

## MATERIALS INFORMATION and TECHNICAL RESOURCES for ARTISTS - Adhesives and Sizes

A “**size**” is a material that is applied to a support (wood, fabric, etc.) to effectively seal the surface and serve as a barrier layer between the support and the paint and ground layers. Certain materials used as size will help to prevent **Support Induced Discoloration (SID)**, a phenomenon that occurs when water-soluble impurities in the support migrate up through the ground and paint layers. A layer of size reduces the absorbency of the support, but size should not be applied too thickly. Too thick an application can lead to problems of delamination. It is best to use either a sponge or a brush and apply an even, thin solution that effectively penetrates the surface of the support. Sizing both the back and front of wooden supports will help mitigate warping of the panel. It is generally best to also size the sides of the panel. This is even more important if the support will remain unframed or is of lesser quality wood. Fabric supports, whether adhered to a rigid panel or mounted onto a stretcher, tend to shrink once properly sized. This is especially true when an animal glue size is used. Sizing reduces the absorbency of the fibers (preventing “**striketrough**” or mediums/solvents from seeping through to the back of the support), protects the canvas from the acidity of certain materials (e.g. drying oils, alkyds), and creates a taut, planar surface suitable for painting.

COATING #1	COATING #2	COATING #3	GROUND	STRIKETHROUGH	STIFFNESS
GAC 200	GAC 200		Linseed Oil Grounds	None	Stiff
GAC 400	GAC 100	GAC 100	Linseed Oil Grounds	None	Moderate
Acrylic Gesso	Acrylic Gesso	Acrylic Gesso	Linseed Oil Grounds	None	Moderate
GAC 100	Fluid Matte Medium		Linseed Oil Grounds	None	Flexible
GAC 100	Matte Medium		Linseed Oil Grounds	None	Flexible
Polymer Medium	Polymer Medium		Linseed Oil Grounds	None	Flexible
GAC 100	GAC 100		Linseed Oil Grounds	None	Flexible
Rabbit Skin Glue	Rabbit Skin Glue		Linseed Oil Grounds	None/Very Slight	Stiff
GAC 400	GAC 100		Linseed Oil Grounds	Very Slight	Moderate
GAC 200			Linseed Oil Grounds	Very Slight	Moderate
GAC 100	Acrylic Gesso		Linseed Oil Grounds	Very Slight	Flexible
PVA Size	PVA Size		Linseed Oil Grounds	Very Slight	Flexible
Polymer Medium			Linseed Oil Grounds	Very Slight	Flexible
GAC 100			Linseed Oil Grounds	Very Slight	Flexible
Rabbit Skin Glue			Linseed Oil Grounds	Slight/Moderate	Moderate
Acrylic Gesso	Acrylic Gesso		Linseed Oil Grounds	Slight/Moderate	Flexible
GAC 400			Linseed Oil Grounds	Moderate/Severe	Moderate
Acrylic Gesso			Linseed Oil Grounds	Severe	Flexible
PVA Size			Linseed Oil Grounds	Severe	Flexible

Table 1 — Various sizes for protecting and stiffening canvas.

Table (courtesy of Golden Artist Colors, Inc.) summarizing results obtained using various sizes in combination with linseed oil grounds and canvas supports.

## PROTEINACEOUS SIZES AND GLUES

**Animal glues** are produced from a wide range of animal tissues (e.g. hides, bones, etc.). **Rabbit skin glue (RSG)** is a term that is sometimes used as a descriptor for all animal glue products, so RSG is not always derived from rabbits but may come from other animals such as goats, sheep, and most commonly cows. **Isinglass** is glue derived from the bladders of sturgeon fish. It is used as a size for handmade papers and by art conservators in their work. Other fish derived glues are also available, some of them in liquid form. These are generally best avoided as they often contain other ingredients, **Gelatin**, another term associated with animal glue, generally refers to grades that are more refined. Gelatin is available in sheets, shards, pellets, or powders. Grocery store food gelatin tends to be weaker than other grades of gelatin. Animal glues can be dissolved in hot water and applied as a warm, liquid solution. Most animal glues will gel at room temperature. (Animal glues can also be applied in cold, soft gelled form with a spatula or palette knife, although this is generally not suggested).

