't think the paper wells would fill, so grittiness would not be apparent. In the darker regions, it may be less obvious as you say.

In the gum bichromate process, the gum is mixed with the sensitizer forming a thicker exposure layer which may reduce the dependence of that system on paper texture.

I have a little bit of ferrous chloride (as pale green crystals), so I was thinking of mixing it with ferric chloride and applying this to the paper to attempt to cause a greyscale without the use of light brush strokes, or exposure, while maintaining a heavy coat. This may shed more "light" on whether the problem is related to pooling of the sensitizer on the paper surface.

Peter

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Katharine Thayer

Posted: Thu Dec 09, 2010 2:19 am



Joined: 19 Nov 2010
Posts: 44

Hi Peter and all,

I've run into two computer-related problems: (1) I knocked a glass of 7-up over onto my keyboard and ruined it, and (2) picasaweb is working weird for me again. The first problem, I'm getting around by using my laptop to access the web til my new keyboard arrives, but the second one is a problem for my dialogue with Peter, since while I can see the album of Peter's prints with all the thumbnails lined up, it won't let me click on one and see it in a bigger version; when I do that all I get is a blank page. This is a problem that I've had periodically with picasaweb; I assume it's one of those sites, like this one, that's not very accommodating to Mac users.

So the short of it is, I can't see the things you posted well enough to make anything of them. This is asking a lot, but if it wouldn't be too much trouble, I wonder if you could mail them to me?

As for the density estimates, I'm still not sure. By Stouffer's specifications of densities of the step wedge, .15 for step 2 and 1.45 for step 10, the print density range would be 1.3. Visually, that doesn't seem likely to me. And I can't access print 3a to estimate its density range by my own methods, so I'm unable to compare. I did see your question to the alt-photo list and maybe someone there can give you a better answer than I can at this moment.

I know that photoshop can give screwy density numbers unless you're careful to disable scanner settings and scan without the scanner setting black point and white point, for example, but since you're also scanning the Stouffer stepwedge, you've at least got something to compare to. So, as I said, I'm not sure.

And thanks for your earlier thoughts about the tests I posted; I'll get back to them when I have things in better order here.


Katharine

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pgum

Posted: Thu Dec 09, 2010 3:17 am

 [quote](#)

Katherine,

Joined: 19 Oct 2010
Posts: 52



Well I hope the new keyboard is a good one. I have changed everything on my computer over the years...except the KB. It is one of those old ones that actually feels good to use. I find that most modern KBs give me the feeling that there is putty under the keys while this one gives me good sharp clicks...still going strong after about 16 years and a sugared coffee dump followed by a water rinse, with the loss of a couple of insignificant keys.

The picasa site has this problem in some browsers it seems. I was noticing the same problem just a few days ago, so I proceeded to update my firefox browser to 3.5 on a pc, and the problem vanished.

I'll email the image files and if you have a chance some time to check the red channel density range on 3a, that would be great.


Peter

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Botanic88

Posted: Thu Dec 09, 2010 11:41 am

 [quote](#)

Hi all

Joined: 14 Aug 2010
Posts: 50

In the end I did my *in vitro* tests concerning relief thicknesses in a different way. First I repeated your experiment Peter, with ferric chloride and sand. This worked well although I thought the colour change stopped a bit below the level where the gum was fixed. It was difficult to tell!

After doing this I realised that using soaked filter paper instead of sand probably wouldn't work. So I repeated your tests without the sand and it worked okay (a film immediately hardens between the salt and the gum).

So I did my 'linear variation' test using the same technique (without sand). Unfortunately the levels were not so clear this time but the overall result looks fairly clear. It looks as though the thickness of the relief is in linear proportion to the amount of ferric chloride.

I may repeat the tests to get better levels. Next time I will put a small amount of acidified gum in the bottom of each test tube before adding the measured amounts of ferric chloride. Then I will add the bulk of the gum. The advantage of not using sand is that everything ends up as visible, fixed, coloured gum, with soft gum on top.

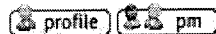
If the proportion is linear it has consequences both for Ferric Gum and its negative working cousin.

We know that the dark tones are compressed in the positive working process, for reasons you have explained, Peter. However the dark tones will be expanded in the negative working process for a different reason. The linear proportions mean that the relief thickness will not 'grow by smaller increments' as the relief gets thicker. With Carbon Prints I think the relief thickness does 'grow by smaller increments', for reasons we have discussed in earlier posts (Beer's law).

I am also doing some other tests but more of them later.

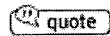
Michael

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pgum

Posted: Thu Dec 09, 2010 7:55 pm



Hi all,

Joined: 19 Oct 2010
Posts: 52

It makes sense to me that the gel thickness is linear since hydrogels are full of water spaces which allow any unreacted ferric chloride to diffuse through it and continue to react with fresh gum. Michael, your results are helping to confirm that this is in fact the case, so now we have pretty good evidence.

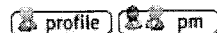
Grit again...

I did a confirming test for higher ferric regions in the grey tones by using potassium ferrocyanide (not ferricyanide). The ferrocyanide will produce prussian blue in the presence of ferric ions vs the ferricyanide which produces this in the presence of ferrous. The test showed that the ferric ions are in excess in tiny regions producing a gritty prussian blue image. This is just a positive confirmation of the source of the image grit being higher ferric concentrations.

I attempted to see if the prussian blue pigmentation was found in pooled areas or wells in the paper, but it was too difficult to discern because using one eye, even after magnification, it is difficult to determine depth. The actual cause whether it be paper texture or acidity etc still remains unknown.

