State of the Union: Investigating Accepted and Innovative Materials for Glass Fills
Annotated Bibliography
ARTC666 Spring 2022

Paraloid B-72

Koob, Stephen P. 2009. "Paraloid® B-72: 25 Years of Use as a Consolidant and Adhesive for Ceramics and Glass." In *Holding It All Together: Ancient and Modern Approaches to Joining, Repair and Consolidation*, edited by Janet Ambers, Catherine Higgitt, and Lynne Harrison, 113–99. London: Archetype.

This article examines the use of Paraloid B-72 as an adhesive and consolidant in the treatment of glass and ceramics in the 25 years prior to publication in 2009. Koob discusses application methods and techniques as well as benefits and limitations of the material. Specific to glass, Koob addresses assembly but not fills.

Koob, S., Benrubi, S., van Giffen, NAR. and Hannah, N. 2011. "An Old Material, a New Technique: Casting Paraloid® B-72 for Filling Losses in Glass." *Proceedings of Symposium 2011: Adhesives and Consolidants for Conservation: Research and Application,* Ottawa: Canadian Conservation Institute.

This paper presents the technique of casting Paraloid® B-72 films for use as a fill material on glass. This technique reduces or eliminates air bubbles in the B-72 films and allows for the creation of both clear and colored fills. The authors share several case studies and instructions for casting films.

Giffen, N. Astrid R. van, Stephen P. Koob, and Robin O'Hern. 2013. "New Developments for Casting Paraloid® B-72 for Filling Losses in Glass." In *Recent Advances in Glass, Stained-Glass, and Ceramics Conservation 2013*, Preprints of the ICOM-CC Glass and Ceramics Working Group Interim Meeting and the Forum of the International Scientific Committee for the Conservation of Stained Glass, Amsterdam, NL, 7–10 October 2013, edited by Hannelore Roemich and Kate van Lookeren Campagne, 53-59. ICOM Committee for Conservation.

This article builds on research published in 2011, presenting advances in and modifications to the technique of casting Paraloid® B-72 films. New applications include: casting thick films, manipulating fills for complex curvatures, mimicking textures and creating complex molds.

van der Wielen, Roy, and Suzan de Groot. 2019. "Thermocasting of PARALOID B-72: Solvent-Free Production of Acrylic Flat-Glass Restoration Casts." In *Recent Advances in Glass and Ceramics Conservation 2019: Interim Meeting of the ICOM-CC Glass and Ceramics Working Group and Icon Ceramics and Glass Group Conference, 5-7 September 2019, London, United Kingdom*, edited by Victoria Schussler and Janis Mandrus, 111- 120. ICOM Committee for Conservation.

This paper presents the initial results of a new method for casting B-72 in which pellets are heated in a silicone mold to create cast fills. This technique results in a bubble free cast that can be made to a variety of thicknesses in a short time and with minimal shrinkage. Color can be imparted through the use of dyes or heat fusing of acrylic paint.

Bristow, Hana, and Jan Dariusz Cutajar. 2017. "Archaeological Glass Conservation: Comparative Approaches and Practicalities of Using Acrylic Resin Films as Gap Fills." *Objects Specialty Group Postprints (American Institute for Conservation of Historic and Artistic Works. Objects Specialty Group)* 24: 188–206.

This paper discusses two approaches to compensation of archaeological glass using acrylic resins, sharing practicalities, challenges and conclusions of the techniques used. The authors share two case studies: one in which Paraloid B-72 was used alone, and one in which B-72 was mixed with B-48N and B-44.

Epoxies

Down, Jane L. 2001. "Review of CCI Research on Epoxy Resin Adhesives for Glass Conservation." *Studies in Conservation* 46 (supp 1): 39-46. https://doi.org/10.1179/sic.2001.46.Supplement-1.39.

This article discusses research into epoxy resins used in glass conservation, highlighting yellowing, strength after aging and removability. The author provides detailed information about Hxtal NYL-1, one of the best epoxies identified from the research by the CCI and concludes that Hxtal and Epo-Tek 301-2 have better yellowing resistance than other epoxies.

