

JUST PAINT

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Taming the Foam Monster in Acrylic Paint!

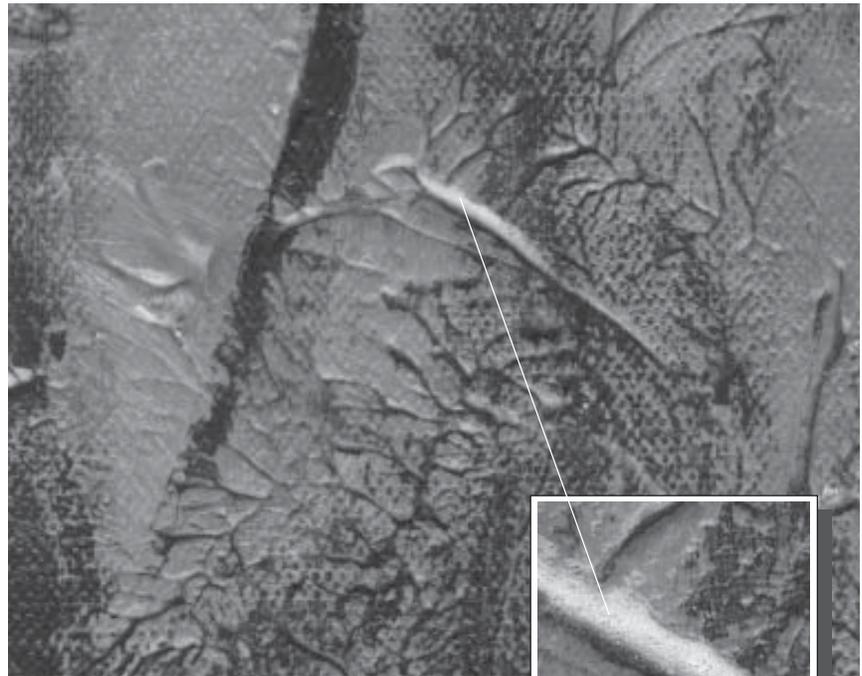
One of the most critical problems in the manufacture and use of acrylic paint is the development of foam. It can cause structural problems in the dry paint film by weakening it and can create a more permeable paint surface capable of imbibing dirt and other discoloring pollutants. But the primary problem with foam is that it can cause a clouding or fogging in an otherwise transparent acrylic surface.

Understanding how foam is created leads to an understanding of how to deal with and potentially avoid it. While it is easy to suggest not to create foam in the first place, this is sometimes difficult to achieve with waterborne acrylics. No matter how careful one is with their working technique, the simple movement of a paint filled brush rising with high points on the work and slapping down into valleys is enough to create a dried cloud of foam. This is usually only a problem when working in transparent layers or applying a transparent coat of varnish.

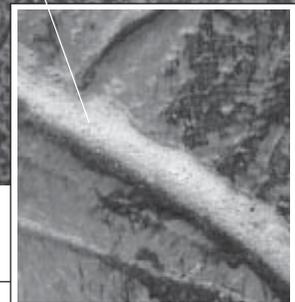
The Source of Foam

Foam generation in waterborne acrylic paints and mediums comes from several sources. Yet, all of these have, as their primary basis, the use of chemical wetting agents called surfactants. From the same family of chemicals as detergents, surfactants tend to be extraordinarily good at creating foam. However, they are indispensable. By reducing the surface tension of water, they serve to stabilize the acrylic polymer, and are also required for dispersing pigments into the acrylic.

Optimizing surfactant use is the most complex and critical part of paint formulation. Their high propensity for foam generation requires tight controls. Each pigment, each system, each material, re-



INSET: Detail of foam generated from inappropriate use of acrylic polymer as a topcoat.



quires different levels and types or combinations of surfactants to make a stable paint. While it is sometimes possible to substitute a lower foaming product, it is important not to sacrifice overall paint performance.

Creating foam is usually an unavoidable consequence of the high speed mixing and shearing processes required to disperse pigments and make paints. Chemical defoamers, which act to both reduce foam generation as well as break foam structure once it occurs, are part of every waterborne paint formulation. Thicker paints allow for the incorporation of stronger defoamers, yet the thicker the paint, the more resistant the foam is to dissipating. It may take up to several weeks or months for foam that is stirred in to rise out

of heavy bodied acrylics. Thinner bodied paints, like Golden Fluid Acrylics, require a much more delicate defoamer to avoid other film defects that too much or too strong a defoamer can cause. Shaking or strong agitation of these colors during mixing may cause a froth of foam like the head of a beer.

