Investigating Accepted and Innovative Materials for Glass Fills

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The number of material choices the conservator has when filling losses in glass are limited, and those typically used – epoxies, acrylics, or polyester resins – each have their own benefits and drawbacks. There is interest in finding alternative materials with better working properties, chemical stability, and reversibility.

The authors collected information about well-established and innovative materials used to create fills for glass by engaging with published sources and colleagues across the globe. Based on the information gathered, as well as anecdotal evidence, the following fill materials were comparatively tested on study collection glass objects: PARALOID B-72, HXTAL NYL-1, mulberry paper (Kozo and gampi papers, Hiromi Paper, Inc.), agar bioplastic (Benchmark Agarose LE, Universal Medical), and nanocellulose film (Cellulose Nanocrystals and Nanofibrils, CelluloseLab). Each of the fill materials was tested on clear and colored glass using a variety of techniques. Work included hands-on experimentation to deepen practical knowledge of glass fill materials, gain an appreciation for the skill it takes to create a successful fill, and develop the ability to evaluate the working properties and aesthetic viability of new material options compared to traditional ones.

While the reasons for choosing trusted epoxy and PARALOID B-72 became even more apparent, experimentation enabled a better understanding of their limitations and the merits of research into alternative materials. Mulberry papers, agar, and nanocellulose produced aesthetically satisfactory results for thinner-walled vessels and could be appropriate for some archaeological glasses, but none were quite as successful across the board as our traditional materials.

Based on aesthetics and workability, agar proved to be the most viable option as a new fill material for glass and deserves further research. Initial tests were conducted using accelerated aging, thickness measurements, colorimetry, gas chromatography mass spectrometry (GC-MS), pyrolysis GC-MS, and Fourier-transform infrared spectroscopy (Shulman 2022). The results showed significant color changes and some dimensional distortion when agar was exposed to extreme temperatures and relative humidity levels, but no chemical breakdown of the material was detected with the analytical techniques used. Additional analysis and long-term aging studies that align more closely with a true museum environment are warranted for further evaluation of agar as a potential fill material.

REFERENCE

Shulman, Katharine. 2022. Agar Bioplastic: Understanding its degradation and exploring its use as a fill for glass. Paper presented at the ANAGPIC Annual Student Conference, Winterthur, Delaware, United States, April.

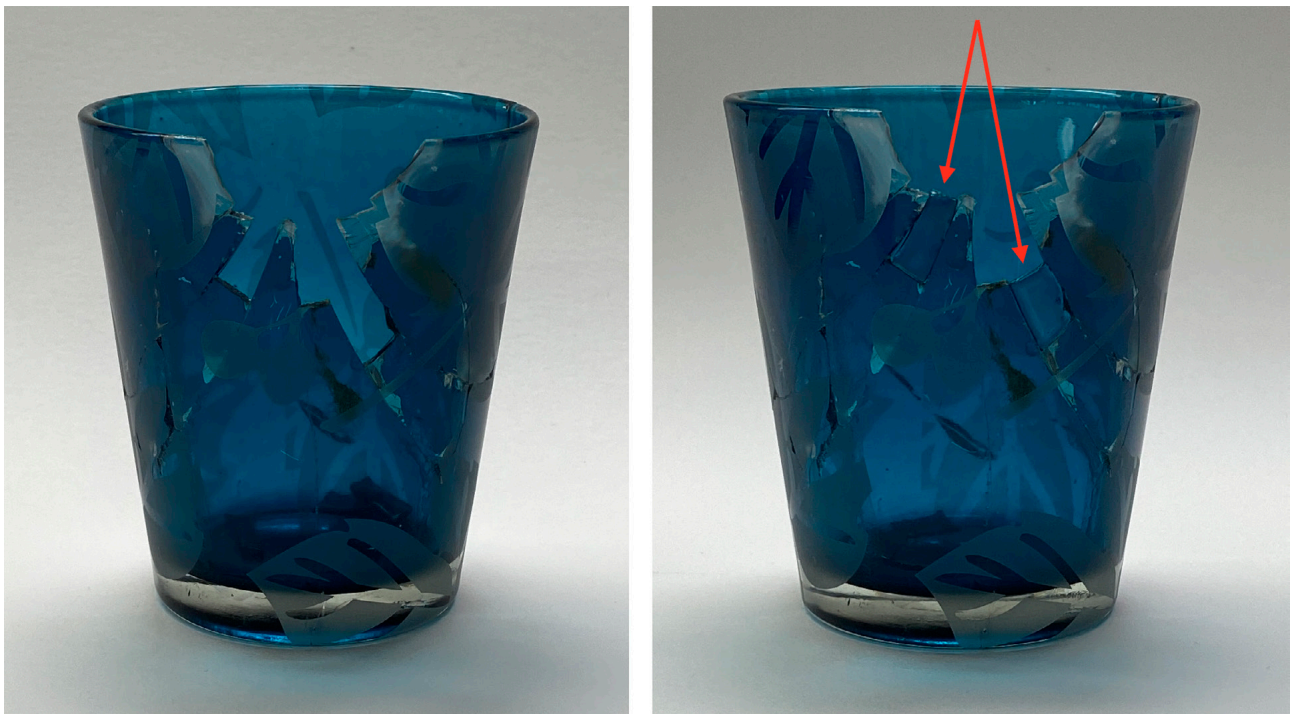

Figure 1. Glass cup without filled losses (left) compared to agar fills tinted with Orasol dyes (right). Blue flashed glass with molded decoration, date unknown, H 8.5 cm × Diam. 7.5 cm. University of Delaware Art Conservation Department, Study collection • Courtesy of authors