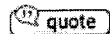
Peter

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Katharine Thayer

Posted: Fri Dec 10, 2010 3:52 am



Joined: 19 Nov 2010
Posts: 44

Hey Peter, thanks for sending those images. I still can't get my mind around using rgb values as equivalents for density, (not saying I disapprove of it, it's just not how I think about print values) but in checking this out I discovered some discrepancies in my methods for estimating densities. For one thing, my Vue-Scan density values match Stouffer's specifications for the densities of the reflective stepwedge up to step 9, and underestimates steps 10, 11 and 12 (I'm going to assume Stouffer's specs are right). For another thing, the conversion table I've been using for estimating density values from photoshop numbers, which I copied from a reliable source assuming it was correct, doesn't jive with the numbers I get when I scan the Stouffer wedge into photoshop and look at the numbers there. So I'm going to have to do some rethinking about my estimates of density ranges. This doesn't affect what I've said about the ferric gum having about the same range as gum bichromate; if I'm wrong I'm wrong for both in the same way. But if this is true it means that gum bichromate can print a range of 1.3-1.4, which just doesn't seem reasonable to me. After all, the range of carbon is about 1.6, if I remember right. So, I still don't know whether what you're doing is valid, but now I'm more concerned about the validity of my own method.

A couple of questions: (1) what makes you say that the blue and green channel are more affected by the stain than the red channel? I'm not seeing that. (2) what paper did you use for the test where you concluded that the exposed sensitizer was gritty without pigment? All I see there is paper texture, I'm not seeing any grittiness at all (is that actual size or is it enlarged? I couldn't tell) so I'm not sure I agree with the conclusion. Did you scan these or use a digital camera? Scanning tends to overemphasize paper texture; it makes it very difficult to scan a gum print and have it look like the original.

I've been comparing ferric gum with pigment to exposed ferric chloride without pigment (in the margins of my prints) to plain paper, and I'm not seeing much difference between the ferric chloride without pigment and the plain paper. When I get my keyboard (maybe tomorrow) I'll post the comparison. I also want to print on yupo (a plastic sheet that's coated for watercolor painting) and see how that looks, but it's still raining here, in fact we're supposed to get something like 6 inches in the next couple of days, so there won't be any sun for printing in the near future.


Katharine

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Botanic88

Posted: Fri Dec 10, 2010 11:49 am

 [quote](#)

Hi all

Joined: 14 Aug 2010
Posts: 50

I appreciate that you are both doing the work to understand the grittiness, Peter and Katherine. My light-box has been in the cellar for 20 years so it may not even work now!



In an earlier post I mentioned my hunch that the grittiness problem could be caused by the ferric chloride getting damp because it's hygroscopic. Would it be worthwhile to do two tests just to rule this idea out?

(1) Wrap the paper in 'cling film' to keep it dry during the exposure, and see whether this makes any improvement at all.

(2) Expose two pieces, one very close to the light source and the other further away. The close one could be exposed for a much shorter time so that it shouldn't get as damp as the other one.

Michael

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Katharine Thayer

Posted: Fri Dec 10, 2010 3:36 pm

 [quote](#)

Joined: 19 Nov 2010
Posts: 44

Sorry, Michael, I haven't read your posts very carefully; I'm not very interested in all the theoretical speculation and possibilities, only in the practical aspects. So I missed the speculation about grittiness being due to the ferric chloride absorbing water because it's hygroscopic. I do notice the print getting damp sometimes, but only sometimes; it seems (to me) to be possibly related to temperature differences or dew point issues or something of the like between the glass and the air, causing condensation inside the glass. I never noticed this when exposing gum bichromate in the sun, but then I've done very few sun exposures for gum bichromate, and the few I've done have been done in more temperate weather, so I'm not sure these memories constitute a valid comparison.

If it's condensation, will cling wrap keep it dry? I'm not sure it would. As for getting closer to the light source, I had an amusing moment thinking of myself going up in the space shuttle to check this out. An easier way to test this would be to brush ferric chloride on two pieces of paper, dry them, expose one right away and leave the other out in the air and see if it gets damp, then expose the damp ferric chloride and see if it's grittier than the one that didn't get damp. I would do this in a warm enough environment that you could be sure that there's no condensation forming under the glass to confound the results.

Katharine

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< Ferric Gum Process

Botanic88

Joined: 14 Aug 2010
Posts: 50

Posted: Fri Dec 10, 2010 4:34 pm quote

Katherine

I expect my speculation that the grittiness might be due to prints getting damp during lengthy exposures was not made very obvious - sorry!

I wouldn't expect the same thing to occur with Gum Bichromate because the materials are not very hygroscopic, I think. But ferric chloride is very hygroscopic. If some is brushed onto glass just as a solution, then it is impossible to dry it and keep it dry for more than a few seconds even with a fan heater. Also I thought it was clear that the grittiness in Ferric Gum and in Gum Bichromate probably have quite different causes.

Anyway I thought it might be worthwhile for you or Peter to do a simple test to see if there is any noticeable difference between prints kept as dry as possible and ones allowed to get slightly damp. Exposing one print sandwiched firmly between two pieces of glass and another with more access to the air might do the trick. Alternatively Peter might be able to compare a 'close and quick' exposure with a 'distant and slow' one.

Michael

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pgum

Joined: 19 Oct 2010
Posts: 52

Posted: Fri Dec 10, 2010 10:14 pm quote

Katherine,

Stain and RGB channels

The stain I am referring to is the iron stain which casts a yellow-orange hue on the print. The stain absorbs very little red light so by working on the red channel in the density measurement, it can be effectively nullified without having to remove it chemically which may affect the pigment density by causing some losses.

You said that the density measurements may be off in absolute terms, but from a relative standpoint, I can see that they should still be valid. I'll leave the density topic alone for now and accept that the density estimate I made is probably valid assuming the Stouffer wedge is accurate which I think we will have to assume.