Foaming in Varnish

It has been the practice of many artists and paint companies to recommend using polymer medium as a varnish for acrylic paintings. We have seen many cases where this has caused irreparable foam damage to the surface of the painting. It is nearly impossible to apply a layer of polymer medium without creating foam, which will not dissipate and is not removable. For this reason we recommend using Golden Soft Gel (Gloss) if an isolating coat is needed or when strong defoaming is

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SURFACTANTS
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▼

WILL CADMIUM ALWAYS BE ON THE PALETTE? ALTERNATIVE PIGMENTS ARE BECOMING AVAILABLE!

Environmental and health concerns have spurred increasingly stringent regulatory requirements for the use and disposal of Cadmium based pigments. As a result, many industries have decreased or entirely eliminated the utilization of these colorants. If these trends continue, formulating cadmium pigment into artist paints will become increasingly difficult, and ultimately, may be impossible due to lack of availability. However, the introduction of newer organic pigments has made finding suitable alternatives easier than ever. While not identical to cadmium based pigments, their properties are similar enough in some respects, and superior enough in others, to warrant consideration. Golden Artist Colors has recently introduced three such colors; **Hansa Yellow Opaque**, **Pyrrole Red Light**, and **Pyrrole Orange**. Also in this group is **Pyrrole Red**, which was first made available by Golden in 1990.

Cadmium pigments were discovered around 1820 and first commercialized for artists' use by the mid 1840's. Although Claude Monet used them extensively in the 1840's and 50's, the scarcity of the metal kept their use relatively limited in artists materials until the 1920's. Their introduction provided unequalled hues in the yellow to deep red range, in terms of brightness and lightfastness.

While cadmium pigments are considered extremely lightfast under conditions of indoor use and exposure, they fade a great deal when used outdoors in acrylic paints. For this reason, they should not be used in exterior mural painting. The difference between indoor and outdoor performance is thought to be due to the combination of environmental factors encountered outside; moisture, ultraviolet radiation and air. These cause bleaching induced by oxidation of the cadmium sulfide to cadmium sulfate. That is why the water permeable acrylic vehicle is prone to this effect, while cadmium pigments used in impermeable binders, such as rigid plastics, are not.

Industrial Use

Only 5-7% of total cadmium pigment production is used in the manufacture of artist materials. Since most is used elsewhere, clues to future availability may be found by looking at what is happening with the higher use industries.

Cadmium pigments excel in high heat applications, as encountered in the glass and injection plastics industries. Although the performance of cadmium pigments in the glass industry may be unequalled, their use is prohibited to a large extent due to the "Toxics in Packaging" laws of many states, which limit the intentional additions of heavy metals to packaging materials. Glass is manufactured primarily as a packaging material. These restrictions

have also impacted plastic packaging, but not applications known as "engineered resins" which encompass such uses as injection molded handles and housings for lawn and power tools. These are high heat applications where the cadmium pigments continue to outperform organics due to their heat stability.

Another industry which has declined drastically in cadmium pigment use is automotive manufacturing. Whether it is a matter of color fashion, with earth tones favored over a bright red interior, or a response to increased regulation, industry sources report that cadmium pigment use has been all but eliminated.

Toxicity and Environmental Impact

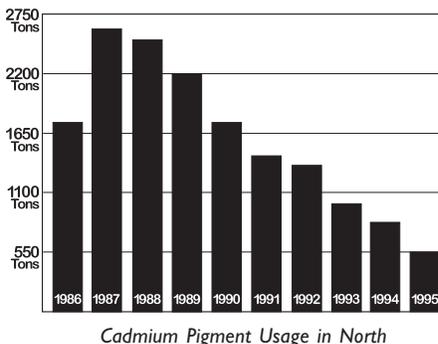
Animal studies have shown that cadmium pigments are potential carcinogens when inhaled, which is why they carry the warning, "do not spray apply". They are not believed to be toxic by ingestion if they are of low solubility as determined by laboratory testing. Over the years, pigment manufacturers have produced cadmium pigments of progressively lower solubility of both the cadmium and selenium in efforts to increase safety. The solubility tests are designed to mimic the pH, temperature and agitation that would be experienced in the stomach. However, detractors from this theory correctly point out that there are other mechanisms at work in the body and that these analyses should not be considered entirely conclusive. Therefore, while use of low solubility cadmium pigments diminishes their toxicity, there is still reason to treat paints made with cadmium pigments with extra care and to seek alternatives.

