21st CENTURY ALCHEMY

A Printer's Workbook for Ferric-Ferrous Dry Print Out with the Noble Metals

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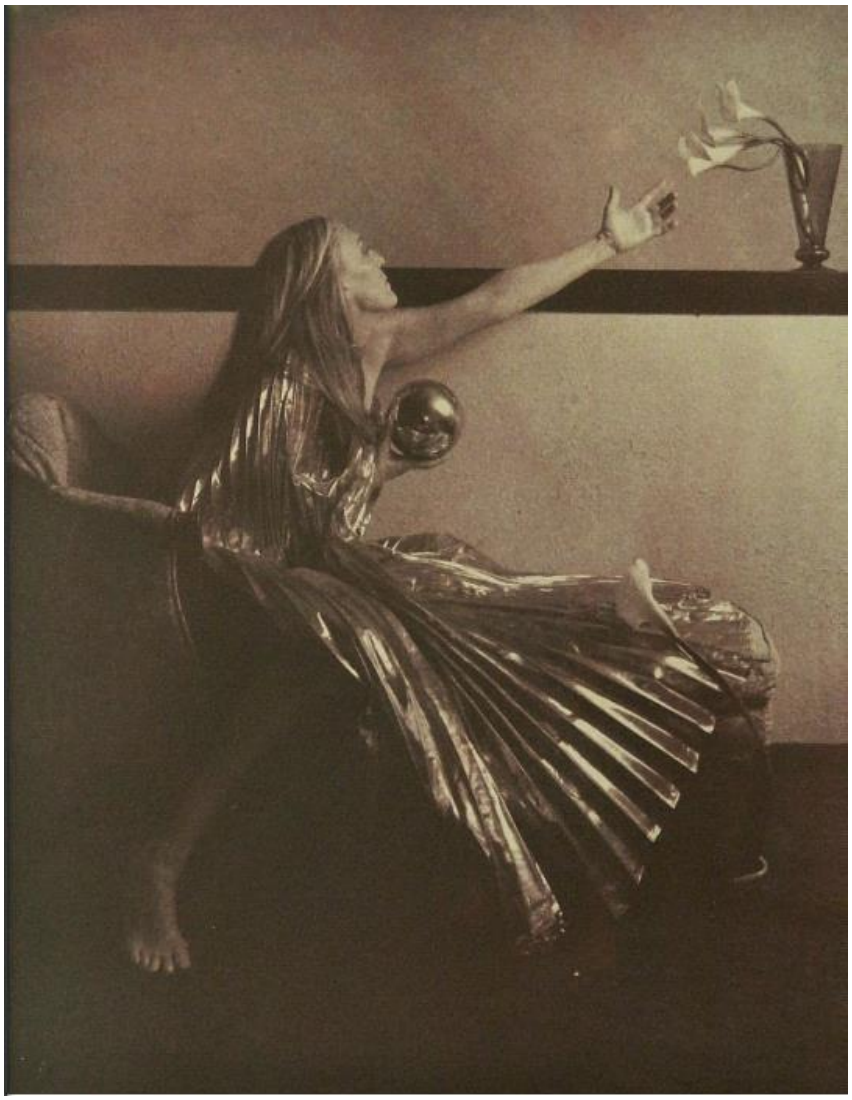

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REVISION NOTE

In May 2022, I realized that I had overlooked a vital fact about the light-sensitive chemicals used in my ferric-ferrous dry print out process (sodium ferric oxalate, ammonium ferric oxalate, ferric oxalate, ammonium ferric citrate and ammonium ferric sulfate): as the chemicals oxidize the ferric iron degrades to ferrous iron. This is an obvious fact; however, I failed to recognized its significance to the specifications I provided in the formulas for ferric-ferrous dry print out. This important note addresses that earlier omission as it applies to dry print out of gold and the PGMs.

I received on May 4 2022 an absolutely fresh lot of ammonium ferric oxalate (AFO). My preliminary testing indicated that the new batch worked with gold chloride (the earlier batch, from the fall of 2021 and which replaced an earlier batch, from the fall of 2019, could not be used to print gold). My first test of the new lot of AFO was with the Chrysotype Supreme formula. That formula specifies mixing thoroughly 10ml of 40% ammonium ferric oxalate and 3 drops of 1% ascorbic acid (vitamin C solution). However, the AFO used at the time when I was testing to determine the minimum number of drops of C needed to print out gold was over one year old. That AFO inevitably contained as a result of degradation some – an unknown amount – of ferrous iron. Therefore, my conclusion that 3 drops of 1% C would yield the highest quality gold prints was based on an incorrect assumption. With this new lot of absolutely fresh AFO – along with the knowledge that the AFO I used for the test in 2013 was a least 1.5 years old -- I can approximate a baseline of drops of 1% C to 10ml of AFO.

My conclusion is that I cannot precisely specify the number of drops of 1% C (for printing gold) and 2% C (for printing the PGMs) to be added to 10ml of ammonium ferric oxalate (as well as sodium ferric oxalate, ferric oxalate, ammonium ferric citrate and ammonium ferric sulfate). The fresher a lot of any of the chemicals is, MORE drops of C must mixed to reduce more of the ferric iron to ferrous. In the case of the absolutely fresh AFO received on May 4, 2022 (Michael Jacobson at Artcraft Chemicals notified me promptly on receipt of the fresh lot from the manufacturer), I had to mix in 5 drops of 1% C to prepare the 10ml of 40% AFO for printing with gold. As a result, I can say if you have absolutely fresh AFO mix in 5 drops of 1% C; otherwise, for AFO older than 6 months you must test incrementally, adding more drops of C to 10ml of the AFO until a test print shows the desired contrast (which be low until you add a contrast booster).

When preparing AFO for the PGMs – specifically, with my ferric-ferrous dry print out process, platinum, palladium, rhodium, and iridium – the number of drops of 2% C mixed with the AFO or sodium ferric oxalate is much higher. For solutions known to be fresh, I recommend a preliminary test with 12 drops of 2% C mixed thoroughly (by shaking or stirring for 30 seconds). I invented dry print out with palladium in the summer of 2012, and the ammonium ferric oxalate I used was at least 2 years old. For that I needed only 8 drops of 2% C. In the case of sodium ferric oxalate, which I prepare conforming to Richard Sullivan's excellent formula (see later in this text), the guiding factor will be the age of the ferric oxalate. I have at no time ever encountered a problem with ferric oxalate, but I routinely (about every four years) discard any I have on hand and replace it with a fresh jar). Even, so I would recommend testing, starting with 8 drops of 2% C mixed with 10ml of freshly prepared sodium ferric oxalate up 12 drops.

Whether my realization regarding the particular sensitivity of ammonium ferric oxalate to ferrous content applies to the obsolete – and more than a little ridiculous – paper hydration for printing out inferior images in gold (very narrow latitude with blown highlights and blocked deep shadows, garish colors and grain) I neither know nor care. If you wish to print on hydrated paper, that's your problem. If you wish to use a tool – a glass coating rod – for applying sensitizer to paper, for which in the 19th century you would have been the object of ridicule every bit as much as Mike Ware was ridiculed (destroying all credibility for "his" formulas, regardless of who actually invented them) when he claimed to have invented the glass coating rod, that too is your problem. I do not cater to the limited intelligence of the majority of members of the Photrio Analog forum.

I. Introduction and Background

This book presents 21st century formulas for dry print out of photographic images, using either ink jet or film negatives, on dry paper, on clayboard, on fabric, on glass, even on Pictorico transparency film. Five different noble metals are supported for these formulas:

- platinum
- palladium
- gold
- rhodium
- iridium

These metals can be used alone or in any combination to print out on dry paper grainless, monochrome, continuous tone photographs. Images never before conceivable -- locked out by petrified thinking and the loathsome greed to sell overpriced specialty chemicals and workshops that are little more than infomercials -- are now available to serve every printer's vision.

In 2011 I discovered that if I deliberately converted some of the ferric iron in a double ferric oxalate (ammonium ferric oxalate, sodium ferric oxalate, lithium ferric oxalate, etc.) to ferrous iron, forming a suspension with both ferric and ferrous iron together, I could greatly enhance the reduction of gold chloride mixed with such a solution to elemental gold that formed a true, continuous tone photographic image. In the ensuing months, as I approached each other precious metal in turn to work out a printing formula for each, it dawned on me that I had not invented a new process for printing gold, but one for all of the noble metals. This book is presented as a series of formulas for printing out on dry paper 5 of the noble metals and combinations of those metals. In fact, I propose but a single formula, with slight variations, for dry print out of gold, platinum, palladium, iridium, and rhodium.

The world of fine art photograph printing is transformed. No longer need the fine art printer ask, "Should I print in platinum or in palladium?" Those limitations are wiped away. The question a printer might ask now is, "What would a print from equal parts of platinum, palladium, iridium, gold, rhodium look like?"

The formulas presented in this book constitute a radical departure from the obsolete 19th century way of doing things. The only guesswork in print ng with these processes is which formula will give the printer the ideal look for any given negative. Further, these processes have all been refined over nearly a decade. All have been confirmed with XRF Spectrometric analysis. Instructional videos are on line for them.