The paper I used for the sensitizer-only print was Arches watercolour hot pressed. I have not done additional sizing. It contains a factory applied unhardened gelatine size. I have used this for all of my test prints to-date with the exception of two of the test prints early on. The sensitizer-only print scan (#15) that I emailed to you is from a print that is 3 inches in actual length. All of these test prints have been scanned with a flatbed scanner.

There are advantages and disadvantages of having us use different materials and making comparisons from other processes. It is good in that we can try many different things, but it does make it difficult to compare notes. I am starting to suspect that what you and I consider grit may differ. My reference for comparison is

based on casein and gelatine prints made in a negative process using iron salts. In that process I tend to get a very smooth greyscale with a much finer grain and little effect from paper texture, but that process has other limitations, so I am working with this one to see what it can do. It may very well be that what I consider to be grit is actually paper texture effects from your reference point of gum bichromate.

The dried ferric chloride does become very difficult to see in more exposed areas and this is why I use the blue channel to see it after I completed a scan, since it is an effective absorber of blue light and appears much darker than surrounding areas when viewed from this channel.

Michael,

I don't feel too optimistic about the theory of moisture being the culprit. I say that now because the RH in my work area has been down around 25% for the last week or so (very cold dry air mass) vs 40-50% before that and I haven't noticed any changes in the prints.

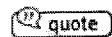
Peter

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Botanic88

Posted: Sat Dec 11, 2010 11:06 am



Hi all

Joined: 14 Aug 2010
Posts: 50

A new thought about grit!

You have firmly established that the latent grit occurs in the ferric chloride on the paper during the exposure.

Peter wrote:

I was able to positively confirm that the pigment grit is occurring pretty well 1:1 with the locations of the darker patches of yellow sensitizer (sensitizer grit). This was done by scanning an unpigmented print, then applying the gum/pigment, and scanning it once more, then comparing the two images as overlays.

Peter wrote:

I did a confirming test for higher ferric regions in the grey tones by using potassium ferrocyanide (not ferricyanide). The ferrocyanide will produce prussian blue in the presence of ferric ions vs the ferricyanide which produces this in the presence of ferrous. The test showed that the ferric ions are in excess in tiny regions producing a gritty prussian blue image. This is just a positive confirmation of the source of the image grit being higher ferric concentrations.

However think about Cyanotypes for a moment. The ammonium ferric citrate and the ferricyanide are brushed onto the paper in the same way as in Ferric Gum, aren't they? But there is no grittiness in Cyanotypes, I believe. It follows that the difference between the ferric chloride we are using and the iron salts used in Cyanotype must be a factor in producing the grittiness. The only other explanations would involve differences in the exposures or the concentration of the chemicals.

I am not saying that the hypotheses about the paper fibres are wrong. Just that they are not a sufficient explanations on their own. Otherwise they would affect Cyanotypes equally.

You might be tempted to try a Cyanotype using ferric chloride instead of ammonium ferric citrate, to see whether the ferric chloride will produce grittiness in that process. In case you have never tried this before I won't spoil the surprise you may get! Just don't bother to mix too much solution in advance.

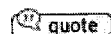
Michael

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Katharine Thayer

Posted: Sat Dec 11, 2010 3:40 pm



Joined: 19 Nov 2010
Posts: 44

Botanic88 wrote:

Katherine

I expect my speculation that the grittiness might be due to prints getting damp during lengthy exposures was not made very obvious - sorry!

No, it was quite obvious, and my post directly responded to that speculation by saying that I had noticed dampness only sometimes (or do my 40 minute exposures not qualify as "lengthy exposures" in your mind, so my observations can be discounted?) and when it did, it was when there was a temperature/dew point issue that caused condensation behind the glass (behind the entire glass, not just in the area where the print was).

And yes, I understand that you think that the causes for grittiness are different for ferric gum and gum bichromate; that's the possible difference I was considering when I thought about whether I'd ever seen this with gum bichromate, and then decided that the fact that I'd never seen it with gum bichromate didn't mean anything, because I never exposed gum bichromate outside during this kind of weather. To put it more explicitly, I was not able to say that the dampness I'd seen occurred only with ferric gum, because of the confounding variable of condensation, which may or not occur with printing gum bichromate in similar conditions. At any rate, I print with heavy glass pressing the negative into very close contact with the paper, with thick felt behind the paper to ensure complete contact, so it seems unlikely that very much air would be getting in between there to the ferric chloride.

Speaking for myself, I still don't know whether grittiness in ferric gum and gum bichromate have the same cause. I've speculated that it does, but I don't know; you've speculated that it doesn't, but you don't know either. All we can do is build up a database of observations until something finally tips the balance one way or the other.


Katharine

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Katharine Thayer

Posted: Sat Dec 11, 2010 4:27 pm

 [quote](#)

Hi Peter, thanks for reply.

Joined: 19 Nov 2010
Posts: 44

I have my new keyboard and I have to admit I like the quiet keys; the only key that makes any noise is the spacebar, so all I hear is a quiet thunk thunk thunk between words. A new aesthetic to get used to.

Okay, by my estimates, using the figures I got from scanning the Stouffer wedge into photoshop, the density range of the print you sent me is 1.2 (without attempting to remove the stain electronically) which I believe is the same number you got. Then I re-estimated the two unstained prints in your group that I had estimated before; oddly enough for one (print 1 with the stain removed) I get the same value I got before, .65, but for the other one, (print 3 I think?) I got .75 before but now I get 1.15. I'm still not entirely sure this is right, but at least my conversion table now corresponds to my observed values for the Stouffer scale, whereas the one I was using before didn't.

I understand your reasoning about using the red channel, but I still dislike using stained prints to estimate density from, although I also understand your reasoning about the stain removal causing loss of density. However, it is the final print tonal scale I'm interested in, however it is arrived at.