In the industrial setting of the paint manufacturer, where inhalation of dry pigment is much more likely, the Occupational Safety and Health Administration (OSHA) regulates all cadmium compounds and has set stringent workplace exposure limits and hygiene requirements. OSHA's permissible exposure limit for cadmium exposure through inhalation is 5 micrograms per cubic meter of air breathed. In an 8

hour workshift, approximately 9 cubic meters of air are breathed. Workers exposed to cadmium approaching this level are required to have periodic testing to determine their blood levels of the element.

There are also concerns regarding the long term environmental impact of cadmium in landfills. These are largely the result of the use of soluble cadmium compounds in battery manufacture and the proliferation of spent batteries in the waste stream. However, for the purposes of reducing the potential for cadmium compounds leaching out of landfills, cadmium from all sources is of concern to the agencies regulating waste disposal. Any cadmium-containing waste that leaches levels of the metal greater than 1 mg/liter in the Environmental Protection Agency (EPA) Toxicity Characteristic Leaching Procedure test method is considered hazardous waste. This is a rigorous acid solubility test which some cadmium pigmented artists paints will not pass. In recent years, numerous states have passed additional regulations designed to reduce cadmium entering the waste stream from the packaging and printing industries, regardless of solubility.

Periodically, bills are introduced in state legislation that would prohibit uses of cadmium in consumer products. In Minnesota, a bill to this effect was passed for ink, paint and dye products, but did contain an exemption for art materials. Similarly, in Europe, art materials enjoy an exemption from prohibitions of cadmium use in consumer products.



Product Review: GOLDEN Fluid Acrylics Offer Great Versatility

Golden Heavy Body Acrylics were the first line of paints produced by Golden Artist Colors, Inc. in 1980. Formulated to have an exceptionally smooth, thick texture, these paints were regarded as the best quality available; however, they did not meet the needs of all users. Many artists were thinning the Heavy Body paints with water. They wanted a paint that flowed from the brush more easily; that they could pour, puddle and drip, stain with, or use as an alternative to watercolors. Others wanted to spray apply the acrylic paints. Simply adding water or medium to the Heavy Body Acrylic paints was sufficient to meet some of these needs. However, this was not always satisfactory due to the difficulty of mixing in water and the loss of tinting strength and coverage.

Taking all these needs into account, Golden Artist Colors started creating Fluid Colors on a custom basis for artists requiring a thinner, yet fully pigmented paint. The first development was for an artist wanting to achieve the color saturation Morris Louis obtained from the Magna products. Eventually, the popularity of these Custom Fluids reached the point where Golden was able to introduce them as a standard product line.

The main difference between Golden Fluid Acrylics and Heavy Body Acrylics is their viscosity or consistency. Formulating the Fluid Acrylics is a more difficult process, as there is a tendency for highly loaded paints at a low viscosity to thicken over time. They are produced with the same pigments at the same load as the Heavy Body paints, yielding similar tinting strength. However, many artists believe they are actually stronger than the Heavy Body colors due to their greater leveling.

Although the Fluid Acrylic line is less extensive than the Golden Heavy Body line, it offers a broad range of pigment options. Missing are some of the heavier metal pigments which do not remain stable in the thinner Fluid consistency. They tend to settle to the bottom of the container, packing densely enough to prevent easy stirring.

Properties of Fluid Acrylics

Fillers are frequently added to acrylics to give all colors in a line a uniform finish and opacity. As with Golden Heavy Body Acrylics, flattening agents and opacifiers are *not* formulated into the Golden Fluid Acrylics. Subsequently, there are large variations in gloss within the line, as is quite evident when looking at the hand-painted color chart. For example, Ultramarine Blue and Burnt Sienna are quite matte, while Quinacridone Gold and Vat Orange are extremely

glossy. Each color's sheen and degree of opacity depend upon the unique nature of the pigment used. Like oil paints, where lean colors tend to be very matte and fat colors tend to be quite glossy, the colors have what many artists describe and appreciate as "the organic look".

By maintaining purity, the colors retain their clearest and cleanest quality, especially when used in brilliant washes or glazes.