Emphasis must be placed on two points:

• A complete, normal photographic image prints out fully on paper that is not hydrated or otherwise dampened in hope of triggering print out – rather, the sensitizer is applied to the paper, allowed to dry for up to several days if so desired, and then contact printed until an image fully forms. No steampunk hydration chambers need be constructed, nor is there any heavy breathing on one's paper in a lastditch

effort to coax a reluctant image into print. And there is no hunching over sensitized paper in a closet, clutching a blow dryer (that throws up toxic chemicals into the air) trying to dry paper without drying emulsion – or is it the other way around? Who cares, nobody need do any of that ever again.

• The newcomer to fine art printing obtains results immediately. There is no learning curve. Cost is greatly reduced, waste virtually eliminated, and results are more consistent and more reliable.

The key to this sudden and total breakthrough is so simple. It has been there since the first tests were made for printing with the double ferric oxalate -- ammonium ferric oxalate --150 years ago. In the 1800s, printers saw the key and decided it was a flaw of all double ferric oxalates. They first uttered the dogma that has literally fogged the minds of printers ever since: The presence of any ferrous iron in a double ferric oxalate fogs a print and must be voided at all costs. And those same people who sell you workshops will also happily sell you a test kit for ferrous iron so that you know when to throw away your expensive chemicals and buy new ones from them.

The fact is that ferrous iron, present in a double ferric oxalate along with ferric iron, triggers reduction of noble metals to their elemental, image-forming state. Who knows, had printers figured that out in the 1880s, we might never have seen the silver gelatin print dominate photographic printing for 100 years.

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II. MATERIALS

METAL SALTS

Gold chloride and some of the Platinum Group Metal (PGM) salts print out with the double ferric-ferrous chlorides ammonium ferric oxalate and sodium ferric oxalate. Osmium chloride does not print out at all; rhenium chloride is an unknown – hard to find and extremely expensive when located; ruthenium has some practical (and extraordinary) applications for printing with the noble metals, but that is a topic beyond the scope of this introductory manual, but which I may share in the future.

Only the fact that the PGM metals are used in various industrial and medical processes keeps them available at reasonable prices. Platinum chloride, palladium chloride, iridium chloride, ad rhodium chloride are most readily available in the United States from Pressure Chemical in Pittsburgh, Pennsylvania, under the Product category of Catalysts (https://presschem.com/products/productsales/catalysts-2/). In Richard Eugene Puckett's documentary "The Sky My Face To Weep" on youtube.com he receives an order of iridium from Pressure Chemicals: a tiny bottle with 5 grams arrives in a ridiculously large box.

Gold and silver are not PGMs and therefore not available through that dealer. A secondary source, for gold chloride (as chloroauric acid) and silver nitrate, as well as for platinum and palladium salts is Artcraft Chemicals, Altamont, New York (https://www.artcraftchemicals.com/product-category/metalssalts/). Expect volatility in prices during pandemics and trade wars...

The specific metal salts of interest, discussed under the section for printing with each, are:

• Palladium: Sodium tetrachloropalladate (II) (38% Pd) • Platinum: Potassium tetrachloroplatinate (II) (47% Pt)
• Iridium: Dihydrogen Hexachloroiridate (IV) Hydrate (40% Ir) or Iridium (III) Chloride Hydrate (53% Ir)
• Gold: Chloroauric (III) Acid ("gold chloride")
• Rhodium: Rhodium (III) Chloride Hydrate (40% Rh)

Note that lithium palladium chloride (specified for the now obsolete Ziatype), poUtassium palladium chloride, and ammonium chloroplatinate are interchangeable with their respective versions in the above list.

UV Light Source

The best source for contact printing is the sun. The sun is rich in UV light and is free. The drawbacks to sunlight are that it is not always available and that it can be too strong a light source: print out can easily occur too quickly, preventing the printer from determining when exposure is exactly as desired. For that reason, ultraviolet lamps and bulbs are highly valuable tools.

One can purchase UV printing units prefabricated. They generally cost from $300 to over $1000. One can easily make a V printing unit for under $100. Tubes are sold at most hardware stores, along with the wiring necessary. The casing can be any light proof material. 24 inch “Hyper Tough” brand fluorescent UV tubes are sold with fixture and mounting hardware at Walmart for under $12 a unit. The author has used 5 of those units side by side for printing up to 11x14. LED UV bulbs are sold on Amazon and elsewhere for about $5 each ($10 for a 2 pack).

STORAGE BOTTLES

Virtually all of the chemicals discussed in this text are toxic, some are deadly poisons. Therefore, storage bottles must be unique in color and shape from any household food or beverage containers. Ideally, they should also be resistant to UV light. Small brown glass bottles with plastic stoppers are excellent for the metal salts and all light-sensitive chemicals, solid or liquid.

All chemicals, regardless of the nature of the bottles in which they are stored, must be clearly labeled.

All chemicals, vessels, containers, implements and tools used for these printing processes should be kept well apart from any food stuffs and items associated with food. Ideally, the

printer would purchase a small under counter refrigerator for a modest price in which to store all chemicals. Finally, all tools (including but not limited to thermometers, shot glasses, stirring rods, cylinders and eyedroppers) should be stored entirely apart from any like tools used for any purpose whatsoever.

CONTACT PRINT FRAME

Photographer’s Formulary offers a reasonably priced 8x10 contact print frame that accommodates negatives up to 8x10 and paper up to 9x11. That frame is available not only from Photographer’s Formulary but also from the New York stores, Adorama and B&H Photo Video. Larger (and sturdier) contact print frames are available from various sources. An interwebs search for “contact print frame” will return numerous options.

BRUSHES

A brush should be at least one-quarter the width of the area to be coated. The author’s personal preference is slightly wider than that – a 3 inch brush for 8x10, 2 inch for 5x7. The brush should be flat (not a puff brush) with soft bristles – a brush of the sort used for spreading thin media across large surfaces. Thick, hard bristles are not appropriate as they are intended for spreading thick media. The glass coating rod was the standard tool used by photographers in the 19th century to apply collodion to sheets of glass – none of the dry print out formulas use thick media. And the glass coating rod is no more appropriate than paper hydration.

The author recommends a 3 inch Royal & Langnickel® Jumbo™ Soft Flat Brush. The brush is designed for spreading thin media evenly across a large substrate. It sells generally for under $10. This brush does not soak up one’s solution and, unlike the highly vaunted Richeson 9010 brushes, this brush does not splay.

Also, note that a brush with aferrule is perfectly fine to use if you do not leave it in water after use, but wipe the entire brush dry. A ferrule only drops metal particles onto paper if it is allowed to rust. If rust should appear discard the brush and buy a new one (unless the ferrule on your $90 Richeson rusts…).

TRAYS

Trays specified for analog photography are expensive and unnecessary. Therefore, think outside the tray: the big box stores such as Walmart, etc., sell inexpensive storage trays,with flat bottoms, in a great variety of width, length and height at modest prices. A tray simply needs to be at least an inch wider/longer than the largest sheet of paper to be immersed inside it. Ideally the bottom is flat and not ridged.

PAPER

Specific papers have specific characteristics which are only apparent to the printer after having used them. Further, a given batch of a paper may exhibit defects that are not observable in a different batch of the same paper. In papers known to suffer from defects, the wise printer will purchase only a few sheets before committing to a large order.

Alternative substrates to paper are also available and are discussed in the next section.

Only purchase “hot press” paper (never buy any paper specified as “cold press” or “gros grain”). Hot press paper offers a harder and smoother surface. Most of the sensitizers sink into cold press or gros grain papers and do not print properly.

Reliable and Readily Available Papers

The following papers are known from direct experience to work with all processes discussed in this book. Further, these papers are widely available:

• Bergger Cot 320 (NOT Cot160) – the author’s favorite for all printing.
• Legion Revere Platinum
• Arches Platine Hot Press (not for long-term storage: the paper is internally sized with a carbonate, which can over time seep its way to the surface and interfere with printing)
• Clearprint Vellum (needs to be prewashed and ironed – undera sheet of heavier paper – to minimize puckering when sensitized

Occasionally Problematic but Widely available, and not suitable for gold:

• Hahnemuhle Platinum (two different batches had spots, about the size of a dime or a little smaller, similar to watermarks, in the image area of about 1 sheet in 4)
• Fabriano Artistico Hot Press (same problem)
• Arches Aquarelle (formerly excellent for gold, but since Canson revision worthless for gold)

OTHER SUBSTRATES

The noble metals print out on the following substrates with little or no preparation:

• Yes! stretched canvas – requires a strong boost in contrast, and final printout should appear to be far too dark, which is deceptive as reduction of the noble metal(s) is very slow and the excessively dark image is ferrous iron which dissolves in clearing
• Pictorico (and other brands) transparency material for ink jet printing. Gold prints purple because moisture of the sensitizer remains on the surface.

Substrates that can be prepared with simple immersion in a noble metal sensitizer include:

• Polyester fabric, especially heavy, stiff satin or silk
• Silk and satin, the genuine fabric produced by silk worms
• Linen, very fine weave

It is possible to sensitize any of the above fabrics by preparing double volume of the sensitizer and applying it to the fabric either by floating or with a sponge brush. A flat bottom tray is appropriate to reduce waste when floating.

Sizing the fabric with either gelatin or gum arabic is more economical and results in stronger image print out. All fabrics respond well to multiple layers of gum arabic or gelatin with, after drying, intervening layers of formalin, formaldehyde or glyoxal (to harden each layer).