If animal glues are to be used as a sizing material, artists should consider the following:

- Glues respond readily to changes in temperature and relative humidity. Animal glues will shrink as the humidity drops and swell and soften when the humidity rises. These changes can lead to delamination and/or flaking of the overlying ground and paint layers and to planar deformations in the support.
- Animal glue size should be used with a rigid support (or a canvas adhered to a rigid support) as the rigidity mitigates the expansion and contraction of the size layer.
- Glues tend to form fairly rigid and brittle films and should not be applied too thickly to supports. 2-3 coats of dilute size are preferable to one thick layer of glue. Instructions provided by the manufacturer for glue-size preparation procedures should be followed.
- The surface of the support should be sanded after each coat of glue size with the exception of the final coat.
- Animal glue sizes are not recommended for use with acrylic ground/paint systems. They are compatible with glue-based grounds (e.g. true gesso, chalk) and oil and/or alkyd paint systems.
- Although rabbit skin/animal glue possesses hygroscopic properties, many artists continue to use this traditional material as a size and/or adhesive. If you choose to use animal glue to adhere your canvas to a wooden support, the following steps are recommended:

Prepare your animal glue following the directions on the package. Brush a generous, even coat of glue onto the panel's surface. You may allow this coat to dry before continuing with the process or proceed immediately. Immerse the canvas into the glue, wringing the fabric to

remove any excess. Position the fabric onto the panel. Use a brayer/bone folder to eliminate any air bubbles, working from the center outwards to the edges. If you have decided to keep excess fabric along the outer edges, fold them over and attach to the backside of the panel (or affix them later). Immediately apply a coat of glue to the reverse of the panel (NOTE: It is not advised to leave a coat of animal glue exposed to the environment. Subsequent layers of priming and paint need to be applied to the reverse in order to avoid warping, mimicking the same layering used on the front of the panel). For allow for adequate drying, stand the panel on its edge or lean against a wall.

Older artist manuals suggest the addition of alum to harden animal glues and make them less water soluble. This is no longer recommended as it tends to make the glue overly brittle. Weak solutions of formaldehyde were also applied to tan the glue. Artists should strictly avoid formaldehyde as it has been shown to be a significant health hazard.

## ACRYLIC-BASED ADHESIVES AND SIZES

There are several types of acrylic-based resins that can be used as sizes and adhesives. Methods of application and aging properties vary widely depending on the type of acrylic polymer(s), the presence of additives, and whether the acrylic resin is delivered in an aqueous or solvent-based solution.

NOTE: “**Dispersion**” and “**Emulsion**” are terms that refer to mixtures of things that are not normally compatible and/or miscible. These terms are often used by art supply companies as product descriptors. A dispersion (e.g. ketchup, ink) is simply a slurry of small, solid particles suspended in a primary vehicle. There are two categories of emulsions: oil-in-water (o/w) emulsions (e.g. mayonnaise, moisturizers) and water-in-oil (w/o) emulsions (e.g. sunscreen).

**Acrylic-Based Resins** are available in a wide array of pre-dissolved solvent solutions, as dry resins, and as commercially available fixatives. Artists should be aware that the most of these products available today have yet to be tested for their long-term aging properties (e.g. propensity for yellowing, darkening, difficulty to remove over time, etc.). For absorbent panel supports, artists may consider sealing the surface (taking care not to apply a layer that is too thick) with certain acrylic-based resins. Paraloid B-72 can be dissolved in aromatic solvents (or combinations of ethanol and aromatic solvents) and applied thinly to absorbent rigid supports. Thin applications of MSA varnish may also be used to seal rigid supports. Note that these materials will remain soluble to solvents so it is probably best to avoid applying a subsequent layer that contains mineral spirits and/or turpentine (e.g. oil grounds). If acrylic-based resins are used as a sealant/size, they should only be used

for absorbent rigid supports (not flexible supports) and are best used in combination with aqueous-based grounds (e.g. acrylic).

**Acrylic Polymer Dispersions** come in two forms: fluid acrylic dispersions which are composed of finely distributed particles of resin suspended in water (these dispersions often appear “milky white” but clarify with drying) and gelled acrylic dispersions which are fluid dispersions with additional thickeners. As the water evaporates from a dispersion, the solid particles move closer together forming a continuous, transparent or semi-transparent film. Certain acrylic dispersions when delivered in dilute aqueous solutions have good penetration and wetting properties. They dry fairly quickly and do not have to be mixed with toxic solvents.