There are options for artists requiring a uniform sheen from the paints. These include blending the colors that are relatively glossy or matte with an offsetting matte or gloss gel or medium. If it is important to maintain a thin consistency, Fluid Matte Medium or Polymer Medium is the best choice. While these will adjust the sheen of the resulting mixture, color strength will be reduced as well. If high color strength is important, then the best option is to apply a matte, satin or gloss varnish once the artwork is complete. This will unify the sheen of the entire surface.

The Fluid colors retain excellent flexibility when dry, greatly diminishing the possibility of the type of cracking that can occur in natural and other synthetic polymer systems. Acrylics withstand the constant stress and strain of the canvas as it moves with changes in humidity, temperature and during shipping. However, it is important to note that acrylic will begin to harden at 15 degrees Centigrade or 59 degrees Fahrenheit, and will become quite hard and brittle at temperatures near and below freezing. This is especially important when considering handling a painting under such conditions. Extreme care should be exercised. It is important to allow the painting to warm sufficiently before rolling, unrolling or any other handling occurs.

Reducing Golden Fluid Acrylics with water is much easier than the thicker Heavy Body

Acrylics. Being closer in viscosity, the two are more physically compatible and less work is required to achieve a homogenous mixture. This results in less foam generation and a more uniform mixture. Remember, the more water added to the acrylics, the greater the subsequent shrinking of the paint layer. Also, too much water reduces the binding capability of acrylic paints and tends to flatten their sheen.

Generally, when used for applications other than staining and washes, the maximum recommended dilution is a 1:1 mixture of Fluid Acrylic to water. When using the Fluids specifically for staining or watercolor techniques, there is no limit to the amount of water that can be added, as film integrity is less important. Instead, the integrity of the system results from the substrate absorbing the paint mixture.

Applications of Fluid Acrylics

As a result of their low viscosity range, the Fluids brush out smoothly and evenly. They load a brush better than thicker paints, and flow consistently, allowing for longer, more uniform strokes. Thin, highly pigmented passages may be laid down, which are not possible when using a thicker paint that has been diluted.

The Fluid Colors can be mixed with all other Golden paint lines, including Heavy Body Acrylics, Airbrush colors, High Load Colors, Iridescent Colors, Paste Paints, and Matte Acrylics. This allows artists to create any consistency paint desired, whether extremely thick or thin, without color loss. Mixing with Golden Mediums and Gels is also an effective method of changing the consistency of the paint, if the subsequent loss in color strength is acceptable. For example, when a heavier stroke is required, blending in Golden Soft, Regular, Heavy or Extra-Heavy Gel will work to thicken the paint to the extent required.

Glazing Applications

When highly transparent glazes are desired, the Fluids are the best colorants to use. They mix very easily into any of the gels or mediums, especially the thinner products. This reduces the chance of incorporating foam into the mixture, which reduces transparency. As the Fluids are highly pigmented, to achieve a transparent film, add less than 2% Fluid color into a gloss Gel or Polymer Medium.

Pouring and Other Applications

The Fluids are excellent for pouring, puddling, dripping and dragging to yield unique effects. One can control the size and shape of a pour or drip by altering the speed, distance from the surface or container nozzle size. Try Golden Clear Tar Gel in mixes with the Fluids for dripping purposes, and making

- Over

Fluid Acrylic Review *(Continued)*

lines ranging in thickness from spider-web fine to relatively thick. Pouring applications result in relatively thick films that can be affected by the shrinkage acrylic paints experience upon drying (approximately 25-40%). This, coupled with their thin consistency, may yield surface defects called crazes. Crazes may appear as rips, tears or valleys, and result from the tremendous force exerted on the surface of the paint film as it shrinks while drying. Adding up to 5% of Fluids to Golden GAC-800 can reduce the crazing that occurs in thick pours.

Achieving Watercolor Effects

When mixed with water, or water with Golden Acrylic Flow Release to reduce surface tension, the Fluids are very useful for staining or watercolor techniques. In addition to paper, suitable surfaces include raw or gessoed canvas. They also work well in conjunction with Golden Absorbent Ground which can be applied onto any gessoed support to create the absorbent qualities of a watercolor paper.

The main differences between Fluid Acrylics and watercolors is that the Fluids dry quicker and are not water-soluble when dry. While this will limit the ability to remove color, it results in background washes that stay in place when overpainting. It also allows for much more distinct, sharp edges when painting over dried colors, compared to watercolors which resolubilize and bleed together. Because a stain created with the Fluids is not resolvable, it may be painted over or varnished with any other waterborne system without concern. This lack of water resolvability of the Fluid Acrylics does require that tools and brushes be cleaned with water before the paint has a chance to dry.