Hmm, that stepwedge you say was 3" long measures 38" on my screen (it takes a *lot* of scrolling to see it all, so I had to measure it in segments and add them together) so it's no wonder that the paper texture is so prominent. But that makes me even more sure that there's none of what I would call grittiness, because surely with that much magnification it would have shown up (and I agree that we don't mean the same thing by the word "grittiness.") The smoothest gum bichromate print may show a certain amount of paper texture when scanned, depending on the paper, but no grittiness at all, by my definition. I used to use Arches Aquarelle (hot press) a lot, and I can say from experience that with my scanner, that paper picked up a lot of paper texture when scanned (I mean the paper texture was much more obvious in the scanned file than in the original print itself, so the additional paper texture in the scanned reproduction could be considered a

scanning artifact.)

The Arches bright white that I use now has a very crisp smooth surface, and picks up no almost no gratuitous paper texture in scanning. I'll post a comparison later today after I dig out an old gum bichromate print on Arches Aquarelle (nothing else to do, now that I've filled sandbags and deployed them where I think they might do the most good).

The fact that you didn't see the "grittiness" by eye (or magnifying glass or loupe?) but it showed up in the blue channel is a bit concerning to me, not as much as it would if it had actually looked like grittiness, but still, a bit concerning. It's a long-established observation that when you split channels, the artifactual "noise" that's introduced in the scan is often deposited in the blue channel. Way back when I was making digital negatives for gum monochromes by the Dan Burkholder, method, I used to scan color photos and convert them to black and white negatives; to do this, I would (per Burkholder) look at the channels individually and throw out any channel that had too much noise in it (almost always the blue channel) and then use the channel mixer to create a pleasing black and white negative. After I started making color separations and realized that I preferred using color separations for printing monochromes as well as tricolor, I stopped making monochrome negatives from color pictures, but I haven't forgotten that the blue channel often contains extraneous noise. So I'd be a little leery of using the blue channel to check for "grittiness."

At any rate, I see no grittiness in sensitized and exposed, but unpigmented, areas of ferric gum prints on my Arches bright white paper, either by eye or by magnifying glass, or by enlarging a scanned file in photoshop, either all channels together or the blue channel alone. There's some occasional blobs of "stuff" in the blue channel, but it doesn't look like grittiness to me; it doesn't resemble the grittiness of the pigmented areas.


Later,
Katharine

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Botanic88

Posted: Sat Dec 11, 2010 5:49 pm

 [quote](#)

Hi Katherine

Joined: 14 Aug 2010
Posts: 50



Katherine wrote:

Speaking for myself, I still don't know whether grittiness in ferric gum and gum bichromate have the same cause. I've speculated that it does, but I don't know; you've speculated that it doesn't, but you don't know either. All we can do is build up a database of observations until something finally tips the balance one way or the other.

Peter has given us two kinds of evidence (quoted in my last post) which seem to demonstrate pretty conclusively that the grittiness in Ferric Gum occurs in the exposed print before any gum is involved. So the grittiness can only have the same cause in both processes if it has nothing to do with the gum in Gum Bichromate.


Michael

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Katharine Thayer

Posted: Sat Dec 11, 2010 6:39 pm

 [quote](#)

Botanic88 wrote:

Hi Katherine

Joined: 19 Nov 2010
Posts: 44

Katherine wrote:

Speaking for myself, I still don't know whether grittiness in ferric gum and gum bichromate have the same cause. I've speculated that it does, but I don't know; you've speculated that it doesn't, but you don't know either. All we can do is build up a database of observations until something finally tips the balance one way or the

other.

Peter has given us two kinds of evidence (quoted in my last post) which seem to demonstrate pretty conclusively that the grittiness in Ferric Gum occurs in the exposed print before any gum is involved. So the grittiness can only have the same cause in both processes if it has nothing to do with the gum in Gum Bichromate.

Michael


But I have reported that my observations about grittiness in exposed unpigmented ferric sensitizer differ from his, as I reported in my last post and will post visuals of later, nor do I interpret his observations as he does, so taken all together, I do not find the evidence conclusive either way so far.

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Botanic88

Posted: Sat Dec 11, 2010 8:56 pm

 [quote](#)

Hi Katherine

Joined: 14 Aug 2010
Posts: 50

Even if you are not seeing the same thing as Peter, your own evidence makes the point.

Katherine wrote:

Another thing I've thought about in the interim is that when I just made ferric chloride marks on paper with the same heavy pigment mix, using a sort of calligraphic motion with a brush to make the marks vary in value (which resulted in a nice gradation of tones in the ferric gum "print") there was no grittiness whatever in the lighter tones.

Your evidence seems to make it clear that something happening on the paper during the exposure is a factor in producing the grittiness, and whatever this factor is it happens before the gum is involved.


Michael

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Katharine Thayer

Posted: Sat Dec 11, 2010 9:27 pm

 [quote](#)

Botanic88 wrote:

Hi Katherine

Joined: 19 Nov 2010
Posts: 44

Even if you are not seeing the same thing as Peter, your own evidence makes the point.

Katherine wrote:

Another thing I've thought about in the interim is that when I just made ferric chloride marks on paper with the same heavy pigment mix, using a sort of calligraphic motion with a brush to make the marks vary in value (which resulted in a nice gradation of tones in the ferric gum "print") there was no grittiness whatever in the lighter tones.

Your evidence seems to make it clear that something happening on the paper during the exposure is a factor in producing the grittiness, and whatever this factor is it happens before the gum is involved.

Michael

Ah. We're talking about different things again. But no, this observation does not make the point that grittiness in ferric gum has a different cause than grittiness in gum bichromate. All it indicates, anecdotally, is that the grittiness in the ferric gum process seems to be introduced in the photochemical reaction rather


than in the fixing of the gum by ferric chloride. But it doesn't say anything one way or the other about a mechanism for grittiness in gum bichromate, so can't say anything about whether they are the same or different. We are pretty sure that the cause for grittiness in ferric gum is photochemical, but we don't know that the cause for grittiness in gum bichromate is not photochemical; the problem is that gum is a necessary part of the photochemical reaction in gum bichromate, so you can't separate the gum out in the same way. So it's unknown, as I said.

