JUST PAINT

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Welcome to Just Paint #31. If you regularly read Just Paint, you know our passion for what we do extends well beyond paintmaking. Our mission is "To grow a sustainable company dedicated to creating and sharing the most imaginative and innovative tools of color, line and texture for inspiring those who turn their vision into reality". Sustainability for me and this Company is being a valued Corporate Citizen -- valued by our employee owners, local community, arts community, and global community.

This concept has so many threads connecting what we do, but most of all it means making sure our products and processes are safe for each of these communities. This responsibility also means ensuring you have the necessary information to use our professional products safely. This past July, we discovered that 654, 2 fl. oz. bottles of QoR® Synthetic Ox Gall were delivered to retailers with an excess of MIT, a preservative that at this excess level can cause allergic skin reactions in susceptible people. We immediately recalled the product from retailers and distributors and put an announcement on our websites. We asked retailers to do the same for artists that may have purchased the material. We have since made necessary changes in our processes to ensure that all future batches would be at the safe and recommended level of preservative. If the product was used in a painting, there is no other concern for its performance.

As of the date of this publication, all bottles recalled are off retailer shelves. But, if you have this product, call GOLDEN Customer Service at (800) 959 6543 so that we can expedite the return and replacement of the material. Lot numbers are: 365254, 366319, 366408, 366626.

As a leading paint maker in our industry we take the quality and safety of our product very seriously and I apologize for causing our customers any inconvenience. In 34 years of making artist colors, we have never had to recall a product for safety reasons. In the future we will continue to do everything to assure that our products are correctly manufactured and labeled for their safe use.

If you have questions, please contact me at mgolden@goldenpaints.com.

Mark

New! QoR® Modern Watercolor

By Ulysses Jackson

A tube of paint is opened, pressure is applied, material comes out and it just works. It is this consistent function of a product that allows artists to focus on larger issues such as what to paint and how to achieve it. As both an artist and a Formulator, I am still amazed every time I open a tube of paint and brush it out. I get caught up in the feel, function, and more importantly how could this be improved, or function better? Before I started studying coatings and their formulation, the mystery of the experience was all I knew. After seeing behind the scenes it is even more exciting and amazing. Now that I have been researching coatings for a decade with Golden Artist Colors, the possibilities appear to be endless.

The development of QoR Watercolor falls under this category, allowing for an expansion in options for artists, and offering a new field of research and discovery for GOLDEN. With this expansion into new territories came significant and nuanced formulation challenges. The types of challenges that keeps one scouring technical literature, walking around with preoccupied looks, and staring at the ceiling during the night thinking about the next series of trials to be set up. However, these are the challenges that formulators live for – problem solving and constant improvement!

QoR Watercolor – The Beginning

How exciting that Mark Golden brings research from the Art Conservation field regarding a unique raw material and requests the GOLDEN Research and Development Lab investigate it. At this point our final use for Aquazol® was not defined and could have turned many different directions as a final target product was yet to be determined. In fact, we initially had four distinct product ideas in process and culled down to the most promising, banking the others for later investigation.

The first step in understanding any new raw material is to conduct a technical literature search. Often there is little more than a technical data sheet and an MSDS from a raw material manufacturer. To say that technical data sheets offer scant information is almost always an understatement, and it is usually up to the Formulator to tease additional information out of the manufacturer with pointed lines of questioning and long chains of e-mails. This can be daunting as there are several thousands of raw materials created and currently offered

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to the coating industry. Fortunately, with Aquazol this was not the case as Conservators have written many papers detailing its working properties and long term aging characteristics. Because Conservators are confident that this material will not crosslink or degrade over time, and are increasingly using it in a wide array of Conservation practices, it afforded GOLDEN some initial sense of a material that would meet the rigors of our in-house testing. Some of the uses of Aquazol included fills for sculpture and pigmented fills in oil paintings. Conservation scientists utilize this material as it allows them to build up a surface before in-painting, and if an error is made, or a later conservation treatment is needed, the Aquazol fill can be removed with water or a wide range of polar organic solvents. Based on these previous areas of research, we gained the confidence to attempt to pigment the system and see where it lined up with other resoluble resins.

Aquazol is offered from the manufacturer at various molecular weights, each of which has unique qualities and benefits. To determine the appropriate version and blend we first dissolved a sample of each in water to create a clear base. Then with these clear bases we mixed in pigments of varying chemical classes at a few different load points to gain an understanding of the raw material's attributes. At the same time, we included other resoluble resins as controls. The outcomes were exciting and showed that this resin system had very good inherent wetting properties and good film forming attributes. These results led us to the creation of a full line of Aquazol bound paints, now known as QoR Watercolor.

Determining QoR Properties – The Challenges Begin

If only it was that easy: simply mix some binder, pigment and water and send it out into the world to sit for various durations of time in artists' studios and remain usable. The fact that this is rarely the case, leads to job security for us Formulators and R&D Lab staff. The reality is that there are many aspects to formulating a line of colors that one has to take into account. It has been said that if a Formulator is doing their job well, the artist will be unaware. This is

Binder trial of 10 mil paint film on 2DX cards. Binders contained same pigment load.

remarkably accurate as we try to foresee as many of the potential performance issues as possible, and remove them before an artist ever gets the material in their studio, with hopes of furthering the sense of wonder and mystery mentioned before. In order to do this, we rely on scientific research, constant application testing, feedback from artists, and previous knowledge of raw material interaction from other projects.

Some of the areas that require attention and balancing in a good formula are shelf stability, freeze/thaw stability, flexibility, drying rates, re-solubility rates, pigment chemistry, pigment interactions, pigment loading, resistance to microbial growth, rheology, liveliness on the paper, brightness, the ability to mix with other watercolor brands, health and safety issues, the ability to layer, the ability to lift, as well as many more.

In the development of QoR Watercolor, we wanted working qualities similar to traditional watercolors, while offering the unique attributes of a synthetic binder. If we were to make these materials too different, artists who were used to traditional watercolor would not be able to achieve the techniques they rely on. Yet, if it was not different enough, it would be *just* another watercolor.

Pigment loading was an area we thought that Aquazol would allow some benefits. Every binder has a maximum amount of "gluing" strength, which means that it can coat every pigment particle and the spaces in between. This is usually referred to as Critical Pigment Volume Content (CPVC). Pigment loading below this amount means that there is excess binding potential, while being above this amount means that materials get chalky, bronzed, or have significant pigment lift once dry. Due to the controlled molecular weight and high electron density in the functional groups of Aquazol we expected that more pigment could fit in, and were pleasantly surprised as to how much we could load into this material. Each pigment is different and the maximum loading is affected by its pigment chemistry, surface treatment, morphology (shape), and surface area. This means that for each of the 65 different single pigments in the QoR line, we had to determine the maximum amount of pigment the binder would allow and then test surrounding load amount to find the tight rope of being bound just enough.

Each pigment has its own personality. Some are very friendly and can be stabilized easily while others are very stubborn and offer up some form of stability issue that must be addressed.

These attributes vary widely depending on the chemistry of the pigment family, and additional surface treatments applied by manufacturers. Instability can be exhibited in the form of significant separation, which is the notorious thick layer of clear that comes out of a tube. Other times instability can be seen as flocculation that can occur where pigments have an affinity for one another forming agglomerates over time.

Continued on page 6

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Paint and Paper: Making a Watercolor

By Cathy Jennings

Watercolor paper is an active part in the creation of a painting, for watercolor artists paint with their paper rather than simply upon it. For this reason, which watercolor paper an artist selects influences both the painting process and the finished painting. Paper choice can be as personal as color palette and subject, and it is not unusual for a painter to have a favorite paper surface from a specific manufacturer. Other painters might change the paper depending upon the subject to be painted, for the paper's qualities impact the painting process.

Good Watercolor Paper

Archival watercolor paper is stable, durable, evenly textured, and stands up to the abuse of brush and paint. Most artist-grade paper is 100% cotton and manufactured on cylinder mold machines, although it is possible to pay a bit more for handmade paper of equal or superior quality. There is an international standard for the 'weight' or thickness of a paper, and the most commonly used weight is 140 lb / 300 gsm (pounds per ream, or grams per square meter). Depending upon how 'wet' an artist paints, the paper might or might not need to be stretched to prevent cockling or buckling as the moist fibers expand during application.