A single application of a Fluid Acrylic stain will create an intense color, while watercolors typically take several layers to get the same intensity. This may be an economical advantage, as the Fluid colors can be diluted further than watercolors while yielding similar color intensities. Golden Fluid Acrylics and watercolors can also be used together to take advantage of their various attributes. An example is to use Fluids for background stains or areas that require a distinct edge, while using watercolors for overpainting and softer edges. Another technique is to apply undiluted Fluids as a permanent resist. After allowing them to dry on the surface, watercolors or Fluid stains can be applied, and they will only be absorbed into areas that are not already painted with the Fluids.

Another attribute of using Fluid Acrylic for watercolor effects is that when thicker, more intense areas are desired, the Fluid can be used at a lesser or no reduction in order for it to remain on the surface. Watercolors do not lend

themselves to such techniques due to their brittle and delicate nature in thick applications.

Spray Applications

Diluting the Fluids with an equal part of Golden Airbrush Medium generally yields a mixture with excellent sprayability. This allows the paint to flow smoothly through the spray unit, while minimizing tip build-up and clogging. Although the Fluids can also be diluted with water, they typically will not spray as smoothly. Generally, the Fluids spray well through spray assemblies ranging from fine airbrushes to industrial spray guns. The spray unit should have a nozzle size of 0.3 mm or greater. Smaller nozzle sizes will work, but will require further dilution with Golden Airbrush Medium. Typical air pressure required is 30 - 60 psi.

When using the Fluids for commercial illustration purposes, thinning with Airbrush Medium may lead to frisketting problems. In heavier applications, the slow drying Airbrush Medium causes the paint film to stay soft for as long as a few days. During this time, the paint may stick to the frisket, causing lifting problems. To avoid this, the Fluids should be thinned with the faster drying Golden Airbrush Transparent Extender.

Application on Apparel

A 1:1 mixture of the Fluids and Airbrush Medium creates a paint that works very well for airbrushing artwork on clothing. The spray consistency allows for creating very fine detail. The colors are durable enough to withstand multiple wash/dry cycles with minimal loss of color intensity. Even after spraying on several layers, the garment does not get stiff, offering a relatively

soft hand. Another advantage is that it is not necessary to heat-set the paints to get good laundering fastness. Simply allowing them to air dry for a week or more is sufficient. If this is not possible, run the garment through a clothes dryer for 40 minutes on high setting to accelerate curing.

Hard Edge Work

When using the Fluids for hard edge taping techniques, there are some specific techniques that will help yield the cleanest line possible. First, the selection of tape is an important consideration. Tapes that have elasticity (such as electrical tape) make it more difficult to achieve a perfectly straight line. Tapes with high tack may cause lifting of lower layers of paint. Lower tack masking tapes used in household and automotive painting are quite useful. It may be beneficial to condition tape to reduce the tack by adhering it to and removing it from a clean surface prior to use.

A problem often encountered while doing hard edge techniques is that the paint will bleed under the tape, resulting in a jagged edge. A way to avoid this and to maintain a true hard edge, is to apply a clear sealant over the tape before applying color. After the tape is in place, apply Golden GAC-200 over the edges that are to be painted. If spraying, thin it with Golden Airbrush Transparent Extender. After the GAC-200 dries, apply the paint. Whenever possible, pull the tape up while the paint is still wet.

Golden Fluid Acrylics are highly versatile paints that work well in many applications. If you are interested in trying them, call 1-800-959-6543 for a color chart and other information.

Paint and Coating Testing Manual

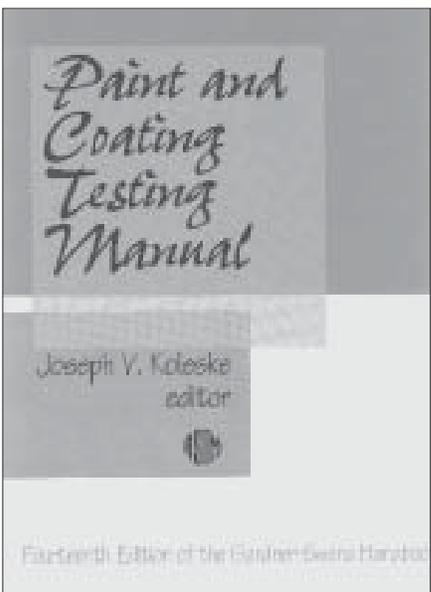
Artists' Paints by Ben Gavett

The Paint and Coating Testing Manual is a one volume, nearly 900 page, summation of test methods employed by manufacturers to evaluate the integrity of coatings. It is an encyclopedic reference of information relating to paint raw materials and finished product applications. The Manual has been published for decades, but it wasn't until the fourteenth edition, published in 1995, that Artists' Paints were included.

