

Innovations in Sealed Packages Crib Sheet

Included within this document are notes from Hugh Phibbs talk "*Reconsiderations; enclosing to create a better preservation environment*" at the *Innovations in Sealed Packages* event hosted by Tru Vue and John Jones, June 2015.

At this event, and the museum and gallery visits arranged by Tru Vue surrounding it, Hugh mentioned many different materials that he recommends for use in creating a simple but effective sealed package. Some of these materials are well known to the preservation community, others less so. The materials table below includes an image of each material, the name used by Hugh within his talks, any other names that the material might be known by, important notes for use, and potential suppliers. Where possible, suppliers who are based in, or will deliver to, the UK and Europe have been included. However, some materials appear to currently only be available in the US. If this is the case the suggestion would be to contact the US supplier to see who they recommend internationally. The suppliers listed are by no means an exhaustive list and there may be others not included

within this table. Below the materials table are a few images to demonstrate making a sealed package with either hot melt adhesive or ATG tape, as shown by Hugh.

There were two topics in relation to Tru Vue materials that were raised at the majority of talks and events. The first was when to use laminated glass in a sealed package and when to use acrylic. To aid in this decision a table of glass and acrylic pros and cons has been included. The second topic was the anti-static nature of Tru Vue's Optium® Museum Acrylic. A chart comparing the conductivity of a variety of glazing materials has also been included.

Hugh Phibbs is happy to answer questions or discuss ideas relating to this topic and can be reached at preservator6@aol.com

Jennifer Booth, Tru Vue's International Museum and Conservation Liaison can be reached at jbooth@tru-vue.com

Material Table

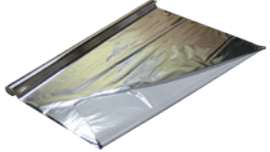

Image	Name	Alternative Names	Notes	Suppliers
	Mylar 2 mil reflective film	<ul style="list-style-type: none">• Viagrow VMY130	<ul style="list-style-type: none">• Four layers: PET/PE/AL/PE• When using supersticky ATG use clear side (looks silver because you can see the aluminium) inside package (white on outside)• When using hot melt put white side in, silver side out.	US Supplier: www.homedepot.com UK Supplier: www.amazon.co.uk - search for mylar reflective silver/white under garden and outdoors.
	5 mil ATG	<ul style="list-style-type: none">• 3M™ 969• Scotch® ATG adhesive transfer tape• Super Sticky ATG	<ul style="list-style-type: none">• Use 3M™ product only - other products loose adhesion.	www.3mdirect.co.uk or any 3M™ supplier





Image	Name	Alternative Names	Notes	Suppliers
	3M™ 3748 Scotch-Weld hot melt adhesive sticks	<ul style="list-style-type: none"> • Jet Melt 	<ul style="list-style-type: none"> • Electrical grade – • Safe for copper and silver • NB different colours available; double check before purchase 	www.vikingtapes.co.uk or any 3M™ supplier
	MarvelSeal 1311	<ul style="list-style-type: none"> • Scrimback MarvelSeal 	<ul style="list-style-type: none"> • Very expensive 	EdCo supply (Brooklyn NY) www.edcosupply.com Carr McClean www.carrmclean.ca University Products www.universityproducts.com Will ship internationally
	Macrolux®	<ul style="list-style-type: none"> • Polycarbonate twin wall/multi wall 	<ul style="list-style-type: none"> • Available in various thicknesses 	www.polycarbonateshop.co.uk
	Dilite®		<ul style="list-style-type: none"> • 3mm Coroplast/Correx (aluminium composite with polyethylene core) with water deposited heat cured surface covering 	Thyssenkrupp Materials UK http://www.thyssenkruppmaterials.co.uk/index.html


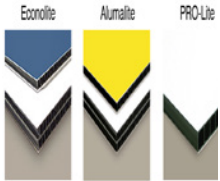
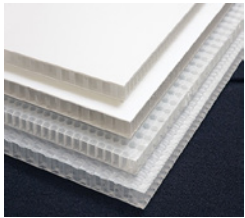