IMPORTANT: Gelatin is suitable for all formulas except those including gold. Gold in the presence of gelatin-sized fabric invariably prints out red. For gray-scale images from gold on fabric arrowroot or gum arabic are necessary.

SIZING FABRIC

The process is simple, and involves adding a layer or two of gum arabic or gelatin, and letting that dry. Then a hardener is layered on and dried. Then the whole whole process repeated several more times. The test of the sensitizer is to drop a single drop of palladium, iridium, or platinum onto a small swatch of the paper. If the drop beads up the paper is ready; if the drop sinks into the fabric more sizing is needed.

1. Prepare a 26% solution of gum arabic by adding a small volume of hot water to the desired amount of gum acacia powder (260 grams for 1 liter of water). Dissolve the powder into a paste, then slowly add more water while warming the solution on low heat. With all the water added, continue stirring over low heat until the solution is clear. The preparation of the gum arabic is quite timeconsuming and vastly simplified by purchasing 1 gallon of gum arabic liquid from Photographers' Formulary:

http://stores.photoformulary.com/gum-arabic-liquid-14-baume/

Photographers' Formulary also sells glyoxal in volume.

2. After each layer of gum arabic (or of gelatin) hardens, pply a layer of glyoxal to the fabric by floating in a tray of glyoxal or by applying it to the fabric with a brush or a squeegee. Stretch the fabric out on a wood frame (as canvas is stretched) and thumbtack it down and size it with gum arabic and let dry. Then coat with glyoxal. Repeat the sizing 3 or 4 times. Allow to dry fully and confirm that the gum arabic size has hardened: drop a single drop of colored liquid, such as food coloring, onto a swatch: if the drop beads on the swatch, the sizing is good; if the drop soaks into the fabric, the sizing is not sufficiently hard. Try applying more glyoxal alone, allowing each additional layer to dry fully.

A note on sizing: the author found sizing fabric to be a time consuming process and prefers floating fabric in sensitizer:

1. Attach a sheet of fabric to a sheet of glass the size of the negative to be contact printed (such as 5x7).
2. Tape or clamp together the excess fabric flat against the back.
3. Run wire hooks through the fabric on the back and twist them together to form a single strand of wire with which to level the glass when raising and lowering it.
4. Lower the fabric covered glass into a flat tray or other dish slightly larger than the glass sheet.
5. Float the fabric for two minutes.
6. Remove the glass sheet from the tray and hang the glass, fabric still attached, fabric down to dry.
7. While the silk is drying, any leftover sensitizer can be applied to coat paper or other substrate such as Pictorico film which when dry can be printed. Note: paper or other substrates sensitized with ammonium ferric ferrous oxalate have a considerably longer shelf life than the paper coated with ammonium ferric oxalate on hydrated paper; days rather than minutes. So there is no concern about wasting precious metals.

MISCELLANEOUS TOOLS

- Thermometer (for confirming proper temperature – typically 85F – for dissolving chemicals and metal salts)
- Shot glass or sauce cup
- Plastic screen (for drying cleared prints)
- Glass or plastic stirring rod
- Rubber gloves
- Large syringe or small baster

III. SOLUTIONS

Obviously, all solutions required for printing using a given formula and metal salt (or salts) need to be prepared in advance of that printing. One, glycerin, used for the Platinotype Supreme (or any of the combination processes when prepared with platinum as the primary metal – over 60% of the total metal content) needs no preparation. Purchase glycerin at 99% or greater purity from pharmacies, big box

stores, or even vape shops.

- Glycerin
- Vitamin C
- Ammonium Ferric Oxalate
- Ammonium Ferric Citrate (when Sigma Aldrich releases a batch of ammonium ferric oxalate is too strong to use for gold)
- Potassium Dichromate
- Muriatic Acid
- Tetrasodium EDTA
- Sodium Sulfite
- Potassium Dichromate
- Various Acids for Special Applications
- Gold Chloride
- Iridium Chloride
- Platinum Chloride
- Palladium Chloride
- Rhodium Chloride

The following are standard Solutions common to all formulas:

- Vitamin C: only use Vitamin C powder or crystals, NOT tablets. Use 1% for gold or mostly gold; 2% for all others.
- Ammonium ferric oxalate or sodium ferric oxalate: always 10ml at 40% strength, mixed with 3 to 7 drops of 1% C for gold; 8 drops of 2% C for all others.
- Tetrasodium EDTA: 50 grams in 1000ml water.
- Hydrochloric Acid: 0.5% for palladium; 2% for the rhodiotype supreme; 1% for all others

Vitamin C

Prepare a 2% ascorbic acid solution for printing with the noble metals. The 2% C solution is also necessary for any formulas combining gold with the other metals when the total volume of gold is less than 50%.

When printing with gold and with any noble metal combination in which gold is at least 50% of the total metals, prepare a 1% solution.

2% Solution:

- Platinotype Supreme
- Palladiotype Supreme
- Rhodiotype Supreme
- Iridiotype Supreme

• Ultimatype Supreme if gold less than 50% of metal
• Auridiotype Supreme if gold less than 50% of metal
• Chrysotype Supreme

1% Solution:

• Auridiotype Supreme (gold-iridium when iridium is less than 50% of the metal content)
• Ultimatype Supreme (gold-platinum when platinum is less than 50% of the metal content)

2% C:

1. Pour 10ml of distilled water into a brown glass bottle.
2. Weigh out 0.2 g of vitamin C (or of sodium ascorbate, which is time-release C with extra sodium added).
3. Pour the C into the water in the bottle.
4. Cap the bottle and shake it vigorously for about 60 seconds, until the C crystals are dissolved.
5. Label this bottle "2% C."

1% C:

1. Pour 10ml of distilled water into a brown glass bottle.
2. Weigh out 0.1 g of vitamin C (or of sodium ascorbate, which is time-release C with extra sodium added).
3. Pour the C into the water in the bottle.
4. Cap and shake the bottle until the C crystals dissolve.
5. Label this bottle "1% C."

Ammonium Ferric Oxalate or Sodium Ferric Oxalate

The purpose of the vitamin C solutions is to prepare 10ml of 40% ammonium ferric ferrous oxalate (AFFO) appropriate for different formulas. This is accomplished in two steps: first, a solution of 10ml of 40% ammonium ferric oxalate is made up; second, drops of either 1% or 2% vitamin C solution are added to the bottle of the ammonium ferric oxalate and mixed thoroughly. NOTE: It is not likely, but quite conceivable that ammonium ferric oxalate purchased commercially may prove to be unacceptable for use. The author purchased in the spring of 2019 fresh ammonium ferric oxalate which suffered, after going into solution, extremely high contrast. Not even palladium could be used for printing. Only one company manufactures ammonium ferric oxalate in North America; therefore, there was no option of purchasing the chemical from other manufacturers. (Ammonium ferric oxalate from a new batch, purchased in the winter of 2020, behaved correctly and the author was able to resume using AFO.)

For platinum and palladium (and other PGMs) the solution to the contrast problem is resolved by preparing and using sodium ferric oxalate instead. Sodium ferric oxalate can absolutely be substituted for the AFO in all formulas in this book.

Artcraftchemicals.com is a reliable seller of ammonium ferric oxalate, as well as of ferric oxalate, sodium

carbonate (washing soda), and of oxalic acid.

To prepare 40% Ammonium Ferric Oxalate:

1. Warm 10ml of distilled water to 85 degrees F in a glass vessel.
2. Weigh out 4 grams of ammonium ferric oxalate and dissolve it in the 10ml of water.
3. Pour the solution into a brown glass bottle labeled "AFFO" (for Ammonium Ferric Ferrous Oxalate).
4. Draw off from its bottle, using a standard eye dropper, a volume of the 1% C solution prepared above.
5. Count from 3 to 7 drops of the 1% C solution into the 10ml bottle of AFFO. For printing very contrasty negatives, add3 drops of 1% C. For contrasty negatives add just 4 to 5drops of the C. For negatives that are less contrasty (such as negatives that would print on grade 2 silver gelatin paper), add 6 or 7 drops of the C.
6. Recap the AFFO bottle.
7. **CRITICAL:** Shake the bottle vigorously for 20 to 30 seconds.
8. On the label, add after "AFFO n:1% C", where "n" is the number of drops added, e.g. "AFFO 5:1% C" to indicate that 5 drops of 1% C were added to the 10ml of AFO.
9. Store in a dark, cool location.

Sodium Ferric Oxalate:

Richard Sullivan in the Articles section of www.bosticksullivan.com provides a simple formula to prepare sodium ferric oxalate. You will need to purchase oxalic acid, sodium carbonate monohydrate, and ferric oxalate for this solution.

Www.artcraftchemicals.com sells all.

To prepare 40% Sodium Ferric Oxalate:

1. Pour 10ml distilled water into a container for at least 50ml.
2. Dissolve 1 gram of oxalic acid in the water.
3. Slowly stir into the oxalic acid solution 1.7 grams of sodium carbonate mono. The solution will fizz intensely but harmlessly as carbon dioxide is released.
4. Stir 1.7 grams of ferric oxalate into the solution.
5. Gently warm the solution, while stirring, until the solution turns a clear but dark green. (NOTE: You may need to warm the solution, in a tray of hot water, enough that the ferric oxalate that will be floating on top disperses, and then set the container in a dark warm place for about an hour. If so, stir and rewarm the solution until it clears finally.)
6. Pour the clear, dark green sodium ferric oxalate into a brown glass stoppered bottle.
7. Label the bottle SFFO (for Sodium Ferric Ferrous Oxalate).
8. Repeat steps 4 through 8 from the instructions for ammonium ferric ferrous oxalate, above. That is, add from 3 to 7 drops of 1% C to the bottle of sodium ferric oxalate and shake the bottle vigorously for 20 to 30 seconds and note on the label the number of drops of C added.
9. Store in a dark, cool location.