When using an acrylic polymer dispersion as a sizing material, artists should consider the following:

- Conduct their own experiments as it can be difficult to identify the exact components and chemical composition of these products. Keep records of the date purchased as well as the manufacturer.
- Check with the manufacturer to see if extensive product testing has been performed to evaluate its suitability as a size and/or adhesive. Many manufacturers offer acrylic dispersion mediums that are acceptable as sizes. One, Golden’s Specialty Acrylic Polymers (GAC) line, has been extensively tested as a size for both acrylic and oil paintings. GAC 200 can be applied as is (if one chooses to dilute it for improved workability, it should not be diluted further than 20-25%). GAC 400 can be used instead of rabbit skin glue to stiffen a canvas and a coat of GAC 100 applied atop GAC 400 can help to provide a barrier against oil penetration. It is essential that GAC products used as sizing material be allowed to dry at 70 F/21 C before ground and paint layers are applied. MSA varnishes can also be used as a size for sealing panels as long as it is not applied too thickly.
- Know that acrylic polymer dispersions tend to be more stable than animal glue sizes. However, this does depend on the polymer and/or additives present in the dispersion. Applicability depends upon the specific purpose.
- Apply acrylic-based sizes evenly to the back, front, and sides of wooden supports to prevent uneven warping.
- Know that acrylic gel mediums can be used to adhere fabric or paper to a rigid support (see “Rigid Supports” document). Avoid using Golden’s Soft Gel as a size/sealant. If acrylic gel is used as both the adhesive and size, it is recommended that an acrylic ground also be used (avoid using a traditional glue ground).

## VINYL-BASED ADHESIVES AND SIZES

The vinyl group is the ethylene molecule minus one hydrogen atom. Vinyl-based sizes and adhesives encompass a wide range of compounds including polyvinyl acetate (PVA or PVAC) and polyvinyl chloride (PVC). PVA resins are colorless, thermoplastic resins prepared by the polymerization of vinyl acetate. PVA water-based dispersions are the main component in most household white glues (e.g. Elmer's Glue). They set through evaporation/absorption. As the water evaporates, the resin particles move closer together forming a continuous film. PVA resins are also present in some hot-melt adhesives, sealants, fabric finishes, and inks. While PVA resins tend to be fairly water-resistant, they produce a somewhat porous film and are inherently acidic unless they are buffered.

When using a vinyl-based polymer as a sizing material, artists should consider the following:

- Conduct their own experiments as it can be difficult to identify the exact components and chemical composition of these products. Keep records of the date purchased as well as the manufacturer.
- Not use PVC polymers as sizing or adhesives as these products may contain potentially hazardous plasticizers and problematic additives.
- Make sure that any PVA polymer used as a size and/or adhesive will have a neutral pH (around 7) upon setting. Lineco pH Neutral adhesive and Gamblin's PVA size are examples of two PVA-based adhesives that have been buffered to a neutral pH.
- Know that pH neutral PVA adhesives are more stable than animal glue sizes. However, this stability is dependent upon the polymer and/or additives present in the dispersion. Some consider acrylic dispersion sizes preferable to PVA sizes. They tend to provide a greater degree of stiffness, are less porous, and are more efficient at preventing support induced discoloration.
- Apply PVA-based sizes evenly to the back, front, and sides of wooden supports to prevent uneven warping.
- Know that pH neutral PVA adhesives can be used to adhere fabric or paper to a rigid support (see "Rigid Supports" document). If a pH neutral adhesive is used as both the adhesive and size, traditional glue grounds should be avoided.

## BEVA 371 ADHESIVE AND BEVA GEL

BEVA 371 is a mixture of ethylene vinyl acetate copolymer, polycyclohexanone resin, phthate ester, and paraffin wax that has been dissolved in aromatic hydrocarbon solvent(s). (The "B" in BEVA stands for Berger as the formulation was developed by Gustav Berger). BEVA can be purchased as a solution, film, a waxy solid, or a gel. It has been used by conservators since 1970.

**BEVA 371 adhesive** is a waxy solid that contains residual aromatic solvents. It is prepared by diluting it with solvents, allowing the adhesive to dry, and then heating it at a temperature of 65.6 degrees Celsius. **BEVA Gel** is an aqueous dispersion of ethylene vinyl acetate and acrylic resins dissolved in a cellulosic material. As BEVA Gel has a higher molecular weight than BEVA 371, a higher temperature (70-72 degrees C) is required to activate the resin. **BEVA Film** is BEVA 371 adhesive that has been cast into a thin film on a silicone-coated sheet of Mylar.