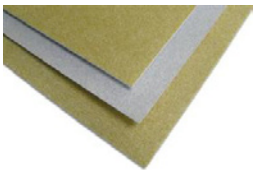



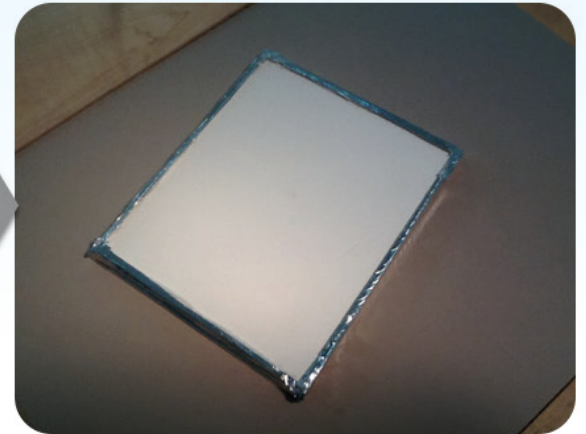
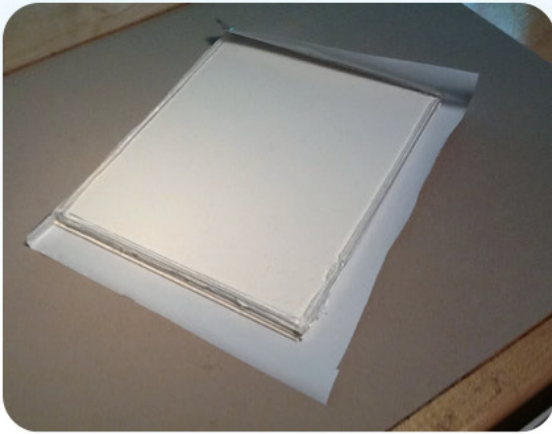
Image	Name	Alternative Names	Notes	Suppliers
	Dibond®		<ul style="list-style-type: none"> Aluminium composite with polyethylene core with powder coated surface covering 	Thyssenkrupp Materials UK www.thyssenkruppmaterials.co.uk/index.html
	PRO-Lite™		<ul style="list-style-type: none"> 10 mil Coroplast/Correx (aluminium composite with polyethylene core) with water deposited heat cured surface covering 	laminators inc www.laminatorsinc.com
	Stinger™ Honeycomb Board		<ul style="list-style-type: none"> Honeycomb polypropalene 5mm/ 10mm/1 inch 	Coroplast suppliers stinger.coroplast.com
	Vivak®	<ul style="list-style-type: none"> PETG Spectar 	<ul style="list-style-type: none"> PETG .02/.04/.06 thicknesses Bayer material science 	Thyssenkrupp Materials UK www.thyssenkruppmaterials.co.uk/index.html
	Corrosion Intercept®		<ul style="list-style-type: none"> Sacrificial scavenger of expanded copper in polythene 	University Products www.universityproducts.com will ship internationally Conservation by Design www.conservaion-by-design.com

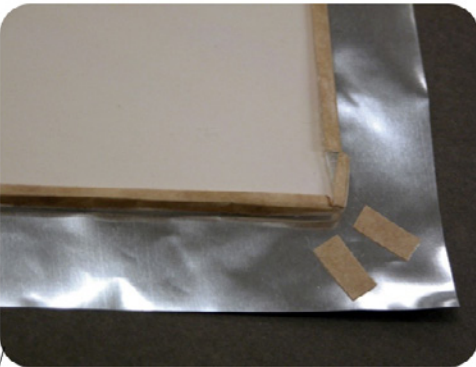
Image	Name	Alternative Names	Notes	Suppliers
	MicroChamber®		<ul style="list-style-type: none"> Black/white active carbon zeolyte and calcium carbonate in two layers of paper 	Conservation Resources International www.conservationresources.com
	Silical Gel Paper	<ul style="list-style-type: none"> Art Sorb® 		Conservation Resources International www.conservationresources.com Conservation by Design www.conservation-by-design.com
	3M™ Polygun		<ul style="list-style-type: none"> For hot melt adhesive application Put notch in applicator tip using a metal file to aid easy and clean application Check plug/convertor for UK use 	www.vikingtapes.co.uk or any 3M™ supplier
	Needle punch polyester batting	<ul style="list-style-type: none"> Polyester felt 	<ul style="list-style-type: none"> Chemically inert with no adhesive 	www.preservationequipment.com
	Cobalt Salt Test	<ul style="list-style-type: none"> Cobalt Indicator Cards 	<ul style="list-style-type: none"> Cobalt Chloride impregnated blotter in sections which can be used to indicate RH of surrounding air 	Conservation by Design www.conservation-by-design.com

Sealed Package Construction



Heat sealing foil to hot melt



ATG package assembly



Glass or Acrylic

Glazing Material	Tru Vue Product	Pro	Con
Laminated Glass		<ul style="list-style-type: none"> • Acts as a vapour barrier • Will not absorb water or warp or bow if one side is wetter than the other • Has a “high energy” surface allowing easy bonding to adhesives and other materials • Higher rigidity – will not bow or deflect in larger sizes the way acrylic can. 	<ul style="list-style-type: none"> • Heavy (can be more than double the weight of acrylic depending upon size) • Fragile; while PVB interlayer should adhere to any shards, laminated glass can still break. • Thermal conductor; solar energy can heat object behind the glass, as the glass remains cool. Condensation can then occur on the glass surface. In a fire heat will transmit through the glass to the object behind • Water attracted to surface through polar bonding can interact with Na and K within the glass to create ions which can then leach out on to the surface • Not as anti-static as Optium Museum Acrylic
UV Filtering Acrylic		<ul style="list-style-type: none"> • Impact resistant • Thermal Insulator; extremely low risk of condensation. In a fire heat will take longer to reach object behind • Lightweight • Anti-Static (this applies to Optium Museum Acrylic and Static Shield – not all UV filtering acrylics) • Low permeability of Oxygen 	<ul style="list-style-type: none"> • Can warp or bow if in conditions where one side is wetter than the other • Not as rigid as laminated glass • Vapour transmission is low but will still occur – 0.014g/100in²/day • Softer surface than glass, although a hard coat is applied, some deep scratching is still possible.