Potassium Dichromate

Contrast boost chemically is hardly necessary for prints working with ink jet negatives. However, a 2% solution of potassium dichromate boosts contrast for film negatives originally prepared for printing on Grade 2 silver gelatin paper.

1. Wear nitrile gloves for working with dichromate as it is poisonous and carcinogenic.
2. Warm 5ml of distilled water in a glass container, such as a shot glass.
3. Weigh out .1 gram of potassium dichromate.
4. Dissolve the dichromate in the warm water, stirring with aplastic or glass stirring rod.
5. Pour the dichromate solution into a stoppered brown glass bottle.
6. Label the bottle 2% Dichromate.
7. 2 drops of the solution added to the AFFO (or SFFO) should provide an adequate contrast boost for the softest negative.

Muriatic Acid

The ferrous iron must be removed from the paper after print out is complete. A 1% acid bath is made up with muriatic acid (~31% strength hydrochloric acid) by adding 30ml to 100ml of water. This acid is strong enough that only a single bath is needed, followed by a water wash. This is a one-shot use solution and so should be prepared immediately before printing and discarded after clearing the print. Wear a splash mask and rubber gloves.

Do not pour from the container of acid; draw off a small volume of the acid in a baster or large syringe. This solution strength is suitable for all processes except the Palladium Supreme which requires 0.5% hydrochloric acid and the Rhodiotype Supreme for which 2% hydrochloric acid is appropriate.

1. Measure 1000ml cold water into a wide-mouthed container.
2. Using a baster or large syringe “inject” 30ml of muriatic acid into the cold water.
3. Stir with a glass or plastic rod.
4. Label the container “1% Hydrochloric Acid” Palladium dissolved in hydrochloric acid. Therefore, for printing pure palladium (Palladiotype Supreme), the acid strength should not exceed 0.5%.
5. Measure 1000ml cold water into a wide-mouthed container.
6. Using a baster or large syringe “inject” 15ml of muriatic acid into the cold water.
7. Stir with a glass or plastic rod.
8. Label the container “0.5% Hydrochloric Acid”.

The Rhodiotype Supreme is a reductive process, in which palladium triggers the reduction of the rhodium to its elemental state. After print out is complete, the palladium, which constitutes only a small percentage of the image, is dissolved using a 2% solution of hydrochloric acid. XRF Spectrometric analysis has shown Rhodiotype Supremes are above 90% rhodium following the reduction of the palladium. dissolved in hydrochloric acid. (Even more of the palladium can be removed but at risk of

serious damage to paper. However, for other substrates, such as polyester fabric or clayboard, and any other not affected by mild hydrochloric acid, a 5% solution in a 10 minute bath with agitation should suffice.)

- Measure 1000ml cold water into a wide-mouthed container.
- Using a baster or large syringe “inject” 60ml of muriatic acid into the cold water.
- Stir with a glass or plastic rod.
- Label the container “2%” Hydrochloric Acid”.

Tetrasodium EDTA

After the acid clearing, the print is washed in running water for about half an hour and then soaked in a 5% solution of Tetrasodium EDTA. The T-EDTA chelates (lifts away) ferrous iron and also raises the pH of the paper after the acid bath.

Dissolve 50 grams of the T-EDTA in 1000ml of water. T-EDTA is not light sensitive, so can store it in any appropriately labeled one liter bottle. Reuse the T-EDTA until it turns yellow (from iron).

Sodium Sulfite

Prints prepared in gold should as a rule be immersed immediately after print out in an iced solution of 5% sodium sulfite. This initial bath, even before the acid bath, prevents the gold print from turning very dark – or, rather, prevents the iron from oxidizing and turning the print black. Prepare a sodium sulfite solution:

1. Dissolve 50 grams of sodium sulfite in 1000ml of warm water.
2. Stir constantly until the sulfite completely dissolves.
3. Immediately before preparing a gold print, add ice cubes to a tray of this sodium sulfite. Use enough ice to lower the solution temperature to below 40F. Tip: If you have a flat or early flat tray, you should be able to clear an 8x10 or 11x14 in only 500ml of iced sulfite.
4. After 5 minutes, transfer the print to a tray of cold waterand agitate for 5 minutes. Then transfer the print to a tray of 1% hydrochloric acid.

Prepare Metal Salts Solutions

Gold Chloride

1. Pour 8ml of distilled water at 85F into a small glasscontainer, such as a shot glass.

2. Add 1 gram of chloroauric acid and stir until dissolved (almost instantaneously).

3. Pour the solution into a stoppered brown glass bottle, cap it, and label it 12% Au.

Iridium Chloride

1. Pour 10ml of distilled water at 85F into a small glass container, such as a shot glass.

2. Add 1 gram of either iridium chloride hydrate or of dihydrogen hexachloroiridate and stir until dissolved (almost instantaneously).
3. Pour the solution into a stoppered brown glass bottle, cap it, and label it 10% Ir.

Platinum Chloride.

Note: contemporary formulas usually specify a 20% solution of platinum; many 19th century sources indicate 15% platinum.

1. Pour 4.5ml of distilled water at 85F into a small glass container, such as a shot glass.
2. Add 1 gram of Potassium Tetrachloroplatinate (II) and stir until dissolved (almost instantaneously).
3. Top off the volume, if necessary, to 5ml.
4. Pour the solution into a stoppered brown glass bottle, cap it, and label it 20% Pt.
5. If you intend to print pure platinum photographs, store the bottle of freshly mixed platinum for at least 18 days. If you intend to mix the platinum with other metals (such as gold, palladium, iridium, and/or rhodium) the "resting" is not necessary and the metal solution can be used immediately after preparation.

Palladium Chloride

Note: contemporary formulas usually specify a 15% solution of palladium; but early 20th century sources indicate 20%.

1. Pour 5ml of distilled water at 85F into a small glass container, such as a shot glass.
2. Weigh out 1 gram of potassium tetrachloropalladate into a small glass container.
3. Pour the palladium into the 5ml of warm distilled water.
4. Stir until dissolved (almost instantaneously). The solution will appear dark red but completely clear when held up to light.
5. Pour the solution into a stoppered brown glass bottle, cap it, and label it 20% Pd.

Rhodium Chloride

A 10% solution of rhodium chloride is necessary for printing the Rhodiotype Supreme. The only source I have found for reasonably priced rhodium used to be

https://presschem.com/products/product-sales/catalysts-2/

$60 a gram for rhodium is at present (11/2021) a fond memory; however, once the price falls back to usual levels presschem will likely again be the most affordable source.

1. Pour 10ml of distilled water at 85F into a small glass container, such as a shot glass.
2. Add 1 gram of rhodium chloride hydrate and stir until dissolved (almost instantaneously).
3. Pour the solution into a stoppered brown glass bottle, cap it, and label it 10% Rh.

IV. FORMULAS

This section presents dry print out formulas for:

- Chrysotype Supreme (pure gold)
- Auridiotype Supreme (gold-iridium
- Ultimatype Supreme (gold-platinum
- Platinotype Supreme (pure platinum)
- Palladiotype Supreme (pure palladium)
- Iridiotype Supreme (iridium with palladium)
- Rhodiotype Supreme (rhodium)

All processes are dry print out: one prepares the sensitizer, applies it to a substrate (paper, fabric, silk, pictorico transparency film, canvas, etc.), dries it, and prints it out.

At no time is any substrate hydrated, humidified, breathed on heavily, or blow dried.

Printing Problems And Solutions

This section discusses common problems that the printer may encounter.

Problem: I tried adding 2 drops of dichromate to my sensitizer (AFFO and palladium) mix but the contrast in my print is still too low.
Solution: Add 4 drops of dichromate to the mixed sensitizer. If a significant contrast boost is not apparent in the next print, the AFFO has gone bad (or is the wrong strength) or the dichromate is old (and weak), or the UV lamps are fading.

Problem: My prints fade in the hydrochloric acid bath.
Solution: The acid is too strong. For pure palladium prints, the maximum strength is .5%. A strong solution of hydrochloric acid dissolves finely divided palladium. Alternatively, use a lighter paper -- less than 200 gsm -- and replace the muriatic/hydrochloric acid with citric acid.

Problem: My prints slowly get darker and after a few weeks are almost entirely black.
Solution: This is caused by insufficient clearing of the iron. Do not clear heavy paper with citric acid, only with hydrochloric acid. Leave the print in the hydrochloric acid baths a full 10 minutes. In addition, use 2 T-EDTA baths (with additional water washes). Make sure that the final water wash is 60 minutes for heavier papers (over 200 gsm) and 30 minutes for lighter papers.

Problem: My prints look gritty and the image does not completely print out.
Solution: You are using an incompatible paper. The sensitizer soaked too far into the fibers. Refer to the papers list above and choose one suitable for this process. If you cannot find a suitable paper, you can size an otherwise unsuitable one with either gum arabic or arrowroot starch. Iron the paper before sizing, then let the sized paper dry thoroughly before repeating the sizing.