Sizing and Texture

Next to fiber content and thickness, sizing and surface texture have the greatest impact upon both the process of painting and the look of a finished watercolor.

Sizing - Internal sizing is often added to the paper pulp before a sheet is made, strengthening the paper and increasing its durability. However, it is the external sizing applied to the paper sheet toward the end of its manufacture, which is most important.

Sizing keeps paper from soaking up paint like a paper towel soaks up spilled coffee. The surface sizing on a sheet of well-sized watercolor paper allows the paint to flow fluidly from the brush and keeps the paint on the surface. This in turn provides time for the artist to manipulate the paint through creation of washes, glazes, and brushstrokes as needed. External sizing also helps with creating hard edges and maintaining brilliance when the watercolor paint dries. Most watercolor papers are "hard sized" to provide an optimal amount of sizing for the application of watercolors. Too much sizing and the surface will resist paint. Too little sizing and the paint will feather and sink into the surface, instantly creating soft-edged splotches of dulled color.

The traditional sizing for watercolor paper is animal gelatin, for it provides the perfect balance between absorbance of and resistance to the paint. Paper mills like Arches® continue to use gelatin sizing. However, alternate materials are also being used, and the Fabriano® paper mill advertises that they use no animal-based products in their watercolor papers. Even under the umbrella of "hard sized," the amount of surface sizing and therefore the way a paper reacts to watercolor paint differs from company to company, even between different paper types from a single paper mill.

Surface texture - Texture also directly influences how the paint acts on the surface and unlike sizing, is an easily seen difference. Traditionally, watercolor painters are provided with three options: hot (or not) pressed, cold pressed, and rough. Hot pressed is the smoothest surface, cold pressed has a medium 'tooth' or texture, and rough is, well, the roughest. The images below were painted on cold pressed, hot pressed, rough, and handmade rough papers. The hot pressed paper allowed for sharper detail in the blossom, while the tooth and bumpiness of the cold pressed and rough surfaces created a more varied petal surface.

With paper texture, the great variety provided by paper mills becomes both most exciting and most confusing: exciting because there are so many options to choose from and confusing because those options are very subjective and there is no standard marker of what makes a hot pressed, cold pressed, or rough texture other than tradition and the label provided by the paper mill. A 'hot pressed' from one paper mill might be close in texture to a 'cold pressed' from another, or a 'cold pressed' similar to a

(Left to right): QoR® Modern Watercolor on Arches® hot pressed 140 lb / 300 gsm, Arches® cold pressed 140 lb / 300 gsm, Fabriano® Artistico 140 lb / 300 gsm and Twinrocker™ handmade rough, 200 lb / 400 gsm.

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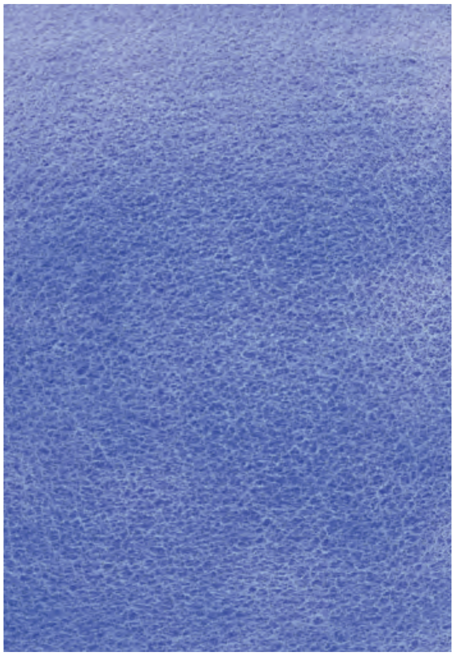


Fabriano® cold pressed traditional white paper, 140 lb / 300 gsm, QoR® Ultramarine Blue (PB29, semi-staining, semi-transparent, granulating)

Fabriano® cold pressed traditional white paper, 140 lb / 300 gsm, QoR® Quinacridone Magenta (PR122, staining, transparent, non-granulating)

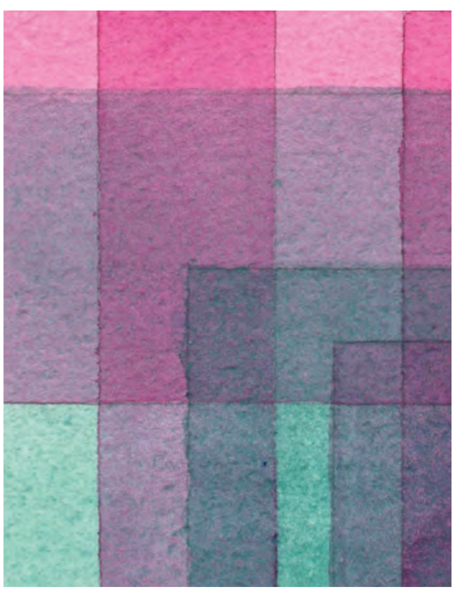
'rough' surface. In addition, since it is possible to paint on either side of good watercolor paper, each sheet provides two textures from which to select. It is more important for the painter to pay attention to the way texture and sizing interact with his or her painting process than to become obsessed with labels.

Texture and the Nature of the Paint

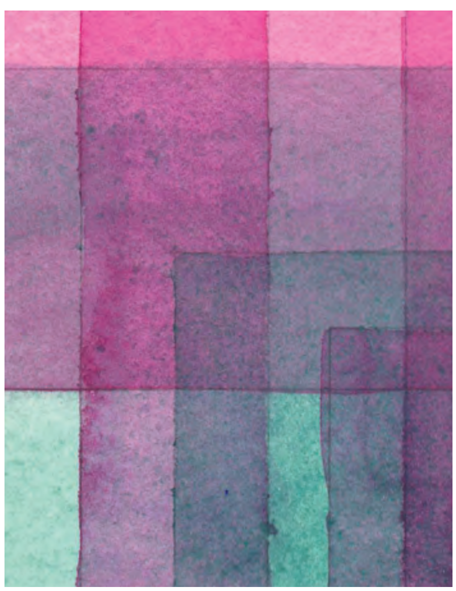
The absence or the presence (and depth) of the hills and valleys of surface texture also interacts with the liquid paint in particular ways that vary depending upon the nature of the pigment and the application process. Transparent paints react less with paper texture, creating a smoother appearance. On cold pressed and rough papers, sedimentary colors will granulate, collecting in denser pools in the 'valleys' and creating dapples. Tapping the paper while the paint dries encourages this separation. These differences can be seen in the example above, where Ultramarine Blue (PB29, semi-staining, semi-transparent, and granulating) gathered in greater density in the paper's valleys while Quinacridone Magenta (PR122, staining, transparent and non-granulating) did not. Both examples were painted on Fabriano cold pressed traditional white watercolor paper. When a mixture of transparent and granulating pigments is used, the results can be even more unexpected and beautiful.

Texture Variety from Different Mills

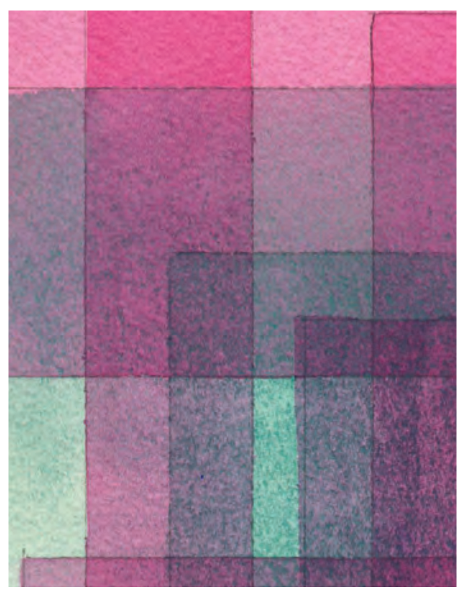
Since each paper company has its own processes and recipes for paper, products across production lines are not identical. The examples below provide comparisons between rough-surfaced papers from Lanaquarelle®, Twinrocker™ (handmade), and Arches watercolor papers. The layers of glazing were created with QoR Quinacridone Magenta (PR122, transparent, staining) and Viridian Green (PG18 semi-transparent, semi-staining). The Lana rough has an overall evenly rough texture, and was the least heavily sized of the examples. For this reason, edges of washes are a little softer and color layers more muted. The hard sizing on the Twinrocker allows the paint to remain clearly separate even with multiple layers, creating sharp edges and the most vibrant color of the three. The Arches rough provides the clearest textural variety of these three examples, and color more intense and edges sharper than in the Lana. This indicates



Rough Lanaquarelle® watercolor paper. Five layers of glazes with Quinacridone Magenta and Viridian.