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Katharine Thayer

Posted: Sat Dec 11, 2010 11:19 pm

 [quote](#)

Hi Michael, I've been puzzling about this all day and am considering that perhaps there's a misunderstanding about what I've said about this before:

Joined: 19 Nov 2010
Posts: 44

Katharine Thayer wrote:

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 said this fairly early in my participation in this dialogue, and I'm not sure I would say it exactly the same way now, because we've learned a lot about grittiness in ferric gum since then, but even then I wasn't meaning to suggest that I thought, in either case, that it's the pigment alone that's accounting for the grittiness, completely apart from its participation in a chemical/photochemical process. After all, if you make a really dark heavy mix of gum and pigment and just brush it out on a piece of paper, you're not going to see grittiness, you'll just see smooth dark paint. So the grittiness I have described that comes from using very heavy mixes of dark pigments in the gum bichromate process isn't a function of the pigment by itself, but of something that happens in the process. What that "something" is, we don't have much of a clue.

One difference I've noticed: when printing ferric gum and gum bichromate with the same pigment mix, the grittiness is more pronounced in ferric gum. One thing I don't know is whether a lighter pigment mix prints smoother tones (no grit) in ferric gum as it does in gum bichromate, since I've only printed ferric gum with rather heavy pigment mixes, and mostly black.

I don't know if that clarifies or just adds more confusion, but thought I'd throw it out there.

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< Ferric Gum Process

Katharine Thayer

Posted: Sun Dec 12, 2010 1:57 am



Joined: 19 Nov 2010
Posts: 44

Re: the likelihood of ferric chloride absorbing moisture during long exposures: I brushed ferric chloride on paper, dried it as I would before exposing it with a positive, and then let it sit out in the air for two hours. The coated paper remained completely dry to the touch for the whole two hours, even in this very damp climate, and the yellow color did not change during that time either; in other words the ferric chloride seemed to remain stable and unchanged during that period of time.

[Later edit] No change after four hours; no dampness, no color change.

[Next morning] Still completely dry to the touch after sitting open to the air for 13 hours.

[After 25 hours] Still dry to the touch. Okay, that's the end of it; I think I've made my point.
katharine

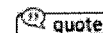
Last edited by Katharine Thayer on Mon Dec 13, 2010 1:32 am; edited 2 times in total

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Katharine Thayer

Posted: Sun Dec 12, 2010 4:09 pm



Joined: 19 Nov 2010
Posts: 44

My observations about grit, for your consideration:

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

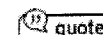
I enlarged the exposed ferric chloride and plain paper samples at least twice as much as I enlarged the detail of the ferric gum photograph, so as to show the paper texture, but even at that unfair disadvantage, it's clear that the texture of the ferric chloride is essentially the same as the paper texture, and furthermore, that that texture is much finer than the grit in the image, so I'm comfortable saying I see no relationship between the grit and the paper texture, and by extension, no apparent relationship between the texture of the exposed ferric chloride and the texture of the ferric gum image. I used the blue channel, per Peter, for showing the exposed ferric chloride and the paper texture.

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pgum

Posted: Mon Dec 13, 2010 3:54 am



Joined: 19 Oct 2010
Posts: 52

Katherine's examples show some obvious differences to mine. The grit appears to be larger grains than those just produced from texture.

I will mention quickly that I did recently produce prints that did have this obvious grit (the image grains are larger than those of just a texture effect). This "grit" occurred when I applied either a more concentrated sensitizer, or when I used ferric chloride and water without the addition of ferric ammonium oxalate. This problem showed up in my attempts to replace the "exotic" ferric ammonium oxalate from my formula because I believe that something more readily available may do as good or better of a job.

Now, I am going to attempt to suggest a possible reason for obvious texture effect. I won't call it grit because as Katherine has confirmed, my observations are those of paper texture in a gum bichromate

context.

Michael wrote:

Quote:

However think about Cyanotypes for a moment. The ammonium ferric citrate and the ferricyanide are brushed onto the paper in the same way as in Ferric Gum, aren't they? But there is no grittiness in Cyanotypes...

OK. This is true, but that process is negative working which may make a difference at least hypothetically as I will attempt to suggest below:

Sensitizer thickness in a negative process:

For example, take two identical containers side by side. Into both we pour a dilute solution of ferric ammonium citrate mixed with potassium ferricyanide (the classical cyanotype combo) but to container A we pour it to one centimeter depth, and to container B we pour it to 5 centimeters. (A=1 cm, B=5 cm). Now we place both containers in the sun for 2 minutes. After 2 minutes, we look down at the containers and notice that each one has turned the same shade of blue. What has happened is each one has absorbed the same number of photons so there were equal ferrous ions produced and equal ferric ferricyanide (prussian blue ions produced). We assume here that all photons in the light sensitive blue and UVA range were absorbed which is the case for a sufficiently concentrated cyanotype coating. So if we replace the container depths with coating depths, we see that the image remains evenly blue independent of the coating thickness as long as we do not reach the point of consuming too much of the ferric ion as in overexposure.

This is not the case in our process since it is the non-reacted ferric ion that is responsible for the image formation and the image is produced from what ferric ion is left after exposure i.e. if there is surplus ferric because the coating is thicker in one area, it will print darker regardless of exposures in a thin and thick layer being equivalent.

What would need to be tested is a positive process for cyanotype. Fortunately this can be tested by temporarily "bleaching out" a cyanotype print with a UV exposure under a step wedge, and then checking for grit or paper texture effects. This is one thing I hope to try.