Problem: I get dark stains in my paper where I pour the sensitizer solution.
Solution: Apply the solution in a thin line near the edge of the coating and take care to brush the solution across the paper as fast as possible.

Problem: My image is too contrasty.
Solution: Add less dichromate to the sensitizer.

Problem: My image is blotchy and grainy.
Solution: Either you used the wrong paper or you humidified the paper. Use a paper known to work with palladium (refer to the list above) and do not humidify.

Problem: My print looked fine after clearing but when it dried it turned yellow.
Solution: Clearing was insufficient. Try adding 50ml of Lime Away to 950ml distilled water. Give the print two 10 minute baths with 10 minutes baths in running water interposed. If that does not work, try Rit Color Remover, which contains sodium hydrosulfite (sodium dithionite). The non-bleaching chemical will not damage paper. Soak overnight.

CHRYSOTYPE SUPREME

Related video: https://www.youtube.com/watch?v=wnqMKLunTpk

The Chrysotype Supreme presents image quality comparable with platinum. The pure gold print is absolutely permanent, and can easily be rendered on any substrate.

The only viable option for a high quality chrysotype before Richard Eugene Puckett invented the Chrysotype Supreme in 2011 was Robert Hunt's formula from 1854. Hunt described his version of the chrysotype in his Manual of Photography, 4th Edition, pages 54 et seq. He printed out a faint image on paper coated with ammonium ferric citrate. He then developed out that faint image with a wash of gold solution which he described as having the color of sherry. The prints so produced are a monochrome purple displaying a full tonal range with details from Dmax to Dmin. Hunt's chrysotype certainly never caught on because it required so much gold.

Terry King attempted to address that limitation, along with the color, in his Chrysotype Rex process: King printed out his weak image on ferric oxalate and developed the print with an 8% solution of gold chloride. While King gained the benefits of lower cost and monochrome gray tones, his C Rex did not display the wide tonal range and overall technical quality of Hunt's gold print (much less of the Chrysotype Supreme).

The next option was Richard Sullivan's gold Ziatype, which yields coarse, grainy, contrasty red images with a 5% solution of gold and ammonium ferric oxalate. The so-called "New Chrysotype" or obscurely named "Chrysotype S" (presumably for "Sullivan", on whose work it was merely a variation) announced by the same university don who claimed to have invented the glass coating rod, produces grainy and contrasty prints with a D-Range of only about 6 or at best 7 stops. This version of Richard Sullivan's Chrysotype is being touted curently in a Focal Press book in which it is scurrilously attributed to Mike Ware.

In 2011, the author invented not just the first and only continuous tone, gray scale, wide dynamic range, grainless true photographic image in pure gold, but also invented a genuinely new way to print with the PGMs: double ferric oxalates. Puckett's breakthrough was implicity itself: mix a small volume ascorbic acid (vitamin C) solution with a small volume of 40% ammonium ferric oxalate. Agitate that mixture vigorously for 15 to 30 seconds to produce ammonium ferric ferrous oxalate – a compound known amongst wastewater treatment engineers as "magic iron."

Puckett arrived at his solution through inductive reasoning. He realized that the ferric iron process was not a simultaneous transformation of the chemicals present (after all, as Einstein observed, time exists expressly so that everything doesn't happen all at once), but a step-by-step progression, a sort of tumbling of chemical dominoes: in the presence of ultraviolet light, the oxalic acid in ammonium ferric oxalate progressively reduces the ferric iron to ferrous iron. And as the ferrous iron approaches critical mass it begins to release the chlorine from the metal salt – gold chloride, in this case. A further chemical transformation occurs in the oxalic acid, causing the elemental gold and the ferrous iron to fall into the fibers of the paper. Thus, to perfect the Chrysotype, ensuring complete progressive reduction of the

gold chloride to elemental – and image-forming – gold, Puckett needed only to pre-convert ferric iron to ferrous up to the point at which the ferrous was at the threshold of falling out of suspension in the ammonium ferric ferrous oxalate, and to begin converting the gold chloride to elemental gold. Vitamin C is commonly used in waste water treatment and also in medical laboratories to reduce ammonium ferric oxalate to the ferrous version. Through simple trial and error Puckett determined the strength of the C solution and volume to be mixed with a known volume of 40% ammonium ferric oxalate.

The Chrysotype Supreme images print out with no hydration and no concern for relative humidity (the author currently resides in El Paso, Texas, which is of course desert with average afternoon humidity at 27%). The first public demonstration of the patented process was on January 22, 2012, to the Austin Alternative Photography Group. In March 2012, View Camera magazine published an article on the process, and in October 2013 attendees at the Alternative Photography Symposium in Santa Fe, New Mexico, witnessed an hour-long demonstration.

in 2019, Puckett exhausted a supply of ammonium ferric oxalate he acquired in 2012. With the purchase of fresh ammonium ferric oxalate he found that his original formula did not work. The new batch of the chemical was excessively vigorous, so much so that not only was it worthless for printing gold, but also for the PGMs. To print platinum, palladium and rhodium, he resorted to mixing his own sodium ferric oxalate. In the fall of 2019 Sigma Aldrich supplied sellers a new batch of the chemical and Puckett was able to print gold again. However, in the fall of 2021, the latest Sigma Adrich batch again failed. Puckett decided to work out an alternate process for gold. The solution was one of the oldest light sensitive compounds. To print if the ammonium ferric oxalate is useless, switch to ammonium ferric citrate.

There are three formulas for successfully printing chrysotypes:
1) Ammonium ferric ferrous oxalate (AFFO) prepared by mixing into 10ml of 40% ammonium ferric oxalate anywhere from 3 to 6 drops of 1% ascorbic acid (vitamin C). The ratio of drops of this solution to the 12% gold solution is 3:4. That is, mix 3 drops of AFFO with 4 drops of gold; mix 12 drops of AFFO with 16 of gold. This formula is for printing with a batch of ammonium ferric oxalate that prints gold – not all do! Some batches are far too contrasty for gold.
2) Ammonium ferric ferrous citrate (AFFC) prepared by mixing into 10ml of 25% ammonium ferric citrate 4 to 8 drops of 1% ascorbic acid (vitamin C). Fewer drops of 1% C added to the solution lowers contrast and more drops boosts contrast.
3) Ammonium ferric ferrous citrate, as above, mixed with ammonium ferric ferrous oxalate prepared by mixing into 10ml of 40% ammonium ferric oxalate 8 drops of 2% C. The ratio of the citrate version to the oxalate version is 2:1. For example, for an 8x10, you would use 16 drops of gold, 8 drops of AFFC and just 4 of the oxalate AFFO. The ratio of sensitizer to gold is 3:4.

Contrast Control

The basic negative for the Chrysotype Supreme process is one exposed and developed for printing on Grade 2 silver gelatin paper. Refer to the Daybooks of Edward Weston for how to prepare such a negative. However, it is possible to print almost any realistic negative with this formula.

To boost contrast of the sensitizer, mix the appropriate number of drops of 26% ferric oxalate 25% ammonium ferric citrate 1 drop added to the solution for a 4x5 is high contrast.

If printing with ammonium ferric ferrous oxalate prepared with just 3 to 6 drops of 1% C control the contrast by varying the numbers of C added to the AFO – 3 drops will yield extremely low contrast and highest quality; 6 drops yield moderate contrast and high quality with no grain. Alternatively, simply prepare the 10ml of 40% AFO and count just 3 drops of 1% C into that (and shake it vigorously to mix). Count into the shot glass when preparing a print 1 drop of 26% ferric oxalate (with no C added) for a soft 4x5, 2 drops for a 5x7, 4 drops of an 8x10 and so forth. The ferric oxalate boosts contrast and MAY stain the paper (it depends on the paper – Arches Platine hot press, hardly stains if at all, Legion Revere Platinum stains consistently. Any stain can be removed either in a strong batch (10%) of T-EDTA until the stain fades, or an overnight bath in a tray of Rit Dye Remover, the primary ingredient of which is sodium diothionite. The dithionite is used by archivists to remove iron stains from documents and prints.