Rough Twinrocker™ watercolor paper. Five layers of glazes with Quinacridone Magenta and Viridian.



Rough Arches® watercolor paper. Five layers of glazes with Quinacridone Magenta and Viridian.

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it is also hard sized, but not to the extent of the Twinrocker. The slightly granulating Viridian paint is settling into the valleys on the paper surfaces and creating dappled optical mixtures of the red and green that highlights the rough textures of these papers.

Some basic differences can help guide paper explorations. The smooth surface of hot pressed paper takes linear strokes and tight detail beautifully. However, it also encourages paints to bloom and puddle, and large flat washes can be harder to create on hot pressed paper. In addition, a hot pressed surface might have small areas on its surface that absorb paint more heavily, creating a widely spread speckle.

Rough surfaces have the greatest texture, perfect for broken washes and fluid expressive approaches and styles that encourage paint separation like that in the glaze example. However, rough surfaces can be unfriendly toward tightly rendered smoothly contoured forms, or heavy detail.

Falling between hot pressed and rough, cold pressed paper has a medium texture with enough ‘tooth’ to allow controlled washes yet not so much that it interferes with tight details and linear brushwork. Cold pressed provides the most flexibility in terms of what it offers a painter, which is perhaps why it is the most popular surface today.

Sizing Gives a Little More Time

The traditional approach to creating a smooth wash is for a bead of paint to flow down from a previous brush stroke to the bottom of a new brush stroke as the wash progresses down the paper. This repeatedly creates a temporary puddle of paint across the paper. Staining paints may create streaky washes as the pigment stains the paper twice where paint strokes overlap or the puddle sits. Sedimentary or granulating paints also can become streaky in a wash as the pigment has more time to settle at the bottom of each stroke while the wash progresses down the paper. A “hard sized” surface allows the painter a tiny bit more time when applying a wash, lessening these striations. In the same way, if lifting paint is necessary to reclaim a lighter area, the transparent layer of sizing between the paint and the paper will help the painter do so. Each movement of a wet brush over the surface, however, loosens the surface sizing and reduces the barrier between paint and paper.

Take Out Your Watercolors and Play!

There are a variety of subtle differences under the umbrella of “hard sized,” and “hot pressed” or “cold pressed” or “rough.” Painting with a paper is the only way to truly know which paper’s surface sizing and texture best merges with your own individual painting rhythms and processes.

Arches® cold pressed molded side

Hansa Yellow Medium PY73	*Nickel Azo Yellow PY150*	*Indian Yellow PY73 & PY150 & PR206*	*Quin. Gold PO48 & PY150*	*Quin. Gold Deep PO48*	*Diarylide Yellow PY83*

Arches® rough cold pressed

Indigo PB15:3 & PBk7 & PV19	*Ultra. Blue PB29*	*French Ultra. Blue PB29*	*Cerulean Blue Chrom. PB36:1*	*Cobalt Teal PG50*	*Viridian Green PG18*

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Continued from page 2

To test for pigment instability, we use accelerated aging techniques in which samples are stored at elevated temperatures for long durations, as well as repeated freezing and thawing cycles. If a stability issue is noticed, a dispersant package has to be constructed that allows for stable spacing of pigment particles in the paint system. There are a wide range of dispersant options available but the chemistry of the raw materials we picked had to not only allow for stability in our system, but also had to be compatible with other brands of Gum Arabic based watercolor.

Properly stabilized and dispersed. | *Flocculation and stability issues.*

Rheology (feel) of watercolor is an interesting aspect, as the main use of the material is designed to be thinned significantly with water; any attribute that can assist with this is seen as a positive. In QoR, most of the rheology of each color is based on the natural pigment interactions within the product. However, having a material that is shear thinning allows for ease of squeezing out of the tube and also allows the material to mix with water without effort. Then as the paint sits on the palette, it should slowly set up again. The range of this shear thinning needs to be controlled, while still allowing each pigment to have its own natural consistency. We looked at a wide array of thixotropic (shear thinning) thickeners that could offer not only control over viscosity and rheology, but also would not negatively affect re-solubility and mixing. Of course it also had to be compatible with other brands of product if intermixed. These materials were then used at the lowest level possible to control the rheology of the product, while not masking the inherent personality of pigments within the system.

During the development of QoR, we asked watercolor artists about their needs. Time and time again we heard that clean, bright colors were desirable. Another topic that came up frequently was concern over lightfastness. During the colorant selection process, we first looked at known stable, lightfast pigment chemistries, from which we selected the cleanest and brightest pigments offered. Additionally, Aquazol has an inherently less amber color than Gum Arabic at equal solids, allowing for some additional brightness of colors in the system.

In watercolor, where the bulk of paint techniques use more stain-like washes, pigment grind is critical to the color qualities of the paint. Grinds were specified in relation to the color space and brightness of each pigment. These are verified lot to lot using a grind gauge which is in essence a micro ramp. In the processing of QoR Watercolor, tight mill specifications are followed. Mill passes are repeated until a predetermined grind for each color is reached. These grinds are in relation to the natural particle size of a pigment. For example, earth colors are inherently coarser, while synthetic organic pigments, such as Quinacridone Magenta, are much finer particles, requiring a finer grind.

Along with studio climate conditions and substrate absorbency, humectants control the drying time, as well as allow palette management of Watercolors. Some of these water loving materials are also designed to remain in the cured product aiding in rates of rewetting with water, as well as offering additional plasticization to the binder. Unlike other paints, watercolors are unique in that equally as many artists use them direct from the tube in the wet form of the product, while others squeeze the tube out, allow it to dry and work by rewetting the dried cake. This means that having our product rewet similar or easier than Gum Arabic based watercolor was a significant concern. A fine balance must be struck because too much humectant can make materials overly sticky at elevated humidity, while not having enough will result in a very hard, slow-to-rewet material. We tested different ratios of various volatile and semi-volatile humectants in a range of climate settings before finalizing a blend and level that was suitable for each color.

The ability to rewet dried watercolor is also affected by the binder. This requirement must be easy to accomplish and permanently achievable. If a binder was to crosslink or permanently coalesce, the ability of water to dissolve the paint would be reduced. To insure the QoR line offered the permanent re-solubilization desired, we ran QoR through various accelerated aging techniques (QUV UV-A cycles, and 510 Mj/m^2 Xenon Arc UV exposures at various thicknesses from 40% reflectance on watercolor paper to 10 mil thick drawdowns on 2DX card sock), then tested rates of rewetting versus an unexposed control. Additionally, to verify that heat alone would not negatively affect solubility, we tested samples that were stored at 120°F for prolonged durations. We observed continued and easy re-solubilization after 1 year of storage in this extreme condition.

QoR Watercolor was tested on lacquered card stock at a thickness of 10 mil for film formation and adhesion. The ability to form a good film even at excessive thickness for watercolor will allow the artist who prefers to work with more opaque passages additional confidence. In these techniques, artists can use the paint with minimal water and/or add QoR Titanium White for a more gouache like effect. As the pigment load is high in QoR, it will allow for faster covering of underlying layers. Additionally, we observed good adhesion to many substrates that would typically not be acceptable for traditional watercolors such as frosted Mylar® or acrylic sheet.

After significant lab resources and approximately 1,500 trials were produced we are pleased to offer this new product line. It is our hope that as artists begin to experiment with QoR, they find that they are able to accomplish not only the paintings they could make with a traditional watercolor but also push the limits, exploring the dynamic range and differences QoR has to offer.

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Value of Plastics as a Painting Support

By Mark Golden

Artists have been using plastics as a substrate for their work since their development as a consumer material. Early plastics were heralded with such acclaim that they were awarded special honors during the London 1862 World's Fair. These nitrocellulose plastics were used in constructions by artists Naum Gabo and Antoine Pevsner in their work of the early 20th century. The Bakelite® plastic (derived from phenol and formaldehyde) became sought after in the 1920's for incorporating in the art deco fashions and high tech radios and gadgets of the 1920's through the 1950's. With advancing knowledge of the science and production methods in the 1930's and especially spurred on by the energies committed to assist in the war effort during the 1940's, a wide range of new plastics that were previously only in research stage were quickly reaching commercial production status.