Comparison of Conductivity

Product		Surface Resistivity per ASTM D257				Static Decay Per Fed. Std 101, Method 4046		
		resistivity in ohms/sq			Conductivity of Material	time in seconds		
		12% R.H.	50% R.H.	70% R.H.		12% R.H.	50% R.H.	70% R.H.
Acrylic	StaticShield™ Acrylic	8.50E+08	2.90E+08	1.40E+08	Dissipative	0.01	0.01	0.01
	Optium Museum Acrylic®	1.14E+12	2.41E+10	1.98E+10		0.01	0.01	0.01
	Anti-static acrylic for high-tech electronics	5.26E+13	5.04E+13	4.64E+12	Insulative	Infinite		
	Regular, uncoated acrylic	> 2E+15	> 2E+15	> 2E+15		Infinite		
Glass	Museum Glass®	1.08E+13	2.39E+12	7.74E+11	Insulative	1.82	0.76	0.44
	Anti-Reflective Laminated Glass	1.11E+13	8.76E+12	1.58E+12		11.08	6.02	1.94
	Regular, uncoated glass		> 1E+14					

(Tested by Fowler Associates at 73°F for 48 hours at 100 volts, <http://www.sfowler.com/authtech/tpres.htm>)

Surface Resistivity (ohms/sq)	1 x 10 ¹⁵	Insulative Materials
	1 x 10 ¹⁴	
	1 x 10 ¹³	
	1 x 10 ¹²	
	1 x 10 ¹¹	Dissipative Materials
	1 x 10 ¹⁰	
	1 x 10 ⁹	
	1 x 10 ⁸	
	1 x 10 ⁷	
	1 x 10 ⁶	
	1 x 10 ⁵	
	1 x 10 ⁴	Conductive Materials
	1 x 10 ³	
	1 x 10 ²	

Surface resistivity measures electron mobility and static dissipation measures the time it takes to neutralize a charge. Two types of tests assess this performance: static charge decay time, and electrostatic discharge (ESD) surface resistance. Qualified testing laboratories review the glazing material's performance at difference humidity levels, such as 12 percent relative humidity (drier) to 70% relative humidity (wetter), because moisture content lowers surface resistivity as wet particles negate the charge build-up. Under less humid, dryer conditions, a static charge is more likely to build up. Relative humidity for both static decay and surface resistance test reports should be reviewed carefully to make an educated selection.

- Static decay per Federal Test Method Standard No. 101C, Test Method Number 4046, specifies that the charged object at 5000 volts should drain the voltage to 500 volts in less than 2.0 seconds.
- Surface resistance per ANSI/ESD S11.11 measures the resistance between two points on a material's surface and is expressed in Ohms. Per ASTM D357, resistivity is expressed in Ohms/square. The higher the surface resistivity, the less conductive the material is. Therefore, lower values indicate better performance.



Hugh Phibbs began working in commercial framing in Washington, D.C., in 1976. Three years later, he joined the conservation staff of the National Gallery of Art. At the Gallery, he worked in the Paper Laboratory and the Department of Exhibitions and Loans, coordinating

the preservation of works of art on paper, books and panel paintings on loan. He has written on preservation for Picture Framing Magazine and the Journal of the American Institute of Conservation. He also has taught preservation classes for the Smithsonian Resident Associates Program, the Professional Picture Framers Association (PPFA), the American Institute for Conservation of Historic and Artistic Works (AIC), the Centre de Conservation du Livre (CCL) in Arles, France; and the Institut National du Patrimoine (INP) in Paris, France. He has given workshops to the staffs of The Louvre, The Hermitage, The Metropolitan Museum of Art, The Getty Museum, MoMA, The Harvard Libraries, and The Smithsonian Museums of Art. He is a professional associate of AIC and recipient of the University Products Lifetime Achievement Award. He retired from the National Gallery in 2014 and continues to write and teach about preservation, while working on innovations for the field.



Dr. Jennifer Booth, Tru Vue Museum and Conservation Liaison, has an archaeological conservation science background and previously worked with the Department of Conservation And Scientific Research of The British Museum on her D. Phil (PhD) at the University of Oxford. As Tru Vue's

museum liaison, Jennifer provides a link between practitioners involved with the protection and conservation of art and cultural heritage, and Tru Vue, to increase understanding of the technical capabilities of the glass and acrylic glazing materials, how glazing options could benefit different collections, and deliver product innovation. Jennifer is available to answer any questions or information and can be reached at jbooth@tru-vue.com or at +44 (0) 79 5077 6911.

This article is intended for educational purposes only and does not replace independent professional judgment. Statements of fact and opinions expressed are those of the author(s) individually and, unless expressly stated to the contrary, are not the opinion or position of Tru Vue or its employees. Tru Vue does not endorse or approve, and assumes no responsibility for, the content, accuracy or completeness of the information presented.