Paper for the Chrysotype Supreme

- Bergger Cot 320 Rag Cotton
- Arches Platine Hot Press Rag Cotton
- Legion Revere Platinum
- Clearprint 1000H 16 and 20 pound Rag Cotton Vellum (Puckers when solution applied, so presoak in distilled water and iron after it dries)

Other substrates than paper that print gold include:

- Pictorico Transparency Film (for ink jet printers)
- Silk
- Polyester satin and silk
- Ampersand Clayboard (cut a test strip from the board to use for determining print out time)

SOLUTIONS

Prepare the following solutions:

- 12% gold chloride
- 1% Vitamin C
- 2% Vitamin C
- 40% Ammonium Ferric Oxalate
- 25% Ammonium Ferric Citrate
- 1% Muriatic Acid
- 5% Tetrasodium EDTA
- 5% Sodium Sulfite
- Ice
- Isopropyl alcohol

For an 8x10 inch print, using the ammonium ferric citrate and oxalate formula:

1. To 10ml of the 40% ammonium ferric citrate add 3 to 12 drops of 1% ascorbic acid. (3 drops is very low contrast and very high quality; 12 high contrast.) NOTE: the exact number of drops of 1% c can very widely depending on the freshness of the ammonium ferric citrate. Recap and shake the bottle vigorously for 30 seconds.
2. Dampen a fine brush.
3. Count 16 drops of the 12% gold chloride into a shot glass.
4. Count 12 drops of the ammonium ferric ferrous citrate (AFFC) into the shot glass.
5. Swirl the glass to mix the two thoroughly.
6. Pour about half of the solution in a zigzag across a dry sheet of paper and brush it out evenly with deft and confident sweeps of the brush. Get it spread as evenly as possible.
7. Pour the remaining solution onto the paper, with swift and confident brushstrokes, where needed to even out the coating.
8. Place the sensitized paper in a dark, dry place to dry.
9. When the paper is dry place it face up on the bottom of a contract print frame.
10. Place a 2 or 3 mil thick sheet of clear mylar on top of the paper. Mylar thicker than 3 mil will reduce image sharpness.7
11. Place the negative emulsion side down on the mylar.
12. Sandwich the paper, the mylar and the negative between the bottom of the frame and the glass of the frame.
13. Expose the whole to UV or sunlight. When the overbrushed area turns dark gray, drop the back to examine your print's progress.
14. When the print has reached the desired density, remove it from the contact frame and immerse it in a tray containing ice cold isopropyl alcohol, at least 50%. Leave the print in the alcohol for at least 1 and ½ hour. Save the alcohol as it can be used until it turns a dark color.
15. Transfer the print to a tray of ice water and agitate for about 60 seconds.
16. Transfer the print to a tray containing the hydrochloric acid. Wear rubber gloves at least for this step as the acid has its sting... Let the print soak face down for 5 to 10 minutes with gentle agitation.
17. Transfer the print to a tray of cool running water. Let the print wash for 5 minutes.
18. Transfer the print to a tray of the 5% T-EDTA. Agitate the print by flipping it over every minute for 5 to 10 minutes total.
19. Transfer the print to a tray of cool running water. Wash a Clearprint vellum print for 15 minutes. Wash a print made on heavy Arches Platine, Arches Aquarelle, or Bergger Cot for 30 minutes. Carefully lay the washed print to dry on a frame or rack with a bed of fine plastic screen is good.
20. Spot a print as you would a traditional black and white silver gelatin print.

For the traditional formula, use only ammonium ferric oxalate. For an 8x10 print:

1. To 10ml of the 40% ammonium ferric oxalate add 3 to 6 drops of 1% ascorbic acid. Recap and shake the bottle vigorously for 30 seconds.
2. Dampen a fine brush.

3. Count 12 drops of the AFFO into a shot glass.
4. Count 16 drops of the 12% gold chloride into a shot glass.

Continue with steps 5 through 18 above.

AURIDIOTYPE SUPREME

A photograph made of gold and iridium is an impossibility with develop out processes and paper hydration processes alike. Even more outrageous, throwing the self-described “Keepers of the Light” into paroxysms of incredulity, is an image all of gold and iridium printed on Pictorico Supreme transparency material. That is exactly why the processes described in this document all share the name “Supreme”: they shatter the chains of the 19th century processes so dear to members of dying forums like Photrio Analog.

This process is the essence of simplicity. It is identical to the Chrysotype Supreme except that iridium chloride can be substituted for up to half of the gold. And the initial print bath in a solution of sodium sulfite is not necessary. For the experimental minded, feel free to add a little platinum and/or palladium to the mix, as well as even rhodium for a hint of red.

PAPERS

Same papers and substrates as for the Chrysotype Supreme.

SOLUTIONS

Prepare the following solutions:

- 12% Gold Chloride
- 10% Iridium Chloride
- 1% Vitamin C
- Ammonium Ferric Ferrous Oxalate
- 1% Muriatic Acid
- 5% Tetrasodium EDTA
- 5% Sodium Sulfite
- Ice

For an 8x10 inch print:

1. Dampen brush.
2. Count 12 drops of the AFFO into a shot glass. Use the AFFO prepared by mixing 7 drops of 1% C with 10ml of ammonium ferric oxalate.
3. Count 7 drops of the 12% gold chloride into a shot glass. (Note: use at least half gold, with the remainder iridium.)

4. Count 5 drops of the 10% iridium into the shot glass.
5. Swirl the glass to mix the two thoroughly.
6. Pour about half of the solution in a zigzag across a dry sheet of paper and brush it out evenly with deft and confident sweeps of the brush. Get it spread as evenly as possible.
7. Pour the remaining solution onto the paper, with swift and confident brushstrokes, where needed to even out the coating.
8. Place the sensitized paper in a dark, dry place to dry.
9. When the paper is dry place it face up on the bottom of a contract print frame.
10. Place a 2 or 3 mil thick sheet of clear mylar on top of the paper. Mylar thicker than 3 mil will reduce image sharpness.
11. Place the negative emulsion side down on the mylar.
12. Sandwich the paper, the mylar and the negative between the bottom of the frame and the glass of the frame.
13. Expose the whole to UV or sunlight.
14. When the overbrushed area turns dark gray, drop the back to examine your print's progress.
15. When the print has reached the desired density, remove it from the contact frame and immerse it in a tray containing the hydrochloric acid. Wear rubber gloves at least for this step as the acid has its sting... Let the print soak face down for 5 to 10 minutes with gentle agitation.
16. Transfer the print to a tray of cool running water. Let the print wash for 5 minutes.
17. Transfer the print to a tray of the 5% T-EDTA. Agitate the print by flipping it over every minute for 5 to 10 minutes total.
18. Transfer the print to a tray of cool running water. Wash a Clearprint vellum print for 15 minutes. Wash a print made on heavy Arches Platine, Arches Aquarelle, or Bergger Cot for 30 minutes. Carefully lay the washed print to dry on a frame or rack with a bed of fine plastic screen is good.
19. Spot a print as you would a traditional black and white silver gelatin print.

PALLADIOTYPE SUPREME

Related Video: https://www.youtube.com/watch?v=w3WPWYwQsuo

Printing with palladium came into common practice apparently in the 1890s. One of the best-known printers who used palladium frequently was Irving Penn. Until Richard Sullivan's Ziatype process in the 1990s, all palladium was printed with the same develop out process as platinum.

Palladium offers a wide tonal range, fine grain, and flexible color ranging from chocolate brown to neutral gray. The primary limitation of a pure palladium print is weak blacks. Most contemporary printers, absorbed in 19th century processes (in their steampunk role as "Keepers of the Light") address that limitation by adding platinum to the palladium. Irving Penn solved the weak blacks of palladium rather more imaginatively: he added iridium to palladium. However one chooses to extend palladium's tonality to include rich blacks, with platinum or iridium, this process supports either or both. Even gold can be added to boost contrast.

Paper for the Palladiotype Supreme

These three papers are not appropriate for any gold or goldbearing formula, but are fine with palladlium, platinum, rhodium, and iridium (along with the papers appropriate for gold).

- Hahnemuhle Platinum
- BFK Rives
- Fabriano Artistico Watercolor Hot Press
- Otherwise, same papers and substrates as for gold.

SOLUTONS

Assemble the following solutions:

- 15% to 20% Palladium Chloride
- 2% Vitamin C
- 2% Potassium Dichromate
- Ammonium Ferric Ferrous Oxalate
- 0.5% Muriatic Acid
- 5% Tetrasodium EDTA

To print an 8x10:

1. Don a pair of rubber or nitrile gloves.
2. Working in weak tungsten light, count 12 to 16 drops of the ammonium ferric ferrous oxalate into a shot glass.
3. Count 12 to 16 drops (an equal count) of 15% palladium chloride into the same shot glass.

4. If you desire a contrast boost, count 1 or 2 drops (maximum) of dichromate into the shot glass.
5. Holding the damp brush in one hand, swirl the liquid in the nshot glass vigorously and pour the sensitizer solution onto the paper inside the sketched negative area.
6. Brush the solution quickly but methodically, vertically, horizontally and diagonally across the paper. Spread the solution out evenly as fast as possible while keeping it more or less within the outline. Do not allow puddles of the sensitizer to stand on the paper. Puddles make dark splotches in prints. Tip: Perfect your brushwork on ordinary paper using diluted corn syrup mixed with food color.
7. Place the sensitized paper in a dark, dry, cool place for 15m to 30 minutes, until dry. On very humid days, a print takes longer to dry. Do not be tempted to print until the sensitizer is dry. Damp sensitizer will destroy your negative.
8. Expose in direct sunlight or to a UV light source. Anticipate exposures ranging from less than 1 minute to as long as 15 minutes, depending on the density of the negative. Keep an eye on any over- brushed sensitizer that went beyond the edge of the negative. When that turns dark gray, drop one side of the print frame back to view print-out progress.
9. Immerse the correctly exposed print in a first bath of iced (~35 degrees Fahrenheit) tap water. This ice water bath minimizes any initial darkening of the image.
10. After five minutes, pour off the cold water and pour 250ml to 500ml of .5% hydrochloric acid, or of citric acid solution (1 tablespoon of citric acid powder dissolved in 500ml water) into the tray, and rock the tray gently for five minutes.
11. Pour off the acid into an appropriately labeled bottle, and wash the print in cool running water for five minutes.
12. Repeat the acid bath and water wash again.
13. After the water wash, pour a solution of Tetrasodium EDTA, prepared with one tablespoon in 500ml of water, into the tray. Rock the tray intermittently for 15 minutes. Save the T-EDTA in an appropriately labeled bottle. You can reuse the acid you saved and this T-EDTA until the solution(s) turn slightly yellow at which time you discard them and mix up fresh solutions.
14. Wash a print on heavy papers, such as Arches Platine or Bergger Cot320, in running water for 45 minutes. Wash lighter papers for 30 minutes.
15. Drain the print holding it by one corner and hang to dry (plastic clips, not metal). Do not touch the emulsion.
16. Spot the dry print with spot tone or India ink as necessary.