The excitement of these new, lightweight, translucent, moldable materials soon became the stuff of nightmares as some of these early plastics degraded, some to gooey masses and some crumbling to dust. Given the history of mid to late 20th century plastics with a profusion of cheap toys and consumer products that seemed to fail once the package was opened, plastics began to lose their appeal. Finally, with growing concerns over non-renewable resources consumed in the production of these materials, and plastics filling our landfills, (not to mention cheap polyester suits) the story continues to be an uphill battle for these valuable materials.

Today, there is an even wider range of plastic alternatives on the market - some actually delivering on the original promise of these materials as a valuable resource for artists. It is so tempting for artists to see every surface as a potential substrate for painting. As we examine the use of plastics as a support for painting, Vaikunt Raghavan, Ph.D., Chemical Engineer and head of the New Product Development group at GOLDEN, explains the science to achieve adhesion onto these surfaces. We will also attempt to sort out the different plastics that artists come in contact with and evaluate positive and negative aspects of each for painting.

Acrylics on Plastics

By Vaikunt Raghavan, Ph.D.

Basics of Wetting and Adhesion

When a liquid comes into contact with any solid, new interfaces or boundaries are generated between these dissimilar materials. Although many factors exist which will promote or inhibit adhesion of the acrylic paint onto the solid plastic, the most important element is the ability of the liquid to 'wet-out' the solid onto which it is painted. When we see a drop of water bead up on plastic, we are seeing the dynamic of surface tension played out. What is a bit confusing is that, not only does the liquid have its own surface tension (liquid/air interfacial tension), but the solid onto which it is placed also has its own surface tension (solid/air interfacial tension or 'surface energy' in solids) as well. In fact, it is the surface tension of the solid (γ_s) which attempts to spread the liquid across the surface. Two forces work to oppose this spread. One is the surface tension of the liquid (γ_L). The higher the surface tension of the liquid, the greater the liquid's attraction to itself. This attempts to reduce the surface area of the liquid. The other opposing force is called the interfacial tension (solid/liquid - γ_{sL}), which attempts to minimize the area of contact between the solid and liquid.[1]

When the contact angle (θ) is small (less than 90°), the liquid will tend to spread across the surface of the solid indicating good wetting. This happens when the surface tension of the liquid is low compared to the solid.

When the contact angle (θ) is zero, the liquid will tend to spread spontaneously across the surface of the solid indicating perfect wetting.

When the contact angle (θ) is large (greater than 90°), the liquid will tend to bead upon the solid indicating poor wetting. This happens when the surface tension of the liquid is high compared to the solid.

Simply stated, for adequate wetting out of a liquid onto any solid, the surface tension of the solid must be higher than that of the liquid.

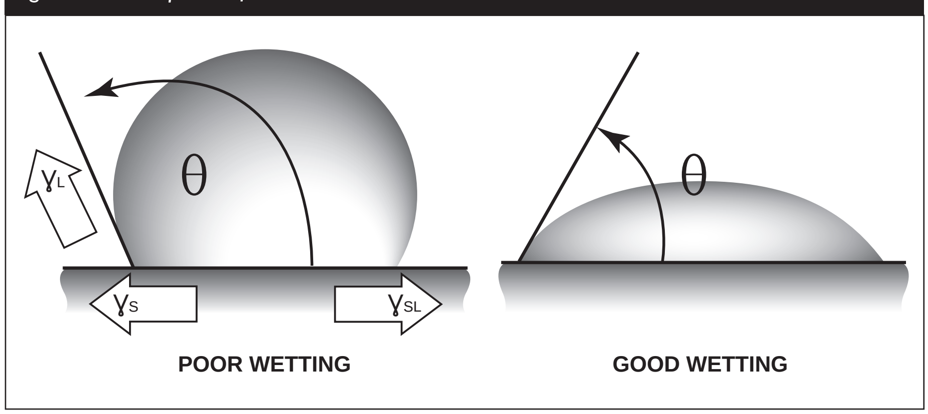
A coating must not only adequately and uniformly wet out the surface, but also adhere well to that surface. Therefore, in addition to spreading wetting it should also have good "adhesional wetting (W_A)" which is defined mathematically as

$$W_A = \gamma_s + \gamma_L - \gamma_{sL}$$

This equation tells us that in order to maximize adhesional wetting (W_A) one must keep interfacial surface tension γ_{sL} as low as possible.

If I've lost you at this point, don't worry, but the fact is that artists are constantly having to deal with the issues of one surface wetting out another to create good contact and subsequently good adhesion of their materials. This is especially evident when artists are using materials that

Figure 1. Solid-liquid Surface Interaction



[1] The balance of these forces may be mathematically expressed as: $\gamma_s = \gamma_{sL} + \gamma_L (\cos \theta)$. The contact angle ($\theta$) is the angle at which the liquid contacts the solid (Figure 1). This contact angle is a measure of "spreading wetting" of a surface.

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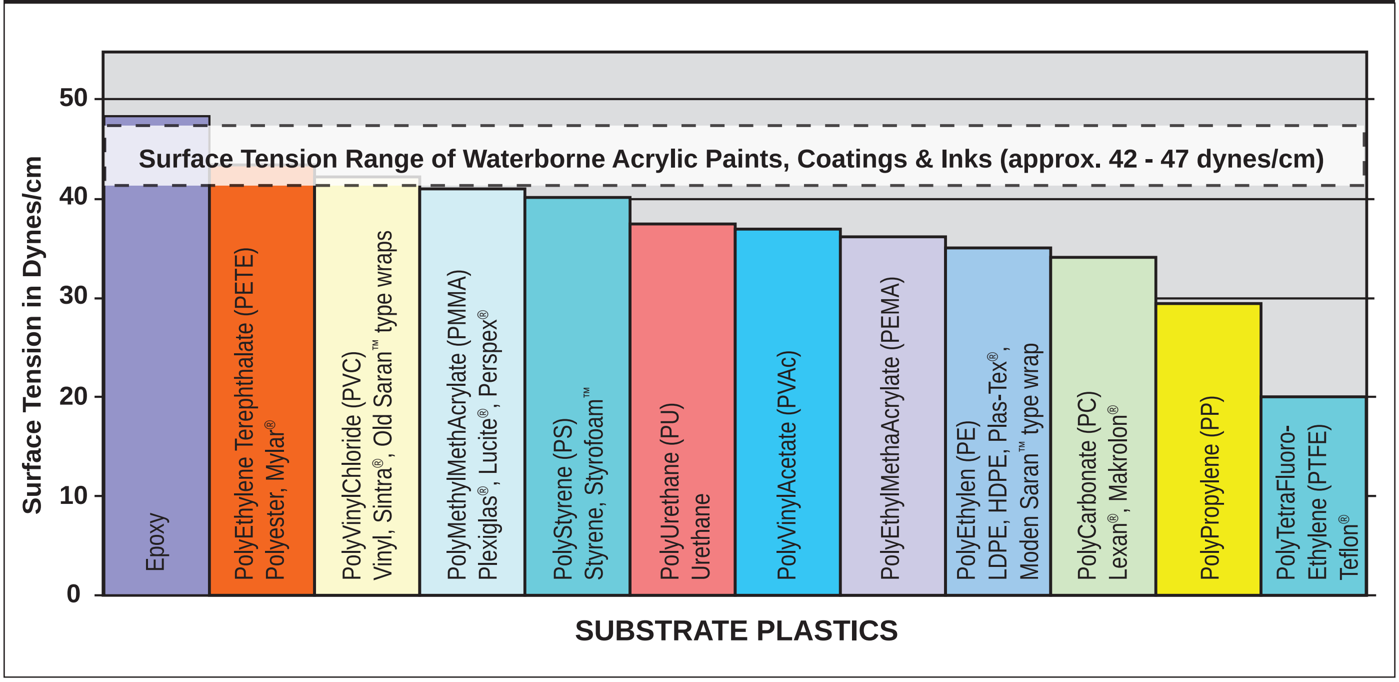
Figure 2. Surface Tension Plot for Various Plastic Substrates



are quite dissimilar in nature. Most of us have seen examples of our paints pooling up on the surface or creating little rivers on top of what we thought would be a continuous film. Or how many of you have used our Acrylic Flow Release or some other flow additive to get your paints to lay down or penetrate better into a surface? What you've experienced is simply the tension between the forces listed above. Sort of makes you wish you paid more attention in science class, doesn't it?