Something unrelated:



Michael,

I thought that this little observation may give you more insight into the ferric chloride-gum arabic combination:

When I did the gum arabic gel thickness test, after the test was over, I removed the gel and it had an aroma that strongly resembled brown ferric ammonium citrate or even ferric acetate. The aroma is somewhat like caramel (burned sugar) and is actually not unpleasant. It is very different for either ferric chloride or gum arabic. Now I read somewhere that gum arabic has something in it called arabic acid, and I am thinking that this may suggest once again that some chemical complex is formed between the two.


Peter

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Botanic88

📅 Posted: Mon Dec 13, 2010 11:22 am

 [quote](#)

Katherine

Joined: 14 Aug 2010
Posts: 50

Your enlarged images are most interesting. Thanks for showing them.

I have viewed the Ferric Gum print at different zoom settings and I think what I am seeing is as follows.

- (1) The tonal grit is certainly on a larger scale than the paper texture and it is different.
- (2) The tonal grit looks like some kind of 'globules'. They are elongated and bent but they are also rounded and self-contained. Let me call them 'globules' for convenience.
- (3) Each globule appears to have an even tone. Some look light grey, some dark grey and some black, but I cannot see any tonal variation within any globule.
- (4) In some areas the globules are similar in tone, but in others there are black globules right next to light ones. It looks as if the tone in each globule is the average of the original details that came within its scope.
- (4) I think some globules are overlapping one another, but I'm not sure.

Please tell me if I am seeing things wrong? It is difficult to be sure on my computer screen.

If I am seeing things correctly and if there is no sign of these globules in the ferric chloride immediately after the exposure then I would draw the following conclusions.

- (1) Something produced during the exposure must cause these globules to form in the moments when the pigmented gum is brushed on.
- (2) The globules are not the result of the pigment clustering. That would result in all the globules having the same tone.
- (3) The globules are not the result of the gelatine size being deformed when water enters it from the gum. That would not allow globules to overlap one another.
- (4) The globules are probably formed entirely within in the gum.

So I think the bottom line is this. Something is produced during the exposure that modifies the way ferric chloride diffuses into the pigmented gum and fixes it. But this only happens when there has been an exposure and it probably happens more with more concentrated ferric chloride and it probably happens less when oxalates are include in the sensitiser.

I have my own hunch about what this 'something' might be (not dampness). I have mentioned it in previous posts. But for the time being I would like to know whether my observations and conclusions look sound.

One more thing. Please could you also show the Gum Bichromate print at 4X magnification? It's not that I think the grittiness has the same cause (!) but I would be interested to see whether the grittiness looks the same.

+++++

Peter

I see what you are saying regarding my comparison with Cyanotypes. In a nutshell, differences due to hidden sensitiser or sensitiser pools won't show up in negative working processes when there is plenty of accessible sensitiser. But such differences will show up in positive working processes because the hidden sensitiser and/or pools contribute to forming the final image.

Good luck with making Cyanotypes behave 'positively'. Another approach might be to use the negative working cousin of Ferric Gum. But this probably wouldn't work because that process uses plenty of oxalate, and that might prevent the grittiness occurring anyway.

Thanks also for your 'olefactory' observations on ferric chloride reacting with gum. I have been moving towards the chemical explanation anyway after Frank's explanations. But as you say this tends to confirm it.

Michael

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Katharine Thayer

Posted: Mon Dec 13, 2010 4:09 pm

[quote](#)

Botanic88 wrote:

Joined: 19 Nov 2010
Posts: 44

I have viewed the Ferric Gum print at different zoom settings and I think what I am seeing is as follows.

- (1) The tonal grit is certainly on a larger scale than the paper texture and it is different.
- (2) The tonal grit looks like some kind of 'globules'. They are elongated and bent but they are also rounded and self-contained. Let me call them 'globules' for convenience.
- (3) Each globule appears to have an even tone. Some look light grey, some dark grey and some black, but I cannot see any tonal variation within any globule.
- (4) In some areas the globules are similar in tone, but in others there are black globules right next to light ones. It looks as if the tone in each globule is the average of the original details that came within its scope.
- (4) I think some globules are overlapping one another, but I'm not sure.

Please tell me if I am seeing things wrong? It is difficult to be sure on my computer screen.

Hi Michael,

You're reading quite a lot into that 72 ppi jpeg. I've looked at this grit with the magnifying glass I use to read the Oxford English Dictionary, and with an 8x loupe, and at that magnification all I see is a fine dark grit, the grains apparently the same size and indistinguishable in value from each other. Then I rescanned the print at a higher resolution and enlarged it digitally, but at 200% it's already breaking into pixels, so I'm not comfortable drawing any conclusions about the shapes of the particles or any other conclusions on the basis of this digital enlargement from a 720 ppi and even a 1200 ppi scan. It's impossible for me to say on the basis of this digital enlargement whether the shapes and values are an accurate representation of the grit itself, or simply a digital artifact resulting from the algorithms that translate the analog image into a digital representation. The only one of your points that I can agree with on the basis of my scrutiny of the actual print, is (1) which is the point I was illustrating by posting these in the first place.

I'm also concerned that there may have been some additional artifact that was introduced when I slightly sharpened the image. The scan was a little blurry compared to the original, so I sharpened it to be an accurate representation of the original, but it's very possible that some of what you were seeing in the enlargement was something introduced in the sharpening. I wouldn't have expected anyone to further enlarge such a low resolution image and draw conclusions about the grit based on those enlargements. I've replaced that part of the jpeg with an unsharpened image, but I'm not sure why, because even without the sharpening I would be very much against drawing any conclusion from enlarging a 72ppi jpeg; that kind of resolution can't give you more information by enlarging, and chances are it will give you less information, or misleading information, by revealing artifacts that weren't in the original print. It's kind of like those guys who keep thinking they've found evidence of McDonald's restaurants and other familiar structures on Mars, by this kind of minute scrutiny of the photographs on NASA's website. If we want to describe this grain accurately, or to compare it to the grain of a gum bichromate print, we would need to have photographs taken through a microscope.