When using BEVA 371 Adhesive/Film/Gel as an adhesive, artists should consider the following:

- Exercise appropriate health and safety procedures. All BEVA products contain a certain amount of aromatic hydrocarbon solvents and some require additional solvents for dilution/preparation. The heat used to activate them can cause residual solvents to off-gas. This is less of an issue with the BEVA Gel.
- BEVA Gel can be used in a similar manner as BEVA Film and BEVA Adhesive but tends not to form as strong of a bond. This may not be an issue depending on the weight and/or nature of the canvas support. It is reversible in water which may counter indicate its use for some circumstances.
- Consider the following steps when adhering canvas to a rigid support (panel supports should first be sealed):

Apply one to two even coats of dilute BEVA adhesive (thin cream consistency) to the panel after cleaning the surface and two coats to the reverse of the canvas (wear adequate protection as solvents are required). If you are using BEVA film it is better to use two sheets of film as opposed to one, although one sheet may be able to provide enough adhesion. Place the film with the BEVA-side facing the panel (or canvas if you are using two sheets) without removing the silicone-coated Mylar and apply heat evenly using an iron (BEVA adhesive requires a temperature of around 65.6 degrees Celsius to be re-activated). Weight down the surface until the BEVA has cooled and then carefully peel away the silicone-coated Mylar (NOTE: If you attempt to remove the Mylar too soon you will pull up the BEVA). If you are using two sheets, repeat this process with the other sheet of BEVA film when applying to the reverse of the canvas support (consider placing silicone-release paper/Mylar beneath the canvas when applying heat, silicone side facing up). Then position your canvas directly atop the BEVA film, place silicone-release paper/Mylar (silicone side facing down) atop the canvas, and apply heat. If you are using BEVA adhesive simply wait for the coats of BEVA to dry (in a well ventilated space) and repeat the aforementioned step. If you experience difficulties using BEVA film, try applying a coat of adhesive to the back of the canvas or switch to the adhesive altogether.

## OTHER TYPES OF SEALANTS

Although not traditionally thought of as sizing materials, **shellac** and **polyurethanes** (both water-born and solvent-born) have been used to seal the surface of wooden supports and decrease absorbency. Both prevent Support Induced Discoloration (SID), a phenomenon that occurs when impurities in the support migrate up through the ground and paint layers.

Shellac is obtained from raw shellac, a resinous material that is excreted by the *Laccifera lacca* insect (native to both India and Thailand) and then chemically refined or washed by hand to produce a variety of grades with varying color and quality. **Sticklac** is the rawest form and still contains the red lac dye. **Seedlac** is sticklac that has been repeatedly washed and strained of contaminants. It contains a small amount of impurities that only further chemical refinement will remove. **De-waxed shellac** is seedlac from which the wax content has been removed, producing flakes that have high water-resistance and transparency. **Bleached shellac**, often considered to be the highest grade of shellac, is produced by removing both the wax and the colored resin content from seedlac, resulting in a “blonde” or nearly colorless product. Bleached shellac become more difficult to dissolve in ethanol the older it is and those using it should choose only the freshest supply.

When using shellac or polyurethane as sealants, artists should consider the following:

- Avoid using them with fabric or paper supports.
- Use them to seal wooden supports only if they are unable to use other products (e.g. PVA, acrylics). Shellac and polyurethane are less than ideal materials in terms of reversibility, brittleness and aging characteristics.
- Apply both of these materials as thinly as possible to the front, back, and sides a wooden support. Applying a sealant coat that is too thick can lead to delamination and flaking of the paint and ground layers. Two to three dilute coats are usually sufficient. Additional coats may be needed if the support is especially absorbent.
- Use solvent-born polyurethane in a well ventilated area and follow proper health and safety procedures. Water-born polyurethanes are less toxic, but create a less effective moisture barrier than solvent-born polyurethanes. When a solvent-born polyurethane is used, a wooden support experiences less planar deformation and/or warping.

## ADDITIONAL REFERENCES AND RESOURCES

### General

Gamblin Colors - Sizes and Grounds <https://www.gamblincolors.com/oil-painting/sizes-and-grounds>

Golden Artist Colors - Preparing a Canvas for Oil Painting  
<http://www.justpaint.org/preparing-a-canvas-for-oil-painting>

Golden Artist Colors - Preparing a Painting Support  
[http://www.goldenpaints.com/technicalinfo\\_prepsupp](http://www.goldenpaints.com/technicalinfo_prepsupp)

“Cold Temperatures Effects on Modern Paints used for Priming Flexible Supports”  
by Christina Young and Eric Hagan in *Preparation for Painting: The Artist's Choice and Its Consequences*, edited by Joyce H. Townsend, Tiarna Doherty, Gunnar Heydenreich, and Jacqueline Ridge (London: Archetype, 2008).  
[https://www.researchgate.net/publication/228778940\\_Cold\\_temperature\\_effects\\_of\\_modern\\_paints\\_used\\_for\\_priming\\_flexible\\_supports](https://www.researchgate.net/publication/228778940_Cold_temperature_effects_of_modern_paints_used_for_priming_flexible_supports)