Adhesion to Plastics

Surface tension actually has its own unit of measurement called dynes or dynes per centimeter, expressed dynes/cm. Clean, well prepared metal surfaces have high surface energies in the order of 400 to 1800 dynes/cm (Aluminum ~500, Copper ~ 1300, Nickel ~ 1800). They are wetted easily by acrylic polymers that have relatively low surface tension in the order of 40 to 50 dynes/cm. Wetting of plastic surfaces, on the other hand, is much more complex than wetting metal surfaces. Plastics being non-porous, non-polar or low-polar, hydrophobic, and being low surface energy materials are difficult to adhere to not just for artists, but also within the automotive, electronics and medical industries.

Plastic surfaces and paints are both polymeric materials and thus have similar surface tensions. There is considerable surface tension closeness or overlap within the narrow band between the plastic substrates (20 to 50 dynes/cm) and the waterborne acrylic dispersion polymers (39 to 47 dynes/cm) as shown in Figure 2. Adhesion between paint and the substrate is dependent on many factors such as differential surface tension, differential expansion to hot and cold, differential modulus (a measure of stiffness), shrinkage during drying/cure, the effects of solvents in the formulation, chemical structure, etc. Yet the most important factor determining adequate adhesion is the differential surface tension. The absence of a large difference between the critical surface tension of the paint and plastic substrates often results in poor surface adhesion or even complete failure.

As a general rule, acceptable bonding adhesion is achieved when the surface energy of a substrate (measured in dynes/cm) is approximately 10 dynes/cm greater than the surface tension of the liquid. In this situation, the liquid is said to "wet out" or adhere to the surface. For this to happen, either the surface tension of the substrate or the paint must break loose of the logjam in Figure 2. An illustration of the surface energy of a hypothetical plastic substrate for good adhesion to waterborne acrylic is presented in Figure 3. As shown here, the higher the surface energy of the solid substrate relative to the surface tension of a liquid, the better its wettability will be, and the smaller the contact angle.

Adhesion strength is generally determined by the properties of a base material and its interface. Optimizing adhesion strength can be accomplished by modifying these interfaces physically and chemically. In formulating waterborne acrylic paints, the use of surface acting modifiers (surfactants) is essential in driving down the surface tension of the liquid paints. These materials can take the acrylic dispersion polymer's surface tension down between 26 to 31 dynes, allowing wetting out of many difficult to coat surfaces.

Improving Coating Compatibility

Cleaners, Degreasers

Surface contamination is the most common reason for premature coating failures. There are many cleaners and degreasers available that are specifically designed to remove dust, dirt, loose particles, trace oils, waxes, grease, silicones, films, oxides, additives, plasticizers, mold release agents and even fingerprints! They range from low VOC products to 100% solvents. Some plastics such as flexible vinyls have very slow evaporating plasticizers that make coating with acrylic paints a problem as they can release those plasticizers to the surface leaving a sticky surface mess.

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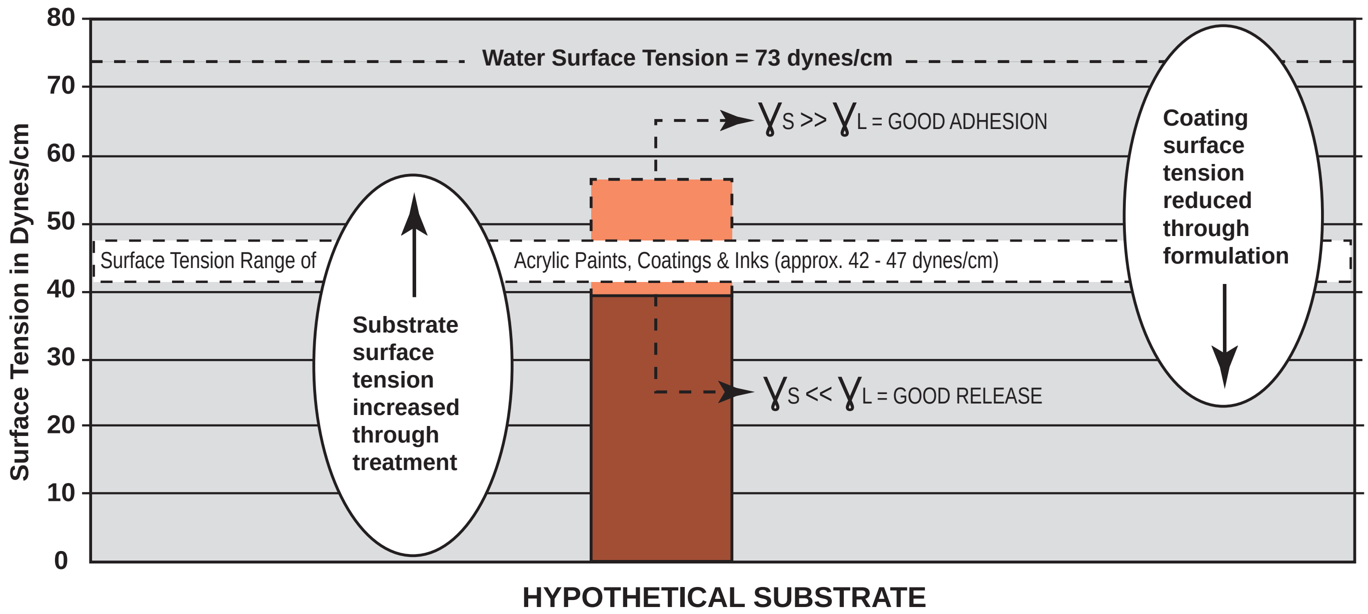
Figure 3. Hypothetical Surface Tension for Good Adhesion



Primers, Tie-coats & Additives

Primers typically consist of a reactive chemical or binder mixed in a solvent. It is either brushed or sprayed onto the substrate surface. The solvent evaporates, leaving the active material behind. Depending on the type of primer, the surface may be ready to bond immediately or may require time to dry thoroughly. Primers are commonly used on PET (Mylar®), Polyurethanes and silicones.

Tie-coats typically act as a chemical bridge between the plastic and the paint. They may simply be an adhesion promoting agent in low concentration dispersed in solvent/water. It is usually applied as a very thin coat. The application of a tie-coat directly to the plastic's surface may eliminate the need for a scuffing process which often results in visible scratch marks.

Silanes are a popular class of adhesion promoters used if the plastic has appropriate functional groups. Special classes of additives known as chlorinated polyolefins (CPOs) are also used as adhesion promoters for paints, coatings and inks on plastics such as untreated polyethylene, polypropylene or thermoplastic polyolefins (TPOs). These CPOs are used in at least three ways:

- As a primer between the substrate and subsequent coatings
- As a tie-coat between coating layers
- As an additive to the paint

Improving Substrate Compatibility

Plastic's surface preparations and/or modifications can greatly improve the acceptance of paints. Bond strengths and functional performance can be dramatically improved by increasing the water-loving (hydrophilic) and surface energy characteristics to promote adhesion, thereby adding value to the product and the process.

Surface Roughening

This is a simple and easy method for artists and quite effective for many plastics. Though it does not change the surface tension of the plastic substrate, the improved bondability comes from increasing the number of mechanical interlocking sites. Abrading a surface gets rid of films, scales and oxides, increasing the area available for bonding. It is important before abrading to first degrease the surface, as it might be more difficult to remove wax or oils from the spaces within the etched surface. After abrading with fine grain sandpaper or emery cloth, make sure to remove all loose particles with a brush or compressed air and then degrease again to remove all residual oils and mold release agents.

The sanded or etched surface will provide opportunities for the acrylic coating to find many small areas to attach to. This can be dramatically influenced by the viscosity (thick to thin) and rheology (flow properties) of the paint. Too thick a paint will not penetrate into the tiny recesses of the etched surface. Paints with poor flow properties won't easily move into and around the bumpier profile of the sanded surface. As a general rule, thinner products will typically provide better penetration and therefore, better adhesion to the plastic surfaces.

