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Instructions for Fumed Silica and Fumed Alumina

Read all information and instructions before using these products!

Both of these products are extremely fine powdered compounds than can be applied wet or dry to paper for enhanced image quality of alternative process printing. They will both provide better blacks and a deeper matte finish to platinum, palladium, and cyanotype prints. **They are safe but can cause irritation so use a mask, gloves and eye protection.** Wear a good mask. An 8211 or 8210 3M works well. The cheap ones will pass the fine particles. **There have been warnings about being a danger to asthmatics. Dry fumed silica and fumed alumina are dust-like. You can obtain an MSDS sheet at www.hazard.com.**

Both compounds are archival.
Silica is neutral in pH and tends towards a warmer tone and tends to be somewhat slower in print speed.
Alumina is slightly acidic (pH 6.5 to 4.5) and is good for platinum and palladium printing on buffered papers and is generally faster in print speed. It appears to give slightly cooler tones than the silica.
They have been tested with platinum and palladium printing and cyanotype, and as a dry matting agent for Bostick & Sullivan albumen pre-coated paper.
They will likely work with a variety of other processes but due to the extensive amount of processes out there, and the variety of processing techniques, further use will need to be explored by the individual printer.

Why two ways to coat?

The **dry method** is fast. Roll on for about 30 seconds, coat sensitizer, expose and process as usual. But it can be messy due to the fluffy nature of the light powders. They can become airborne very easily.
The **wet method** has more dust control but it incorporates a drying step for your paper before you can coat the sensitizer.

How do you use it?

These instructions apply to **both the silica and alumina**. There are two ways to apply the material.

1. Wet Application

Your wet silica and alumina solutions are ready to use, do not dilute them.

Use a high density small diameter foam roller with handle and the plastic tray made for use with the smaller roller. The rollers are usually white and about the diameter of a hot dog. They come in lengths from 2 inches to about 5 inches. You can purchase them from Bostick & Sullivan and at most home improvement stores. *Do not use an ordinary fuzzy fabric roller.*

Pour some solution into the roller tray and wet the foam roller with the solution, use the sloping platform to "wring" out excess solution from the roller. Roll and coat evenly. Put enough on to coat the paper but not so that it is sloppy wet. When rolling the sensitizer on, do it thoroughly until there is no sheen left to the paper and then roll a bit more. You need to go until the sheen is gone but you can go too far with the rolling and the paper will begin to streak.

Air dry or dry the wet coated paper with a hair dryer. A hair dryer may promote silica dust in the air so use caution.

When dry your paper is ready for coating with your sensitizer emulsion (platinum, palladium or cyanotype). Brush the sensitizer until the paper is quite matte and the coating has smoothed out but pay attention because at a certain point, if you brush to much, streaks will appear. Appling your sensitizer takes a longer time and more brushing than is usual with untreated paper. Expose and process in the normal manner.

2. Dry Rolling Application

Use a high density small diameter foam roller with handle and the plastic tray made for use with the smaller roller. The rollers are usually white and about the diameter of a hot dog. They come in lengths from 2 inches to about 5 inches. You can purchase them from Bostick & Sullivan and at most home improvement stores. *Do not use an ordinary fuzzy fabric roller.*

For a 10 x 12 inch sheet of paper use a slightly heaping teaspoonful of fumed material. It will go on surprisingly smooth. It will also stick to the paper. After rolling on, a good technique is to gently rap the paper onto the table on its edge to knock off any excess. A half liter weighs about 25 grams. We estimate about 50 8x10's can be dusted with a half liter of silica or alumina.

It will flow on almost like a liquid. You can easily put on far more than is needed and this may cause problems of clumping etc. Try for a minimum amount that gives the maximum black. There is a point where more does not help, and if too much is applied, brush streaks can appear. If one is printing, for instance a portfolio or suite of prints, it is best to run a series of tests to determine how much to use and coating times etc, for your particular paper and printing technique.

Once your paper is dry rolled, proceed to brush on the sensitizer.

Coat the sensitizer as you normally would but note that there will be some extra feel of drag on your brush. Your sensitizer will, however, tend to spread out more than you would expect.

Continue brushing until the paper is quite matte and the coating has smoothed out but at a certain point, if you go too far, streaks will appear. Applying your sensitizer takes a longer time and more brushing than is usual with undusted paper.

The sensitizer can be air dried or dried with a hair dryer, expose and process in the normal manner.

What is fumed silica?

From Wikipedia:

> *"Fumed silica, also known as pyrogenic silica because it is produced in a flame, consists of microscopic droplets of amorphous silica fused into branched, chainlike, three-dimensional secondary particles which then agglomerate into tertiary particles. The resulting powder has an extremely low bulk density and high surface area. Its three-dimensional structure results in viscosity-increasing, thixotropic behavior when used as a thickener or reinforcing filler."*
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> *"Fumed silica serves as a universal thickening agent, in milkshakes for example, and a anticaking*

agent (free-flow agent) in powders. Like silica gel, it serves as a desiccant. It is used in cosmetics for its light-diffusing properties. It is used as a light abrasive, in products like toothpaste. Other uses include filler in silicone elastomer and viscosity adjustment in paints, coatings, printing inks, adhesives and unsaturated polyester resins. Also used in the production of Kitty Litter."

What is fumed alumina?