Texas A&M University - Adhesives and Consolidants Used in Conservation -  
<http://nautarch.tamu.edu/CRL/conservationmanual/File2.htm>

New York Studio School – Notes on Sizing and Priming  
[http://www.nyss.org/media/uploads/workshop\\_pdf/Stretching\\_Demo\\_Workshop\\_1.pdf](http://www.nyss.org/media/uploads/workshop_pdf/Stretching_Demo_Workshop_1.pdf)

“Sizes and Grounds” in *The Painter's Handbook: Revised and Expanded* by Mark David Gottsegen (New York: Watson-Guption, 2006), pp. 51-72.

### **Proteinaceous Sizes/Adhesives**

Natural Pigments – Preparation of Picture Canvas  
<http://www.naturalpigments.com/art-supply-education/cat/sizes-adhesives/post/preparation-canvas/>

Natural Pigments – Preparing Collagen Glue  
<http://www.naturalpigments.com/art-supply-education/cat/sizes-adhesives/post/glue-sizes-adhesive/>

Natural Pigments – Sizing Paper and Gelatin Sizing  
<http://www.naturalpigments.com/art-supply-education/cat/sizes-adhesives/post/sizing-paper-gelatin/>

*Determining the Acceptable Ranges of Relative Humidity and Temperature in Museums and Galleries – Part 1* by Marion Mecklenburg (Washington DC: Smithsonian Conservation Institute, 2007) pp.8-10



<https://repository.si.edu/bitstream/handle/10088/7056/Mecklenburg-Part1-RH.pdf?sequence=1&isAllowed=y>

*Determining the Acceptable Ranges of Relative Humidity and Temperature in Museums and Galleries - Part 2* by Marion Mecklenburg (Washington DC: Smithsonian Conservation Institute, 2007) pp.4-6

<https://repository.si.edu/bitstream/handle/10088/7055/Mecklenburg-Part2-Temp.pdf?sequence=1&isAllowed=y>

## **Acrylic Polymer Dispersions**

Golden Artist Colors - Special Purpose Mediums

<http://www.goldenpaints.com/products/medium-gels-pastes/special-purpose-mediums>

Golden Artist Colors - GAC Specialty Polymers

<http://www.justpaint.org/gac-specialty-polymers>

CAMEO Materials Database – Paraloid B-72 [http://cameo.mfa.org/wiki/Paraloid@\\_B-72](http://cameo.mfa.org/wiki/Paraloid@_B-72)

Lascaux- Acrylic Sizing

[http://lascaux.ch/pdf/en/produkte/malhilfen/impraeg\\_grund/52304.02\\_impraegnerungen .pdf](http://lascaux.ch/pdf/en/produkte/malhilfen/impraeg_grund/52304.02_impraegnerungen.pdf)

## **Shellac**

CAMEO Materials Database – Shellac <http://cameo.mfa.org/wiki/Shellac>

Victoria and Albert Museum – Aging Properties of Shellac -

<http://www.vam.ac.uk/content/journals/conservation-journal/issue-11/the-ageing-and-stabilisation-of-shellac-varnish-resin-an-undergraduate-research-project-at-imperial-college/>

Natural Pigments – Shellac <http://www.naturalpigments.com/art-supply-education/shellac-use-art/>

University of Oslo - *Investigating Shellac: Documenting the Process, Defining the Product* by Juliane Derry

<https://www.duo.uio.no/bitstream/handle/10852/34480/Derry-Master.pdf?sequence=5>

## **Vinyl Based Adhesives**

CAMEO Materials Database - PVA [http://cameo.mfa.org/wiki/Polyvinyl acetate](http://cameo.mfa.org/wiki/Polyvinyl_acetate)

Lineco - White Neutral PH Adhesive [http://www.lineco.com/cart.php?m=product\\_list&c=1118](http://www.lineco.com/cart.php?m=product_list&c=1118)

## **BEVA 371**

CAMEO Materials Database - BEVA® 371 [http://cameo.mfa.org/wiki/BEVA%C2%AE 371](http://cameo.mfa.org/wiki/BEVA%C2%AE_371)

Conservation Support Systems

<http://www.conservationsupportsystems.com/product/show/beva-371-solution/beva-adhesives>