Chemical Bonding

There is only limited chemical bonding between the typical plastic and the liquid acrylic paint. A plastic resin is considered polar if its charge can be measured as positive or negative. If a polymer has no charge, we say it is non-polar. Many plastics are non-polar, so the opportunity for adhesion is really limited. Unless polyethylene or polypropylene are specially treated (such as flame treatment), their surface energy is so low as to severely limit adhesion. Polyethylene sheeting becomes a great surface for making acrylic skins that can easily be lifted off after drying because of the poor adhesion.

Acrylic Plastics (PMMA), ABS plastics and Polycarbonates are examples of polar plastics and therefore, typically have higher surface energy and improved adhesion for acrylic paints.

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Table I. Paint Prep & Primer Recommendations for Commonly Encountered Substrates

	Invention	Commercialized	Commercial and Derivative Products	Aging Properties	Dynes/cm	Preparation	Notes
Cellulose Nitrate	1862	1872	Pyroxyline, Celluloid, Laquer, Nitrocellulose	Poor	42		Becomes brittle, cracks
Polyvinyl Chloride (PVC, PVdC)	1872	1928	Vinyl, Sintra®, old Saran™ type wraps	Poor to good	33-42	Isopropyl alcohol based cleaner –Tie-coat recommended	Soft PVC (Vinyl) exudes plasticizer, hard PVC can be protected with UV inhibitors and pigments
Polymethyl Methacrylate (PMMA)	1877	1933	Plexiglas®, Lucite®, Perspex®	Good to excellent	41	Isopropyl alcohol based cleaner	Good adhesion of acrylic paint, slightly polar surface increases adhesion of paint
Polystyrene (& foamed polystyrene)	1839	1937	Styrene, Styrofoam™	Poor	34-41	Must be totally covered to reduce embrittlement	Becomes brittle, crumbles
Polyamide	1935	1938	Nylon	Good	33-46	Abrade surface, Isopropyl alcohol based cleaner	Adhesion of paint difficult
Polyethylene	1898	1939	Modern Saran™ type wrap, HDPE, LDPE, PE, Plas-Tex®	Fair	30-31	Isopropyl alcohol based cleaner	Difficult to wet surface, better as a release material for creating acrylic skins
Polyethylene Terepthalate	1929	1941	PET, Polyester, Mylar®	Good to excellent	41-44	Isopropyl alcohol based cleaner	Good adhesion especially when abraded
Acrylonitrile Butadiene Styrene	1948	1950	ABS	Fair to good	35-42	Isopropyl alcohol based cleaner	Slightly polar surface increases adhesion of paint
Polyurethane	1937	1952	Urethane, PU	Good to excellent	36-39	Abrade surface, degrease with acetone	Need to abrade surface for adhesion
Polypropylene	1954	1957	PP	Poor	29-30	Isopropyl alcohol based cleaner	Degrades under UV
Polycarbonate	1953	1958	Lexan®, Makrolon®	Good to excellent	34-46	Isopropyl alcohol based cleaner –Tie-coat recommended	Slightly polar surface increases adhesion of paint
Epoxy	1927	1947		Fair to good	33-52	Abrade surface, degrease with acetone	Polar surface increases adhesion of paint

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Other Treatments for Improving Adhesion of Coating to Plastics

There are a range of treatments used to improve the adhesion of paints to a range of plastics. These require industrial methods to process these substrates. The treatments include Flame Treatment[2], Thermal Treatment[3], Corona Discharge[4], Plasma Treatment[5], Chromic Acid Etching[6], and Adhesive Abrading[7]. There are several other treatments such as iodine and sodium and techniques such as surface grafting, transcrystalline growth, gamma radiation and UV exposure that have been successfully employed to increase surface energy of plastics that find mention in the literature. These are mostly used on difficult to wet substrates such as polyamides, fluoropolymers and polyolefins in industrial settings.

Recommendations for Artists

Some preliminary recommendations are presented in Table 1 for achieving improved adhesion between the acrylic paint and the plastic substrate (by no means are these all inclusive).

The rigid, lightweight, smooth surfaces of modern plastics provide a very tempting substrate for artists to use in their work. As is their right, artists can use and will use all these materials in their various forms for constructions and painting surfaces. It is possible to choose amongst the various plastics to use those that are most likely to produce durable results. Those would certainly include the acrylic, polycarbonate, polyester (PET), urethane plastics and some of the hard PVC Plastics. Other plastics in common use for artists include a range of vinyls and surfaces made with polypropylene plastic. Technologies are constantly being advanced to create new plastic combinations and surface treatments for improved compatibility with coatings. These new materials will allow artists to explore an increasing array of working possibilities. Yet it is clear that not all plastics are created equal and although they all may be tempting, make sure you're choosing the material for the right reasons.

Sorting Through the Plastics

Tempting as these flat, light, semi-rigid, transluscent or transparent materials seem to be as painting supports, the use of them by artists should have a "use at your own risk" warning sign. This article is not an attempt to define all of these possible supports, but to give what we think is a valuable brief on the concepts of adhesion of the acrylic paints and mediums onto these supports. The discussion of the various characteristics of each of these plastic supports will have to wait for another article.

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[2] **Flame Treatment:** This is a process of oxidizing the surface of the substrate by briefly exposing it to flame to introduce functional groups. This increases surface energy and improves bonding. The adiabatic flame temperature is around 1800° C. Flame treated surfaces often retain more stable aging than corona treated surfaces. Flame treatment is used in treating PE, PP and PET.

[3] **Thermal Treatment:** Thermal treatment is very similar to flame treatment except that it exposes the substrate to a blast of hot air around ~500° C instead of flame to oxidize the surface. It also involves a free radical mechanism accompanied by some surface cross-linking and chain scissions which improves wettability and adhesion.

[4] **Corona Discharge:** A process of roughening the surface of the substrate by high voltage across a gap to introduce reactive sites and facilitate mechanical interlocking through a corona discharge at atmospheric pressure in the presence of air. The effectiveness is not permanent so it is best to paint immediately after treatment. It works well for polyethylene, polypropylene and polyester.

[5] **Plasma Treatment:** This is an electrical process that uses ionized air to increase the surface tension of non-porous, non-polar plastic substrates, thereby improving the wettability and adhesion of paints, coatings, adhesives and inks. In air plasma discharge electrons bombard the surface with high energies that break the molecular bonds on the surface. The resulting free radicals rapidly react on the molecular chains on the surface resulting in some cross-linking. As a result of polar groups created on the surface, oxidative effects increases surface energy. Humidity and temperature degrade the treatment rapidly and it is imperative that the surface be coated within a short period of time, usually minutes. There are easy to operate, portable, hand-held plasma treaters, which generate gentler and lower temperature plasma ideal for delicate surfaces, available in the market.

[6] **Chromic Acid Etching:** A process that introduces to the surface of the substrate reactive functional sites such as carboxylic acid/hydroxyl/carbonyl groups and chemical etching to facilitate mechanical interlocking and improve bonding characteristics. It is recommended for polypropylene and polystyrene.

[7] **Adhesive Abrading:** This is a process of abrading the surface of the substrate, especially Teflon®, in the presence of an adhesive to create free radicals that react with the adhesive itself.

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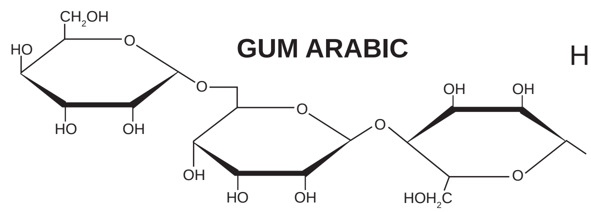
The Science Behind QoR®

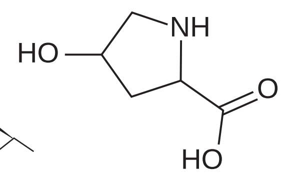
By Mark Golden

Dow® Chemical first patented our new watercolor binder for QoR, (Poly(2-ethyl-w-oxazoline) in 1977. It is now more commonly known as Aquazol® when it was licensed to another manufacturer. Among its several unique properties was its solubility in a wide range of solvents including water. Its properties for use as an adhesive were first investigated by Thomas Chiu, et al. in 1986. They demonstrated that it was quite capable of mixing with a wide range of other polymers used in the coatings and adhesive market and that it might be possible to add to improve other properties of these products. The polymer showed particular stability under shear that would be required if this product was to be milled under significant pressure. Aquazol also showed some promise as a hot melt adhesive, as it proved to be quite stable in substantially higher temperatures (up to 380° C / 715° F).