It is a compound made up of aluminum oxide in very fine particles much the same as silica. Aluminum oxide in coarser form is used as a grit for fine sandpaper and buffing compounds. It is extremely hard and durable. Fumed alumina is used, as is the silica, in making high grade inkjet papers.

Why do we have both?

Both behave in subtly different manners. Silica is slightly slower in printing speed and warmer in tone. Alumina is acidic and tames alkali buffered papers and is faster and cooler in tone.
One of the joys of making handmade photographs is the ability to control the look and feel of one's artistic product. Subtle differences may be important to the advanced printer so we offer both products.

Are they safe?

Fumed silica is not listed as a carcinogen by OSHA, IARC, or NTP. Due to its fineness and thinness, fumed silica can easily become airborne, making it an inhalation risk, capable of causing irritation.
MSDS sheets for alumina indicates that it is also safe except for possible irritation issues that are not permanent. You can obtain an MSDS sheet at www.hazard.com.
Those appear to be the only health factor listed in the MSDS's or other literature. It does not cause silicosis, cancer or any other dire problems.
There has been warnings about it being a danger to asthmatics. It is dust-like. You must wear a mask when rolling it**.** They are safe but can cause irritation so use a mask, gloves and eye protection.
I've also seen MSDS warnings about gastro irritation which appears to conflict with it use in cough syrup and milkshakes.

How does it stick?

Since we don't have electron microscopes or other fancy science equipment we have to go on theory and conjecture.
The particles are in the 5 to 50 nanometer m size range. Howard Efner PhD, one of our team members here calls it "smoke in a bag" which is a pretty good description. Cigarette smoke runs in the 5 nm range. The particles are not only small but also have a huge surface area. Since they are basically quartz or alumina, they are hard and sticky. It is most likely the particles are hanging up in the gelatin and cellulose fibers of the paper the stickum factor works much like Velcro ™.
If the paper is sized with a colloid like gelatin, then any chemical reaction in the gelatin will further harden it and trap the silica.

How does it work?

Several things are going on, and again, we can only make some educated guesses.
Josh Partridge, who has printed his grandmother's work in platinum for the Imogen Cunningham Foundation talked to a friend who is a physicist. What the physicist said was that the silica was diffusing the light, in effect trapping it as it hit the surface, thereby giving a better black.
Alumina, even though it is an insoluble compound, has an acidic pH. Howard Efner PhD says that every particle has some oxygen molecules hanging on it. Thus it can give up some to acidify or neutralize a buffered paper.

We ran two tests of palladium prints on highly buffered Lanaquarell 400 which is known as a very poor paper for platinum and palladium prints. The first with silica, the second without. The first was a nice smooth image with good blacks, the second was grayish and granular as would be expected from our experience with this paper. How the inert silica is protecting the emulsion from the effects of the alkali is at this point unknown.
The second thing happening is that the silica or alumina are providing a far larger surface area for the emulsion to stick to. Though in powder form they look white, like powdered glass, they are transparent and provide a 3 dimensional surface for the image. It is an extremely thin layer but it does allow for more image particles to form for a given area of the print. It is also highly absorptive and also adds more metal to the image. Both silica and alumina are used in microporous inkjet papers. When the industry went to pigment inks in the mid to late 90's, the current dye based papers did not hold the pigment and it could be rubbed off. They began coating the paper with silica and later alumina to give the paper "tooth." This microscopically "rough" surface trapped the tiny pigment particles. In our situation we have a similar issue. Most alt photo process prints develop out the silver or other noble metal and they become trapped on the surface of the paper.

A Bit of History

Just a quick note as to how we got here, where we are, and where we might be going.
We got here by an idea I had about using fumed silica as a matting material in albumen printing. Starches of various types such as rice, arrowroot, potato, and tapioca have been used traditionally for making matte prints. The material was always added to the albumen coating mixture. Adding starch means you are likely adding glucose and that's a problem that can lead to prints turning brown with age. It hit me one day when I was thinking about the weirdness of fumed silica noting that if you dipped your finger into it, it did not appear to rub off. If you rubbed it, it disappeared but didn't seem to go anywhere, you could still feel it on your finger. I had previously played around with it trying to make a support paper for carbon transfer by mixing it with Golden GAC 100. I had once put a pile on some paper to weigh it out and when I dumped what was left back in the jar there was a dull spot where it had been and rubbing my finger over it felt velvety smooth. The interesting point was that tapping the paper did not dislodge the silica like it would have had it been starch.
Fumed silica came about in the mid-50's in modern industry for thickening and making paint and varnishes matte. It had been known for a few decades earlier. It was in the 90's when inkjet inks went from dye based to pigment base that a radical change in the paper was needed as pigment particles did not penetrate the paper the way that dyes did. A coating of silica made the paper useable with pigment inks.
In summer of 2011 I tried rolling some dry silica on to a piece of albumenized paper with a roller. After rolling it for a bit, it seemed to disappear but when touched with a finger you could feel the velvet surface. I then coated the silver on to the albumen paper and voila, got a very matte print.
From there we explored its use in platinum printing, cyanotype and Ziatype. Both silica and alumina products produced great results in improving resolution and dMax.
B+S is and has always been not only a manufacturer of hard to obtain materials for historic photographic processes, but has been in the forefront of research and development of new modern processes built on older techniques and improvements to the traditional ones as well.
Richard Sullivan

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