Similar to the artist being responsible for the compositional soundness of a painting, it is up to the manufacturer to ensure archival and other properties of the paint. In his chapter on Artists' Paints, Gavett describes the role of manufacturer testing in supplying products that meet established criteria and expectations for Working Properties, Film Properties, Stability, and Safety.

Single reprints of the chapter are available by calling Golden Artist Colors or completing the reply card.

ABSTRACT



From Page 2

Alternative Pigments Replace Cadmiums?

The result of increased regulation and concern over toxicity is that cadmium pigment use in the United States has declined about 75%, from approximately 2375 tons in 1987 to 550 tons in 1995. Of this, an industry representative estimated that approximately 5% to 7% is used for artists paint. The number of manufacturers of these pigments has also decreased significantly. While industry representatives believe the trend may be leveling somewhat, one cannot help but wonder if regulatory pressure will ultimately prevent the use of cadmium in artists paints, or otherwise result in supply problems due to the downsizing of the industry.

There is another perspective to the issue of the relative safety of cadmium pigments compared to organics. Due to the OSHA regulations, industrial exposure to cadmium pigments is extremely low. Cadmium entering the wastestream is much more closely controlled. Meanwhile, organic pigment use is treated much more casually with less stringent worker protection in terms of personal protective equipment and industrial hygiene. Those who play devil's advocate wonder if these new organic pigments, which have been evaluated for toxicity less thoroughly by virtue of their newness and lack of long term epidemiological data, will remain untarnished as they come under closer scrutiny in the years to come.

Golden Artist Colors will continue to try to make the best choices based on current knowledge, such as selecting cadmium pigments of the lowest solubility and searching for what are believed to be safest alternatives. Even so, we urge users to control their exposure to any artist material. Treat every material as if it could be chronically toxic. In all cases avoid inges-

tion, excessive skin contact, and if spraying or sanding, use a NIOSH approved respirator. Maintain a moderate level of general dilution ventilation. These are considered good chemical hygiene practices. In following them, unknown potential toxicity matters less, because if materials don't enter the body, they can not be harmful.

Alternatives to Cadmium Pigments

It is apparent that we should not count on cadmium pigments being available forever. Golden Artist Colors has undertaken years of research in an effort to identify and market suitable alternative pigments. Important characteristics include

hue or color position, chroma or color saturation, opacity, indoor lightfastness, and tinting strength. Alternatives should also present distinct advantages over cadmium pigments in the areas of potential toxicity, environmental impact and exterior lightfastness. This is quite a list of objectives, and presents a difficult task, particularly in the yellow range.

However, with the introduction of the Pyrrole family of pigments in 1988, there appear to be good offsets, in terms of these identified criteria, for the orange to medium red range. Additional products utilizing this chemistry, currently under development by the industry, will extend this range into the darker reds. The pyrrole family of pigments is currently represented on the Golden palette by three colors, **Pyrrole Orange**, **Pyrrole Red Light**, and **Pyrrole Red**. These are strong tinting, high chroma colors with excellent lightfastness.

Identifying suitable alternatives for the cadmium yellows has been a somewhat more difficult task. The Bismuth Vanadate family offers many of the attributes being sought, but concerns over the toxicity of the constituent heavy metals (bismuth and vanadium), seem to indicate they may offer little benefit over cadmium pigments. In-