Most significant to our understanding of the value of the binder as a possible substitution for traditional gum arabic was the work in investigating the binder by Richard Wolbers, et al. (1994). In their initial study they investigated the properties of the material after accelerated aging. Wolbers suggested that Aquazol could be quite attractive as a potential conservation material because of its level of solubility in many different solvents and the possibility of it to perform on many different types of mediums and a variety of already painted surfaces. They were particularly interested in any evidence that under aging conditions, the binder would still provide adequate performance. They investigated its light stability, ability to remain resoluble over time or any evidence of cross-linking or degradation. What they discovered is that the material would most likely remain resoluble and it retained its flexibility even under low humidity conditions unlike natural binders such as gelatin or hide glues. The most likely mechanism of failure of the binder was chain scission, causing the binder to lose strength over time. It was also noticed that the binder only changed its color slightly under accelerated light exposure. Of particular interest to some conservators was that the binder had a very similar refractive index to glass, which suggested possible use on reverse glass paintings.

Our first glimpse at the new resin, Aquazol, as a binder for our new QoR Watercolor came from the conservation sciences and the conservators who began to use the binder as an adhesive and for inpainting purposes. For conservation it held several unique properties: readily resoluble in water, quite stable when exposed to accelerated light conditions, quite safe (approved by FDA for use as an indirect contact food label adhesive), and exhibits an extremely low odor, which is not insignificant considering the many very smelly products and solvents required in art conservation.





For us to consider this binder as a replacement for traditional gum arabic in watercolor it had to perform in ways that offered additional properties that could not be achieved in traditional formulas. If not, there was no reason to make just another watercolor. What we found in our initial investigations of Aquazol was that it allowed us to create a color with the potential for greater color strength than any other professional watercolor.

Other than the extensive practical testing of this new watercolor, the next technical evaluation of the test formulas required that we conduct our own accelerated aging studies of these colors. This is where our new watercolor also proved its extreme value. In controlled accelerated aging studies testing against traditional binders, Aquazol remained attached and flexible where the exposed samples of traditional watercolors all became brittle and cleaved from the test supports.

After validating these results, we realized this new Aquazol binder would allow us to achieve something very special and hopefully quite unique for professional watercolor artists. The Aquazol binder compares in many respects to the traditional gum arabic binder. Both of these materials are polymers, which is a critically important chemical structure for any good performing paint binder. A polymer structure simply refers to the fact that these binders contain repeating units of single compounds joined together in much longer lengths. In the case of gum arabic, it is a naturally occurring polysaccharide collected from the Acacia senegal and Acacia seyal trees.

It is a fairly complex chemical structure consisting mainly of a highly branched polysaccharide (number of sugar molecules bonded together) and a protein–polysaccharide complex (hydroxyproline) shaped in a fairly large spherical structures with some scattered larger coils. Aquazol also consists of a repeating structural compound called an ethyloxazoline, pictured below.

Essential to both polymers is that they offer excellent resolubility with water. This is very different from most other common paint binders like acrylic that once dry, are not again reducible in water. In fact, Aquazol allows for an even greater level of resolubility compared to natural gums, allowing artists to more easily reconstitute the dried QoR Watercolor on their palette. The value of this formulation is that it also easily blends with other traditional gum arabic watercolor brands and their mediums.

AQUAZOL®

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Although the science behind QoR is incredibly exciting, it will be the evaluation of these properties by watercolor artists who will find it appealing or not, based on how well it performs for their particular needs and uses. The new synthetic Aquazol binder in QoR will ultimately provide alternate paths for artists who are excited to discover and rediscover the potential of these new watercolors.

Resources available on the web at goldenpaints.com/justpaint/index.php

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The effects of QoR Watercolors on (left) QoR Watercolor Ground, (center) QoR Cold Press Ground and (right) QoR Light Dimensional Ground

QoR® Mediums and Grounds

By Stacy Brock

The recent introduction of QoR®, our new and original take on watercolors, gave us the opportunity to broaden the range of techniques and applications possible with a companion line of Mediums and Grounds. QoR Grounds greatly expand the breadth of surfaces that can accept watercolor paint and provide the freedom to create original surfaces by controlling absorbency and forming textures when used alone or mixed together. The Mediums help facilitate and control application, color saturation, opacity, sheen, lift and wetting. This collection is comprised of tools to hopefully excite the traditional watercolorist and entice the experimental and mixed media artist to explore and discover new possibilities.

QoR Watercolor Ground can broaden the range of what can be used as a watercolor surface. It creates a paper-like absorbent surface on many different materials such as hardboard, canvas, and wood. It can be used with any application technique and works well as a correction fluid to cover mistakes and recover the whiteness of the paper that may be lost due to color staining.

QoR Cold Press Ground is just like the name depicts and has the texture of Cold Press watercolor paper. It is fibrous and can range between a rough handmade paper surface and a smooth cold press finish if skimming with a wet palette knife after application.

Light Dimensional Ground is a joy to work upon. It can be applied thinly or used to create peaks or ridges. It is absorbent and allows for washes to easily spread as well as being capable of holding fine detail. Color lifts easily from this surface, even staining colors that are usually difficult to remove.

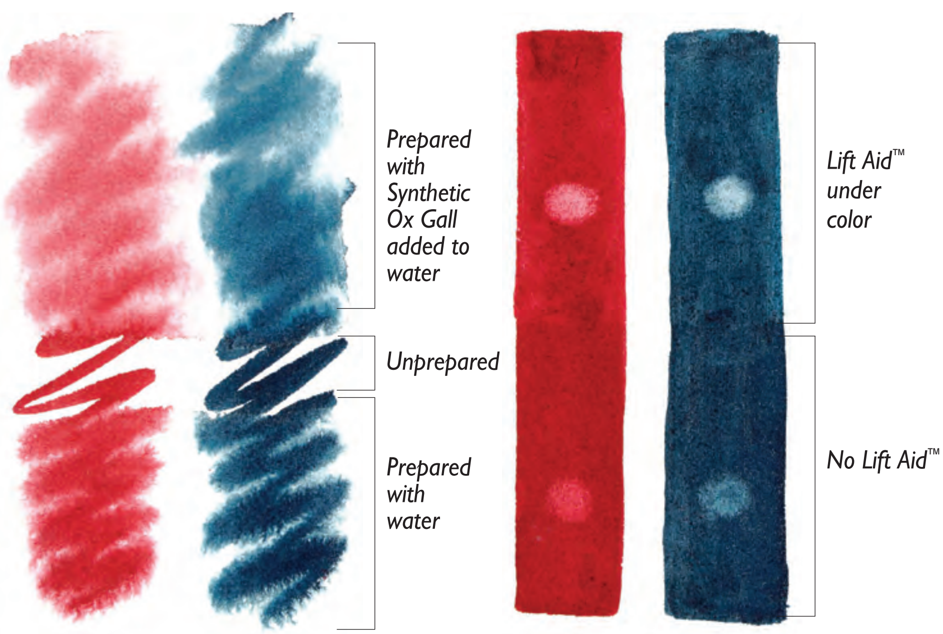
QoR Watercolor Mediums help extend and enhance the creative range and control of watercolors.

Watercolor Medium is an all-purpose medium that can be used to thin, extend, and increase the transparency and flow of watercolors. If used in larger amounts, it can increase the saturation of the colors and add a glossy sheen.

QoR Synthetic Ox Gall is a wetting agent that improves the flow of watercolors. Just a few drops added to water makes the paint easier to blend and really improves washes and wetting on hard sized papers.

QoR Lift Aid™ helps with the removability of watercolor paint when applied to the paper before painting or between washes, glazes and layering.

As you can see, the concept of QoR Watercolors does not end with colors. Like every product that comes from GOLDEN, the idea of equipping artists to realize their creative vision inspires every single one of our materials.



QoR Permanent Alizarin Crimson and Indigo, Synthetic Ox Gall Testing (left).
Wet removal was more successful when paper was pre-treated with QoR Lift Aid™ (right).