Gridley, Rebecca, and Karen Stamm. 2019. "Seeing Clearly: Casting Epoxy Fills for Glass Objects Using Transparent Molds." *Objects Specialty Group Postprints (American Institute for Conservation of Historic and Artistic Works. Objects Specialty Group)* 26.

This paper discusses the use of transparent molds for casting epoxy fills, focusing on two case studies which employ different mold-making techniques (clear silicone rubber and vacuum-formed PVC foil). The case studies clearly illustrate the advantages of transparent mold-making materials which allow the conservator to monitor everything taking place in real time and problem solve accordingly.

Gridley, Rebecca, and Karen Stamm. 2019. "Using Double-Walled PVC Foil Molds to Separately Cast Large Epoxy Resin Fills for Glass Objects." In *Recent Advances in Glass and Ceramics Conservation 2019: Interim Meeting of the ICOM-CC Glass and Ceramics Working Group and Icon Ceramics and Glass Group Conference, 5-7 September 2019, London, United Kingdom*, 101-110. ICOM-CC.

This paper examines the use of double-walled PVC foil in the creation of molds for large epoxy fills for glass. The research builds on techniques coming out of the Met over the past decade in which PVC molds are used for glass fills; however, this paper describes the creation of molds separate from the object – an adaptation of the PVC technique. This process is explained through a treatment case study of a 16th century Austrian glass vessel from the Met collection.

Koob, Stephen P. 2004. "Tips and Tricks with Epoxy and Other Casting and Molding Materials." *Objects Specialty Group Postprints* 10: 16.

This paper provides a nice overview of epoxies used in conservation of glass as fills and adhesives and how to use and control them for optimal results.

Lemajič, Gorazd. 2006. "Transparent PVC Mould: Replacing Missing Pieces on Hollow Glass Objects." In *ICON News*, 3:46–48. ICON.

This paper discusses using transparent PVC as a mold material in the creation of fills for glass. This method of glass restoration was developed independently in Slovenia without contact with glass restorers in the UK or USA though similar techniques were developed and published by conservators at the Met.

Risser, Erik. 1997. “A New Technique for the Casting of Missing Areas in Glass Restoration.” *Journal of Conservation and Museum Studies* 3 (0): 11–15. https://doi.org/10.5334/jcms.3973.

This article explains an alternative technique to casting fills in situ, which minimizes the risk to the glass object as all work, except the initial mold making steps, is carried out away from the object. In the case study presented, Araldite 20/20 epoxy resin was used and tinted with pigments.

Stamm, Karen, Gorazd Lemajič, and Lisa Pilosi. 2013. “Vacuum-Formed PVC Moulds for Casting Epoxy Resin Fills in Glass Objects.” In *Recent Advances in Glass, Stained-Glass, and Ceramics Conservation 2013,* Preprints of the ICOM-CC Glass and Ceramics Working Group Interim Meeting and the Forum of the International Scientific Committee for the Conservation of Stained Glass, Amsterdam, NL, 7–10 October 2013, edited by Hannelore Roemich and Kate van Lookeren Campagne, 69-75. ICOM Committee for Conservation.

This paper introduces a new technique for casting epoxy fills for glass objects using vacuum-formed PVC foil for the mold. The authors discuss the benefits and limitations of hand-forming PVC, as well as the equipment, materials and techniques used for vacuum forming.

Paper

Artal-Isbrand, Paula. 2018. “So Delicate yet so Strong and Versatile – the Use of Paper in Objects Conservation.” *Journal of the American Institute for Conservation* 57 (3): 112–26. https://doi.org/10.1080/01971360.2018.1490134.

This article examines various Asian and western papers and their suitably for use in objects conservation. The author surveys the applications of paper and specifically highlights its use as a fill material for weathered archeological glass.

Comparative/Multi-Material Investigations

Bradley, S.M., and S.E. Wilthew. 1984. “The Evaluation of Some Polyester and Epoxy Resins Used in the Conservation of Glass.” In *ICOM Committee for Conservation 7th Triennial Meeting Copenhagen Denmark 10-14 September 1984*. Copenhagen, Denmark. The International Council of Museums in association with the J. Paul Getty Trust.