I had meant to add the gum bichromate detail for comparison, but when I realized that I hadn't saved that image at its original scan resolution, only at the 72ppi resolution, I didn't, since enlarging the 72 ppi image wouldn't be useful. But I do think it's important to have the comparison, so I dug through the pile and found that print again and rescanned it; I have added it to the jpeg.

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

Katharine

Last edited by Katharine Thayer on Mon Dec 13, 2010 5:26 pm; edited 2 times in total

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Katharine Thayer

Posted: Mon Dec 13, 2010 4:17 pm

[quote](#)

pgum wrote:

Joined: 19 Nov 2010
Posts: 44

Now, I am going to attempt to suggest a possible reason for obvious texture effect. I won't call

it grit because as Katherine has confirmed, my observations are those of paper texture in a gum bichromate context.

Peter, I don't understand this last part of the sentence. Your observations showed, as mine showed, that the ferric chloride texture corresponds to the paper texture, period. "In a gum bichromate context" makes no sense added to that observation, since the observation has nothing to do with gum bichromate, and the context is ferric gum.

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Katharine Thayer

Posted: Mon Dec 13, 2010 7:57 pm



pgum wrote:

Now I read somewhere that gum arabic has something in it called arabic acid

Joined: 19 Nov 2010
Posts: 44

[removed intemperate screech] Arabic acid? This is like that article you recommended earlier in the thread, a guy speculating in 18whenever about a gum effect he "discovered" and hypothesized that it must be caused by a hypothetical compound he named "chromous oxide metagumate." There is no such thing as chromous oxide metagumate, and there's also no such thing as arabic acid. Those guys didn't know what they were talking about; they just made things up as they went along, and they didn't have the benefit of our present knowledge of chemistry. We should not be reading them for anything but historical entertainment, certainly not for useful information about materials and processes. Me go now.

katharine

Last edited by Katharine Thayer on Mon Dec 13, 2010 10:51 pm; edited 1 time in total

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pgum

Posted: Mon Dec 13, 2010 8:22 pm



Katherine,

Joined: 19 Oct 2010
Posts: 52

I was sure that the reference I had was not too out of date. Here are a few references to the compound.

The imaginary material is available for purchase from Sigma Aldrich:

<http://www.sigmaaldrich.com/catalog/DataSheetPage.do?brandKey=SIGMA&symbol=A3006>

Specifications:

Product Name Arabic acid

Product Number A3006

Product Brand SIGMA

CAS Number 32609-14-6

TEST SPECIFICATION

Appearance (Color) White to Yellow

Appearance (Form) Powder

TLC Pass

(Arabinose, Glucuronic acid and Rhamnose are detected after hydrolysis)

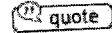
Here is another reference to the properties of the compound:

<http://pubchem.ncbi.nlm.nih.gov/summary/summary.cgi?cid=10264>

So who am I to believe?

Peter

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pgum

Posted: Mon Dec 13, 2010 8:42 pm

Quote:

...paper texture in a gum bichromate context.

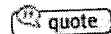
Joined: 19 Oct 2010
Posts: 52

Katherine,

I stated it that way to emphasize that my previous observations of grit were actually paper texture based on the observations that you have made of texture when printing in the gum bichromate process. I do agree that it may be a confusing statement and is probably better off not referencing gum bichromate because we have established that it is texture regardless of the process.

Peter

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Katharine Thayer

Posted: Mon Dec 13, 2010 9:43 pm

pgum wrote:

Joined: 19 Nov 2010
Posts: 44

So who am I to believe?

Well, me of course ☺.

Okay I was wrong; there is such a thing as arabic acid, which as far as I can gather in a few minutes reading is a material derived from the four main sugars in gum arabic: galactose, rhamnose, arabinose and glucuronic acid, and looks to me like one of those old misused words that have somehow survived in usage even though they don't describe something accurately, for example still in the 21st century you see people saying something is "tanned" when it is chromium-crosslinked, which is a residual fragment of a long ago misconception that the dichromated colloid photochemical process was essentially the same as the chrome tanning of leather, or people still thinking that chromium oxide participates in the crosslinking of gum. Some sources even still use the word "arabic acid" interchangeably with "gum arabic," a misusage left over from a hundred years ago.

At any rate, if you treat gum arabic with HCl and acetone you can extract, or produce, this material that's now called "arabic acid," which consists of the four main sugars that make up 98% of the material in gum arabic (galactose, arabinose, rhamnose, and glucuronic acid), re-organized into a compound with known structure (C₅H₁₀O₆) and known molecular weight (166.1293). However, those four sugars aren't organized in that way within the structure of gum arabic itself; the sugars exist as separate individual monosaccharides arranged in huge tangled chains, not in the form of "arabic acid" and it's unhelpful to suggest that arabic acid in that form somehow exists within gum arabic and is available for reacting with anything. That's all I was trying to say; though I admit I didn't say it in a very measured way, the point still stands: when we're talking about what's in gum arabic; there's no such thing as "arabic acid" in gum arabic. Okay?

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< Ferric Gum Process

 quote

pgum

Joined: 19 Oct 2010
Posts: 52

Posted: Tue Dec 14, 2010 3:12 am

Katherine,

Thanks for setting the record straight on arabic acid and gum arabic.

All,

I made this print (see link below) using double my normal sensitizer concentration. The exposure time was about double (2 hrs) although I removed it early and I would think that another 20 minutes would have been optimum.

<http://picasaweb.google.com/pgfriedrichsen/FerricGumProcess#>
see print 19 (let me know if it doesn't show in your browser)

You will immediately notice severe grit in the lighter tones. There is little pigment staining evident by the mostly white border, and a light iron stain evident. You may also notice pin holes; these may be caused by bubbles in the applied gum/pigment or air attempting to escape from the papers surface upon application of the gum/pigment. The print surface is somewhat glossy in darker areas indicating a relatively thick layer of gum arabic/pigment. The print also makes a faint "squeaky-crackly" sound when bent, indicating cracking of the brittle gum layer.