PLATINOTYPE SUPREME

Related video: https://www.youtube.com/watch?v=O2hGsK89rJA

Until Richard Eugene Puckett's announcement in 2013 of dry print out platinum, the only successful process for printing out platinum, on hydrated paper, had been Pizzighelli's Pizzitype in the 1880s. Pizzighelli published a formula in 1890: an equal number of drops of ammonium ferric oxalate and of potassium platinum chloride were brushed onto hydrated paper and printed out immediately. If an image failed to appear fully, the paper was to be hydrated further. Much discussion about tricks and techniques for perfecting Pizzighelli's formula can be found on Google Books, in late 19th and early 20th century photographic magazines. His process was even revived in the 1980s by a Scottish university don who claimed it as his own. (This was the same don who claimed to have invented the glass coating rod and Richard Sullivan's gold process -- and whose shenanigans forced this author to patent the Texas Chrysotype/Chrysotype Supreme and the Rhodiotype Supreme, to protect them from his unsavory ethics.)

The Platinotype Supreme differs from Pizzighelli's Pizzitype in that the ammonium ferric ferrous oxalate Puckett specifies eliminates any need for hydration before or after sensitizing. The platinum forms an image on dry paper. And because of the nature of the chemical response exhibited by platinum chloride exposed to uv light in the presence of ammonium ferric ferrous oxalate, glycerin must be added to suppress graining.

The Platinotype Supreme differs from the Palladiotype Supreme in two ways: the substitution of platinum for palladium, and the addition of pure glycerin to the sensitizer. Apart from that, the two formulas are identical. Indeed, palladium can be substituted for up to half of the platinum, alone or with gold, rhodium, or iridium.

Paper for the Platinotype Supreme

- Hahnemuhle Platinum
- BFK Rives
- Fabriano Artistico Watercolor Hot Press
- Arches Aquarelle
- Bergger Cot 320 Rag Cotton
- Arches Platine Hot Press Rag Cotton
- Legion Revere Platinum
- Clearprint 1000H 16 or 20 pound Rag Cotton Vellum (Puckers when solution applied, so presoak in distilled water and iron after it dries)

Other substrates than paper that print platinum include:

- Pictorico Transparency Film (for ink jet printers)
- Silk

• Polyester satin and silk
• Yes! Prestretched and mounted canvas (not pads). Contrast boost with potassium dichromate and extended print out needed.
• Ampersand Clayboard (cut a test strip from the board to use for determining print out time)

SOLUTIONS

Assemble the following solutions:

• 20% Platinum Chloride
• Glycerin
• 2% Potassium Dichromate
• Ammonium Ferric Ferrous Oxalate AFFO:8-2%C
• 1% Muriatic Acid
• 5% Tetrasodium EDTA

To print an 8x10:

1. Don a pair of rubber or nitrile gloves.
2. Working in weak tungsten light, count 16 drops of the ammonium ferric ferrous oxalate into a shot glass.
3. Count 16 drops (an equal count) of 20% platinum chloride into the same shot glass.
4. Count 6 to 8 drops of glycerin (half as many as of the platinum solution) into the shot glass.
5. If you desire a contrast boost, count 1 or 2 drops (maximum) of potassium dichromate into the shot glass.
6. Swirl the solution gently until the glycerin and other solutions are fully mixed.
7. Holding a damp brush in one hand, pour the sensitizer solution onto the paper inside the sketched negative area.
8. Brush the solution quickly but methodically, vertically, horizontally and diagonally across the paper. Spread the solution out evenly as fast as possible while keeping it more or less within the outline. Do not allow puddles of the sensitizer to stand on the paper. Puddles make dark splotches in prints. Tip: Perfect your brushwork on ordinary paper using diluted corn syrup mixed with food color.
9. Place the sensitized paper in a dark, dry, cool place for 15 to 30 minutes, until dry. On very humid days, a print takes longer to dry. Do not be tempted to print until the sensitizer is dry. Damp sensitizer will destroy your negative.
10. Expose in direct sunlight or to a UV light source. Anticipate exposures ranging from less than 1 minute to as long as 15 minutes, depending on the density of the negative. Keep an eye on any over-brushed sensitizer that went beyond the edge of the negative. When that turns dark gray, drop one side of the print frame back to view print-out progress.
11. Immerse the correctly exposed print in a first bath of iced (~35 degrees Fahrenheit) tap water. This ice water bath minimizes any initial darkening of the image.
12. After five minutes, pour off the cold water and pour 250ml to 500ml of .5% hydrochloric acid, or of

citric acid solution (1 tablespoon of citric acid powder dissolved in 500ml water into the tray, and rock the tray gently for five minutes.
13. Pour off the acid into an appropriately labeled bottle, and wash the print in cool running water for five minutes.
14. Repeat the acid bath and water wash again.
15. After the water wash, pour a solution of Tetrasodium EDTA, prepared with one tablespoon in 500ml of water, into the tray. Rock the tray intermittently for 15 minutes. Save the T-EDTA in an appropriately labeled bottle. You can reuse the acid you saved and this T-EDTA until the solution(s) turn slightly yellow at which time you discard them and mix up fresh solutions.
16. Wash a print on heavy papers, such as Arches Platine or Bergger Cot320, in running water for 45 minutes. Wash lighter papers for 30 minutes.
15. Drain the print holding it by one corner and hang to dry (plastic clips, not metal). Do not touch the emulsion.
17. Spot the dry print with spot tone or India ink as necessary.

ULTIMATYPE SUPREME

YouTube Video: https://www.youtube.com/watch?v=qLsgrdj4pdw

Gold mixed with platinum alone or in ferric oxalate or any double ferric oxalate precipitates prematurely and does not contribute to the photographic image subsequently printed – except to "enhance" it with swirls of red and blue.But when gold is added to ammonium ferric ferrous oxalate and mixed thoroughly, and then platinum is added and mixed thoroughly and immediately thereafter poured on the printing paper, gold remains in suspension and in printing the gold and platinum precipitate synergistically and form an image of ethereal beauty. Ultimatype Supreme prints possess a striking delicacy, expressing a lifelike plasticity and spatial 3-dimensionality. Prints made with about 33% and higher platinum generally print out in a gray tone; prints that are 66% and higher gold generally exhibit a blue-gray cast. The printer can further modify an image's initial hue by immersing the paper in any of various first acid baths. A weak nitric acid bath (2%) reduces the blue hue in a high-gold content print and gives the image a rosy glow. Stronger nitric acid, around 7%, yields a salmon hue. Color shifts toward deep purple with a bath in a 5% solution of tartaric, lactic or phosphoric acid. On the other hand, deepen the blue cast with a first bath in very strong (30% to 40%) boric acid. Clearing in an initial bath of 2% sodium sulfite generally results in a gray scale print when he sensitizer was more gold than platinum.

For an 8x10 inch print recommended solution is 66% gold and the remainder platinum – 8 drops of gold and 4 of platinum. The printer can use up to 8 drops of platinum solution with as few as 4 drops of gold. Replacing more than 66% of the gold with platinum is not recommended: platinum instantly precipitates the gold, with resultant staining and uneven distribution. When the platinum replaces more than half of the gold, the process is actually a Platinotype Supreme and that formula should be used.

Boost contrast by substituting a smaller volume of platinum for gold (such as, 3 drops of platinum with 9 drops of gold). The wide contrast control for this process supports any negative: the tonal range widens as more platinum is substituted for gold.

Paper for the Ultimatype Supreme

Same papers as for the Auridiotype Supreme and the Chrysotype Supreme.

SOLUTIONS

Assemble the following solutions:

- 1% vitamin C
- 40% ammonium ferric oxalate or 40% sodium ferric oxalate
- 1% acid bath, from muriatic (31% hydrochloric) acid
- 5% Tetrasodium EDTA
- 10% potassium platinum chloride
- 10% gold chloride.

As discussed above, other acids can be used to modify print color so that it is not gray or slate gray. Nitric acid generally provides reddish or salmon tones, phosphoric or lactic acid purple tones, and boric blue.