This paper investigates color stability on exposure to light and heat, reversibility, shrinkage, gap filling and adhesive properties of four epoxy resins and four polyester resins found in the conservation literature. Overall, polyester resins had good color stability and epoxy resins formed very strong bonds. It is worth noting that none of the materials examined are currently in use in the field (as of 2022).

Davison, Sandra. 1998. “Reversible Fills for Transparent and Translucent Materials.” *Journal of the American Institute for Conservation* 37 (1): 35–47. https://doi.org/10.1179/019713698806082994.

This article discusses the various materials and techniques used for filling transparent objects, primarily glass, across years and countries. Makes mention of most commonly used materials and those that are currently accepted and preferred.

Davison, Sandra. 2003. *Conservation and Restoration of Glass*. 2nd ed. Oxford: Butterworth-Heinemann.

This book is a great resource for all the basic information regarding how glass is made and conserved. The author provides good information on materials used in conservation treatment and useful tables comparing said materials (pages 210-226, 303-308).

Errett, Raymond. 1972. "The Repair and Restoration of Glass Objects." *International Institute for Conservation of Historic and Artistic Works* 12 (2): 48–49. https://doi.org/10.1179/019713672806029757.

This article discusses materials and techniques historically used in the repair of glass.

Koob, Stephen P. 2006. *Conservation and Care of Glass Objects*. London: Archetype Publications.

This book is a good overview of glass chemistry, technology, deterioration and conservation. Chapter 9 focuses on loss compensation with good information on fill materials and application techniques.

Tennent, Norman H., and Stephen P. Koob. 2010. "An Assessment of Polymers Used in Conservation Treatments at The Corning Museum of Glass." In *Glass and Ceramics Conservation 2010: Interim Meeting of the ICOM-CC Working Group*, Corning, New York, Edited by Hannelore Roemich, 100-109. ICOM Committee for Conservation in association with the Corning Museum of Glass.

This paper discusses the approach to and results of a survey of old polymer repairs to glass objects in the collection of the Corning Museum of Glass. The authors evaluated epoxy, polyester and acrylic resin repairs on sixty objects assessing yellowing, dyestuff fading, crazing, refractive index and dimensional changes.

Wight, K. 2008. The aging of fills in glass and high-fired ceramics. M.S. independent study, Winterthur/University of Delaware Program in Art Conservation, United States of America.

This thesis examines a variety of accepted materials used for loss compensation of glass and ceramics in the field of art conservation as of 2008. The project includes accelerated aging of materials to compare their aging properties.

Innovative Approaches and Materials

Barack, Sarah. 2016. "3D Printing and Fills on Glass Vessels: A Case Study from the Fraunces Tavern Museum." In *Recent Advances in Glass and Ceramics Conservation 2016,* Preprints of the ICOM-CC Glass and Ceramics Working Group Interim Meeting, Wrocław, Poland, 25-29 May 2016, edited by Hannelore Roemich and Lauren Fair, 197-204. ICOM Committee for Conservation.

This paper discusses the use of 3D scanning and printing technology for loss compensation of glass using a specific case study of an 18th century American vessel. The glass was scanned and 3D prints were made of the glass vessel and the area of loss. The fill was cast from the 3D printed vessel and adhered using epoxy.

Analysis of Fill Materials

Tennent, Norman H., Suzan de Groot, and Stephen P. Koob. 2019. "The Identification and Long-Term Stability of Polymer Fills in Ceramics and Glass Artifacts: A Retrospective Assessment Involving FTIR Characterisation." In *Recent Advances in Glass and Ceramics Conservation 2019: Interim Meeting of the ICOM-CC Glass and Ceramics Working Group and Icon Ceramics and Glass Group Conference, 5-7*

September 2019, London, United Kingdom, edited by Victoria Schussler and Janis Mandrus, 121-129. ICOM Committee for Conservation.

This paper discusses the potential use of FTIR to characterize polymers and commercial products used in prior repairs of glass and ceramic objects. The authors found it was possible to ascribe polymers to a specific class however it was difficult and, in many cases, not possible to identify specific commercial products.