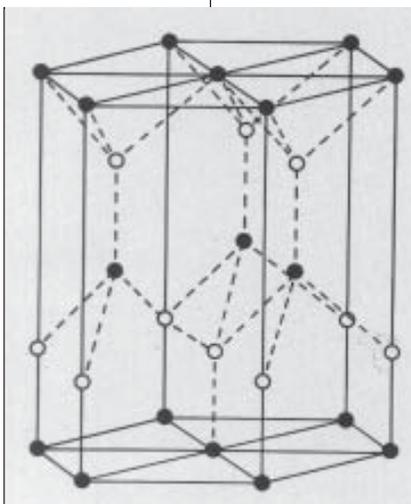
stead, we found that a member of the arylide family of pigments seems to offer the best choice for the artist eschewing cadmium pigment. This pigment, PY 74, is the colorant in Golden **Hansa Yellow Opaque**. It is of a hue between Cadmium Yellow Light and Cadmium Yellow Medium. Its relatively high opacity and excellent interior lightfastness are characteristics not normally encountered in this class of pigment. Exteriorly, its lightfastness is far superior to cadmium yellow and should also exceed the performance of Hansa Yellow Medium (PY 73) and Hansa Yellow Light (PY 3), the other members of this pigment family offered by Golden. There are currently no environmental or toxicity issues associated with PY 74. The tinting strength of Hansa Yellow Opaque is also significantly higher than what might be expected from an arylide and is closer to that characteristic of a cadmium pigment. The arylide yellows are entirely organic in composition, containing no metals. While one pigment doesn't provide a range of choice equal to that available in the current range of cadmium yellows, it is a starting point. Using it as the primary component of a mixing color will extend its attributes to other hue positions.

Although the properties of these new organic pigments are in many ways similar to cadmium colors, they are not identical in every respect. The biggest variation is how the colors mix to create new colors. Organics typically produce cleaner, less muddy mixtures. Other colors, such as the iron oxides, can be added if muddier colors are needed.

Once established, a pigment is rarely deemed entirely superfluous. Cadmium pigments will always have devotees, regardless of any disadvantages. An example of this persistence is the continued demand for true Alizarin Crimson, a pigment that fades badly, long after the introduction of the highly stable quinacridone family, from which a nearly identical match may be made. Another example is the continued demand for lead white, despite its toxicity, concerns about environmental impact and suitability of Titanium and Zinc White blends.

Long term availability of cadmium pigments may be determined by regulatory pressure or by reduced demand resulting from the increased use of new pigments.

It may likely be both.



● = Cadmium ○ = S or Se

Cadmium Yellow is composed primarily of Cadmium Sulfide, with the lighter yellows including some zinc in solid solution. The orange to red range is achieved by incorporating varying amounts of selenium. The redness increases as the amount of selenium is increased.

Survey on Artist's Gesso

There are a variety of materials used to prepare supports for painting. The American Society for Testing and Materials (ASTM) subcommittee on artists' materials is gathering information to help guide the development of a quality standard for acrylic gesso. It is hoped that practicing artists will help by completing and returning this survey, in order to help determine what is most important to the customer.

1 Do you paint in:

- Oils
- Acrylics
- Watercolors
- Gouache
- Other _____

2 Do you stretch and/or prepare your own:

- Canvas
- Paper
- Rigid Supports
- Other _____

3 Do you underpaint an oil painting?

- No Yes Occasionally
- with acrylics
- watercolors
- other _____

4 "Size" is a dilute solution of material applied to porous supports to prevent absorption of paints.

Do you size?

- No Yes
- with rabbit skin glue
- polymer medium

_____ other _____

5 A "primer", "gesso" or "ground" is a coat of paint applied to prepare a surface for painting.

Do you prime?

- No Yes
- with lead based primer
- acrylic gesso
- glue gesso
- other _____

How many coats? _____

Sand between coats?

- Yes No

6 If you use acrylic gesso, do you also size before applying gesso?

- No Yes

7 Do you use commercially pre-primed canvas?

- No Yes Occasionally

- Stretched
- Yardage

8 Please rate the following attributes of a primer in importance:

(Very important is 1. Least important is 5.)

- Opacity 1 2 3 4 5
- Transparency 1 2 3 4 5
- Brightness 1 2 3 4 5
- Absorbency 1 2 3 4 5
- Flexibility 1 2 3 4 5
- Ease of application 1 2 3 4 5
- Surface texture
 - Toothy 1 2 3 4 5
 - Smooth 1 2 3 4 5
- Lightfastness 1 2 3 4 5
- Resistance to changes in heat and humidity 1 2 3 4 5
- Price 1 2 3 4 5

9 Have you ever noticed delamination between:

(Check all that apply. Describe types of materials used)

- Support and primer _____
- Size and primer _____
- Layers of primer _____
- Primer and paint _____

Use the lines below for any additional comments you would like to make.