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Williamsburg's Wax Medium

By Sarah Sands

From the very beginning, oil painters have used mediums to extend, modify, tweak and transform their paint in one way or another. These have run the gamut from the simple use of solvents when creating an initial wash to much more complex concoctions and recipes that involve the blending of various oils, resins, balsams, and waxes. While Williamsburg has always supplied many of the base ingredients for painters who like to make their own mediums, we want to also take this opportunity to highlight our Wax Medium, which comes ready to use and is offered in 8, 16, and 32 oz. cans only.

Wax Medium

A mainstay from the earliest days of the company, Williamsburg's Wax Medium is made from a combination of linseed oil, bleached beeswax and dammar crystals that have been carefully melted and blended together. Unlike other wax pastes currently on the market, our Wax Medium contains absolutely no solvent, making it especially attractive to painters wanting to minimize their exposure to solvents in the studio. Having the feel of a soft paste when scooped from the can, it quickly becomes silky and quite fluid under the pressure of a palette knife as it is worked by itself or blended into paint. It is also unique in that it will form a film even on its own. This is particularly significant because most other wax pastes do not, and adding too high a percentage of wax by itself can cause problems of brittleness and poor adhesion. By contrast, because our Wax Medium starts with a blend of wax and oil together, a painter has much more freedom and leeway in how it is used.

Small additions of 10-20% of Wax Medium will give one's paint a thinner, more flowing consistency, with none of the fumes associated with mineral spirits or turpentine. As one moves into higher ratios, the paint will start to gain a beautiful translucency, while drying to more and more of a satiny sheen. However, some caution should be used at these higher levels since the paint will dry to an increasingly softer film the more wax you add, while greater transparency will make the mixture more vulnerable to the eventual yellowing of the oils. Because of that, it is best to limit applications with higher percentages of the Wax Medium to the upper layers of a painting, and when creating more translucent effects, leaning toward warmer colors where any yellowing will have the least impact. Lastly, Wax Medium can also be blended with other oils and alkyds to create a wide range of variations. A moderate drier, a 3 mil layer which is about the thickness of a piece of office paper, will dry in 4-7 days.

Wax Medium blended with Williamsburg's Slate Black and Alizarin Orange Oil Colors

Turning the World of Cans Upside Down

By Sarah Sands

Recently we set about testing a variety of solutions for what has been a constant problem: preventing a can of paint from forming a skin, especially when stored for months or even years at a time. Plastic wrap pressed against the surface definitely worked, but also created a mess when being removed, while anti-skinning sprays could impact the drytime of the paint itself, especially if the amount was not tightly controlled and a painter happened to use just the topmost layer. Plastic rings that locked the lid in place, and even displacing oxygen by spraying argon gas into the headspace before sealing the can, all showed promise and potential. But in the end the most effective method turned out to be the easiest of all: simply turn the can upside down. By doing this, the wet paint would be pressed against the inside of the lid and create an airtight seal. All the trials using this method showed no evidence of skinning, even when stored at elevated temperatures for a prolonged period.

Based on those results we have decided to package and store our cans in a new, upside-down orientation; so, while the label will still appear right-side up on the shelf, the lid will now be on the bottom and you will need to turn the can over to get to the paint. This might take a little getting used to for some of our customers, but in the end it is a better way to get our paint to you in the best and freshest condition.

While it will take a while for these cans to start appearing on store shelves, we would encourage you to start to store them in this way for yourselves. Just keep in mind this method works best if the can still has a substantial amount of paint inside. When done for the day, make sure to tap the lid securely into place before turning the can over and giving it a good whap against a solid surface in order to pull the paint down against the lid. As the level of paint reaches halfway or less, this method becomes more impractical and less effective. At that point, it makes the most sense to smooth the surface of the paint, removing any gouges or air pockets, and pressing a piece of plastic wrap against the surface.

Left: Williamsburg Cadmium Red Light with lid at top of can.
Right: Cadmium Red Light with lid at bottom of can.

Friedel Dzubas Monumental Works

By James Walsh

By the middle of the twentieth century the traditional notion of the artists studio, that of the 'garret', gave way to the availability of spacious commercial lofts in downtown New York City that had been abandoned in the post-war period. As manufacturing moved out of New York, artists moved into these spaces. Easels were dispensed with as painters utilized these vast studios by stapling canvases directly to the wall, or, as they had learned from Jackson Pollock, tacked canvas directly to the floor.

The New York School coalesced as expatriate artists fled Europe and American artists traveled to New York from all over the United States.

The threads of spontaneity, immediacy and directness gleaned from the ascension of Abstract Expressionist painting came together to create innovations in scale, spreading of color and signature styles of painting.

In this milieu, Friedel Dzubas was among the notable artists who challenged themselves by engaging large scale in their art. Frank Stella, Larry Poons, Jules Olitski, and Al Held were among his contemporaries who were able to work in gradations of scale from the intimate to the monumental.

In the 1950's, Dzubas was painting energetic abstractions with oil paint and he was included in early pivotal shows of the downtown artists such as the Ninth Street Show of 1951 and the follow up Stable Gallery Exhibition.

Our exhibition at The SAGG entitled *'Friedel Dzubas Monumental Works'*, on view from September 13, 2014 through March 28, 2015, features several large-scale paintings nearly ten feet tall and over twenty feet wide. These works represent an important benchmark of Dzubas's achievement in terms of his grappling with the physical limitations of a 'portable' painting, a painting that can be disassembled and rebuilt for exhibitions. The large scale of these works puts as much pressure on the available space of gallery and museum walls as much as they did on Dzubas's ability to make them. As large as the Dzubas paintings in our exhibition are, his largest work 'Crossing', which hung in the Shawmut Bank in Boston for many years, is an astounding fifty-seven feet long.

Somewhat in opposition to the typical practice of the painters of the post war period, Dzubas made small studies in advance of painting larger works. The SAGG has the good fortune to be able to include the study that Dzubas made for one of his large works entitled 'Procession' featured in the exhibition. The 'Study for Procession' is 13 ½ by 31 inches while the fully realized 'Procession' is twenty-four feet long. Both works are made with Magna mineral spirit acrylics. Magna was developed in the late 1940's by paintmaker Sam Golden at his company Bocour Artist Colors. Magna was the first acrylic available for artist use and mixed with mineral spirits, not with water. Jackson Pollock was among the early adopters of Magna.

The original Magna paints, and after 1980, the Mineral Spirit Acrylics manufactured by Golden Artist Colors, Inc., afforded fast drying, luminous color and a distinct advantage for Dzubas, who would apply these paints onto a lean gesso surface that had been saturated with mineral spirits. This enabled Dzubas to feather out the edges of his multiple dense color areas enabling his signature surfaces. The choruses of these distinctive shapes populate his paintings and allowed him to provide pictorial resolutions that were wholly original within the architecture of the rectangle.

Our exhibition 'Friedel Dzubas Monumental Works' looks back to a time when the process of art making was wildly optimistic and open-ended. Dzubas took his painting across a gamut of scale relations and expressive potentials. It's wall-to-wall painting, you can't help but be immersed within.

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Image by Erik Korver

By Emma Golden

The second annual **Made in Paint** exhibition opening was among the most highly attended events hosted by the Golden Foundation to date. Approximately 300 visitors filled the Sam and Adele Golden Gallery (The SAGG) on April 12, 2014 to view the works of 20 artists from around the world. These talented artists' works came together as a result of the 2013 Golden Foundation Residency Program. Nine of the 18 artists in residence from 2013 were able to join us for the Opening as well as two artists from 2012.

The SAGG at Golden Artist Colors hosted at least one artwork by each of the 18 residents and two visiting artists from 2013. Gallery Director, Jim Walsh put together a show that flowed through works with varied substrates, thick to thin textures and an abundance of color. Made in Paint celebrates the unique curiosity and understanding of materials and tools through the artist's investigation into a variety of materials during their time at the Golden Foundation for the Arts.

The Made in Paint exhibition is currently available online at www.thesagg.org. For a show catalog, email contact@goldenfoundation.org.

The Golden Foundation's third Made in Paint alumni show will take place in the Spring of 2015, highlighting the works of this year's 18 artists in residence. The Golden Foundation also hosts Open Studios at the end of every 4-week-long residency. Please email us if you'd like to be notified of these dates. For further information about the Golden Foundation and residency program, go to www.goldenfoundation.org.

The works are also available for purchase. Please contact the Golden Foundation's Executive Director Barbara Golden at b.golden@goldenfoundation.org for pricing.

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