To print an 8x10:

1. Don a pair of rubber or nitrile gloves.
2. Working in weak tungsten light, count 16 drops of the ammonium ferric ferrous oxalate into a shot glass.
3. Count 16 drops (an equal count) of 20% platinum chloride into the same shot glass.
4. If you desire a contrast boost, count 1 or 2 drops (maximum) of potassium dichromate into the shot glass.
5. Swirl the solution gently until solutions are fully mixed.
6. Holding a damp brush in one hand, pour the sensitizer solution onto the paper inside the sketched negative area.
7. Brush the solution quickly but methodically, vertically, horizontally and diagonally across the paper. Spread the solution out evenly as fast as possible while keeping it more or less within the outline. Do not allow puddles of the sensitizer to stand on the paper. Puddles make dark splotches in prints. Tip: Perfect your brushwork on ordinary paper using diluted corn syrup mixed with food color.
8. Place the sensitized paper in a dark, dry, cool place for 15 to 30 minutes, until dry. On very humid days, a print takes longer to dry. Do not be tempted to print until the sensitizer is dry. Damp sensitizer will destroy your negative.
9. Expose in direct sunlight or to a UV light source. Anticipate exposures ranging from less than 1 minute to as long as 15 minutes, depending on the density of the negative. Keep an eye on any over- brushed sensitizer that went beyond the edge of the negative. When that turns dark gray, drop one side of the print frame back to view print-out progress.
10. Immerse the correctly exposed print in a first bath of iced (~35 degrees Fahrenheit) tap water. This ice water bath minimizes any initial darkening of the image.
11. After five minutes, pour off the cold water and pour 250ml to 500ml of .5% hydrochloric acid, or of citric acid solution (1 tablespoon of citric acid powder dissolved in 500ml water into the tray, and rock the tray gently for five minutes.
12. Pour off the acid into an appropriately labeled bottle, and wash the print in cool running water for five minutes.
13. Repeat the acid bath and water wash again.
14. After the water wash, pour a solution of Tetrasodium EDTA, prepared with one tablespoon in 500ml of water, into the tray. Rock the tray intermittently for 15 minutes. Save the T-EDTA in an appropriately labeled bottle. You can reuse the acid you saved and this T-EDTA until the solution(s) turn slightly yellow at which time you discard them and mix up fresh solutions.
15. Wash a print on heavy papers, such as Arches Platine or Bergger Cot320, in running water for 45 minutes. Wash lighter papers for 30 minutes.
16. Drain the print holding it by one corner and hang to dry (plastic clips, not metal). Do not touch the emulsion.

17. Spot the dry print with spot tone or India ink as necessary.

RHODIOTYPE SUPREME

Related video: https://www.youtube.com/watch?v=Z9UFPHy3UTE

In the years following William Willis' 1878 patent perfecting developing out platinum prints, countless would be inventors experimented feverishly with all the remaining noble metals. Processes were announced for copper alone, and copper and silver. Formulas were published for developing out palladium. Iridium and gold proved excellent for replacement toning silver in chloride and bromide prints. But rhodium eluded everyone. Only in the 21st century, with the invention by Richard Eugene Puckett of the ammonium ferric ferrous oxalate processes did the rhodiotype finally become a reality.

The rhodiotype is a subtractive process for printing out rhodium and dissolving most or all of the palladium that aids the reduction. (Both this and my Iridiotype Supreme -- dry print out iridium with a small amount of palladium -- have been validated by XRF spectrometry.) The reduced elemental rhodium is not attacked by hydrochloric acid; the nanoparticles of palladium are readily dissolved.

Paper for the Rhodiotype Supreme

- Hahnemuhle Platinum
- BFK Rives
- Fabriano Artistico Watercolor Hot Press
- Arches Aquarelle
- Bergger Cot 320 Rag Cotton
- Arches Platine Hot Press Rag Cotton
- Legion Revere Platinum
- Clearprint 1000H 16 or 20 pound Rag Cotton Vellum (Puckers when solution applied, so presoak in distilled water and iron ter it dries)

Other substrates than paper that print gold-iridium include:

- Pictorico Transparency Film (for ink jet printers)
- Silk
- Polyester satin and silk
- Yes! Prestretched and mounted canvas (not pads). Contrast boost not needed, just extended exposure|
- Ampersand Clayboard (cut a test strip from the board to use for determining print out time)

SOLUTIONS

Assemble the following solutions:

- 10% Rhodium Chloride
- 10% Palladium Chloride

• Ammonium Ferric Ferrous Oxalate AFFO:8-2%C
• 2% Muriatic Acid
• 5% Tetrasodium EDTA

For an 8x10 inch print:

1. Dampen a brush.
2. Count 16 drops of the 10% rhodium chloride into a shot glass.
3. Count one-quarter as many additional drops of the 10% palladium (than the number of drops of rhodium) into the shot glass. So, if you added 16 drops of rhodium to the shot glass, now add 4 drops of palladium.
4. Count the same number of drops of the AFFO 8:2%C as of rhodium and palladium combined into a shot glass. So, if you added 20 drops combined of rhodium and palladium, add 20 drops of AFFO.
5. Swirl the glass to mix the solutions thoroughly.
6. Pour about half of the solution in a zigzag across a dry sheet of paper and brush it out evenly with deft and confident sweeps of the brush. Get it spread as evenly as possible.
7. Pour the remaining solution onto the paper, with swift and confident brushstrokes, where needed to even out the coating.
8. Place the sensitized paper in a dark, dry place to dry.
9. When the paper is dry place it face up on the bottom of a contract print frame.10. Place a 2 or 3 mil thick sheet of clear mylar on top of the paper. Mylar thicker than 3 mil will reduce image sharpness.
11. Place the negative emulsion side down on the mylar.
12. Sandwich the paper, the mylar and the negative between the bottom of the frame and the glass of the frame.
13. Expose the whole to UV or sunlight.
14. When the overbrushed area turns dark gray, drop the back to examine your print's progress.
15. When the print is approximately one stop darker than desired, remove it from the contact frame and immerse it in a tray containing the 2% hydrochloric acid. Wear rubber gloves at least for this step as the acid has its sting... Let the print soak face down for 5 to 10 minutes with gentle agitation.
16. Flip the print over and continuing agitating until the image has lightened to the desired exposure.
17. Transfer the print to a tray of cool running water. Let the print wash for 5 minutes.
18. Transfer the print to a tray of the 5% T-EDTA. Agitate the print by flipping it over every minute for 5 to 10 minutes total.
19. Wash in running water for at least 30 minutes.
20. Dry the print face up on a sheet of plastic screen mesh.

IRIDIOTYPE SUPREME

Related video: https://www.youtube.com/watch?v=D8jF0n5sWuc

In the summer of 2014, after printing the world's largest chrysotype – The Alamo At Night – Richard Eugene Puckett began working on formulas for printing with rhodium and iridium. Both metals readily printed out full images on Magnani Revere Platinum paper. Puckett recorded the formulas and moved on to prepare for the upcoming documentary by filmmaker Sichendra Bista in which he was featured.

In the fall of 2017, some three years later, Puckett returned to his as yet undocumented iridium process, shooting a sister film to his award-winning documentary about inventing the rhodiotype supreme. As with rhodium, the straightforward print out of iridium, repeated exactly as performed in 2014, failed. Puckett repeated his successful strategy for rhodium this time with iridium. TO his dismay, the palladium would not dissolve in acid of any strength when mixed with iridium. The nobler metal, iridium, protected the palladium. In the end Puckett had to settle for an image that is 60% to 80% iridium and the remainder either palladium or platinum. The difference between the two is that drop for drop iridium-platinum is slightly contrastier than iridium-palladium.

Paper for the Iridiotype Supreme

Same papers as for the Palladiotype Supreme, Platinotype Supreme and Rhodiotype Supreme.

SOLUTIONS

Before printing, one must prepare six fundamental solutions:

1. 2% vitamin C
2. 40% ammonium ferric oxalate or 40% sodium ferric oxalate
3. 2% acid bath, from muriatic (31% hydrochloric) acid
4. 5% Tetrasodium EDTA
5. 10% palladium chloride
6. 10% iridium chloride

For an 8x10 inch print:

1. Dampen a brush.
2. Count 12 drops of the 10% iridium chloride into a shot glass.
3. Count one-quarter as many additional drops of the 10% palladium (than the number of drops of iridium) into the shot glass. So, if you added 12 drops of iridium to the shot glass, now add 3 drops of palladium.
4. Count the same number of drops of the AFFO 8:2%C as of iridium and palladium combined into a shot glass. So, if you added 15 drops combined of iridium and palladium, add 15 drops of AFFO.
5. Swirl the glass to mix the solutions thoroughly.
6. Pour about half of the solution in a zigzag across a dry sheet of paper and brush it out evenly with deft and confident sweeps of the brush. Get it spread as evenly as possible.

7. Pour the remaining solution onto the paper, with swift and confident brushstrokes, where needed to even out the coating.
8. Place the sensitized paper in a dark, dry place to dry.
9. When the paper is dry lay it face up on the bottom of a contract print frame.
10. Place a 2 or 3 mil thick sheet of clear mylar on top of the paper. Mylar thicker than 3 mil will reduce image sharpness.
11. Place the negative emulsion side down on the mylar.
12. Sandwich the paper, the mylar and the negative between the bottom of the frame and the glass of the frame.
13. Expose the whole to UV or sunlight.
14. When the overbrushed area turns dark gray, drop the back to examine your print's progress.
15. When the print is approximately one stop darker than desired, remove it from the contact frame and immerse it in a tray containing the 2% hydrochloric acid. Wear rubber gloves at least for this step as the acid has its sting... Let the print soak face down for 5 to 10 minutes with gentle agitation.
16. Flip the print over and continuing agitating until the image has lightened to the desired exposure.
17. Transfer the print to a tray of cool running water. Let the print wash for 5 minutes.
18. Transfer the print to a tray of the 5% T-EDTA. Agitate the print by flipping it over every minute for 5 to 10 minutes total.
19. Wash in running water for at least 30 minutes.
20. Dry the print face up on a sheet of plastic screen mesh.

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