A doubling of the concentration was an attempt to provide more sensitizer for the gum in the hope that a thicker gum layer may be fixed and the dynamic range could be extended further, but it seems not to work this way at least not right out of the box because of image grit formation, although I wouldn't count it out just yet.


Peter

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Botanic88

Posted: Wed Dec 15, 2010 11:48 am

 quote

Joined: 14 Aug 2010
Posts: 50


Peter

Thanks for showing the 'highly concentrated sensitiser' print.

At the risk of being accused of looking for martians may I say what I am seeing, just to check if it is real or a characteristic of the digital reproduction process?

The tones look very gritty, but the grittiness seems to be related to the paper texture more than I remember with Katherine's prints. I seem to see this especially in the top left corner where there is a transition from sky to the border around the image and then to the paper without any pigment.

The grit seems to come in at least two tones. I seem to see this especially throughout the sky and in the border beneath the image.

I am using a 'magnify' button to see these things so It would be helpful to know whether they are real or not


One more thing. Are you saying that the tonal grit in your 'normal' Ferric Gum prints seems to be related to the paper texture? This would chime with my few 'photograph like' prints. The lighter tones consist of pigment fixed to some parts of the paper texture but not others. The result is something like a half-tone reproduction in a newspaper, with the paper texture giving the half-tone pattern instead of a half-tone screen. However there is a difference because the pigment marks do come in more than one tone.

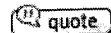
Michael

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Botanic88

Posted: Wed Dec 15, 2010 3:40 pm




Hi all

Joined: 14 Aug 2010
Posts: 50

I just found this research on gum arabic, arabic acid and metal ions, in case anyone is interested.

<http://www.arcsudan.sd/proceedings/40thmeeting/fulltext%20pdf40/Gum%20Arabic.pdf>

It may not be relevant if there is no arabic acid in gum arabic. On the other hand we might be producing some with all the HCL and acidified ferric chloride we have flying all over the place 

Michael

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pgum

Posted: Wed Dec 15, 2010 5:45 pm



All,

Joined: 19 Oct 2010
Posts: 52

The sun was blasting today so I examined this print with magnification. I allowed the sun to graze along the surface so that it would highlight the peaks. I also looked at the print with direct light for comparison.

The paper texture looks like randomly twisted/coiled fibers strewn horizontally and randomly on the surface and quite bumpy at that i.e. there are mound like areas and valleys adjacent to these. The pigment is concentrated in the peaks with sparse pigment in the valleys, in mid tone areas such as the sky. The pigment spreads out somewhat from these peaks in a diffuse distribution. The shapes of these pigment zones look quite random and the pigment particles themselves are not agglomerated and remain finely divided, so yes, there seems to be a relation to the texture in my test print but these areas seem to extend beyond the peaks somewhat. In those earlier prints where grit is not apparent but only texture, it is too difficult to see if there is a similar distribution because the pigment texturing is too fine for the magnification level used.

Off the top of my head I can think of a few possible causes although perhaps you will have others to suggest.

1- sensitizer evaporates and fibers wick this to the surface causing it to concentrate in these peak areas as it dries from the top. The more sensitizer there is applied, the greater the difference.

I think of a case where you have a salt solution in a bottle and insert some type of wick. The top of the wick will have the highest concentration as it evaporates from there.

This theory however doesn't seem to be supported by Katherine's observation that the sensitizer distribution was not 1:1 with the grit that she had observed.


2 Some type of redistribution of the various species formed from the photochemical action

When salts of varying solubility diffuse through hydrogels, the diffusion rates will differ and they may have a tendency to separate.

All conjecture at this point in time.


Peter

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pgum

Posted: Wed Dec 15, 2010 6:32 pm

 [quote](#)

Michael wrote:

Joined: 19 Oct 2010
Posts: 52

Quote:

It may not be relevant if there is no arabic acid in gum arabic. On the other hand we might be producing some with all the HCL and acidified ferric chloride we have flying all over the place

This is something to consider. The arabic acid from what I have read (according to a patent for what those are worth, is extracted by first acidifying the gum and that it is preferable to acidify the gum to a pH of 2 or less before attempting to insolublize the arabic acid with alcohol. I believe that the pH of 2 is within the realm of ferric chloride as it hydrolyzes in water.

I also found this descriptive paragraph regarding the use of gum arabic in lithographic fountain solutions. The paragraph suggests that arabic acid is freed upon acid addition and can then combine with metal ions. In the situation below, it is aluminum rather than iron, but I think it suggests the possibility of a metal complex nonetheless:

from:

<http://magazine-printer.com/printing-process-explained/lithography-files/fountain-solutions.html>

Quote:

Two important key properties are fountain pH and conductivity. What is pH? Well in the Roman days they knew it as "potentia hydrogenii" or "potential for Hydrogen" thus the small "p" and capital "H." Ph is a measurement of the degree of acidity or alkalinity of substances. Ph is important for maintaining high-quality, trouble free printing. The purpose of the acid in fountain solution ensures that the action of the gum is reinforced and not destroyed. An acid such as phosphoric or citric in a sufficiently dilute form will, in combination with the gum arabic, liberate the arabic acid molecules from the gum and permit them to combine with the metal oxides (aluminum) on the plate. This results in the desired hydrophilic (water loving) surface of the non-image areas. This breaks down quickly but is reinforced every time the plate has the fountain solution reapplied (every turn of the plate cylinder). To keep the pH stable, as contaminants such as Calcium Carbonate, attempt to change the solution pH, buffering agents are added. These keep the pH stable during the course of printing.

Peter

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