

Optimising Resin and Fumed Silica Infills for Porcelain Conservation

Introduction

Background

- Epoxy resin is commonly used by ceramic conservators to repair porcelain [1]. However, it yellows with age which can decrease its aesthetic value [2].
- Fumed silica can be used to thicken resin for gap fills [3].
- Fumed silica has UV stabilising properties and has been used in adjacent fields to improve material stability [4].
- Preliminary research by the student suggests possible applications in ceramics conservation.

Project Aims

- Reduce the yellowing effect of epoxy resin during ageing.
- Develop personal project execution skills including time management.
- Publish research in relevant journals.
- Learn new techniques including Fourier-transform infrared spectroscopy (FTIR).

Notes

- Testing six different percentages of fumed silica when mixed with resin.

Method

- All samples, excluding unaged controls, were artificially aged using ultraviolet (UV) light.

Results

- Final data and conclusions cannot be shared due to dissemination plans.

Phase One

- Testing the impact of ageing on the colour change and chemical structure using blocks of the six resin test groups (fig. 1).

- Measured resin colour for analysis with a spectrophotometer.
- Measured sample chemical structure using FTIR.

- Visual trends emerged from colour measurements.
- No obvious trends emerged from the FTIR data.



Fig. 1. Resin samples prepared in silicone moulds

Phase Two

- Testing the impact of ageing on adhesive strength using broken porcelain samples repaired with the six resin test groups.

- Measured adhesive strength by adding weights to the porcelain sample until it broke (fig. 2).
- Recorded break data.

- No obvious trends have emerged from strength testing.
- Extra measurements will be taken for further analysis.



Fig. 2. Porcelain and adhesive strength testing

Discussion

Lessons

- Having a clear plan is important, but details can be finalised after starting.
- Be willing to adapt methods and ask for help to meet project goals.
- Continue to include buffer time in plans for if project timings are delayed.
- All project aims were met while still making accommodations for disabilities.

Challenges

- The trace amounts of fumed silica were difficult to weigh so two batches were created for repeatability.
- Some factors like the break direction of the porcelain were hard to control.
- More repeats would be preferred, but time and material constraints had to be considered.
- Some tasks took longer than planned which meant the project plan was regularly reviewed.

References

1. Conceição, L. C., 2022. Filling in the Gaps: the conservation and restoration of a Ming dynasty porcelain dish from the Monastery of Santa Clara-a-Velha, Lisbon: Nova University Lisbon.
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3. Oakley, V. & Jain, K., 2002. Essentials in the Care and Conservation of Historical Ceramic Objects. London: Archetype Publications Ltd.
4. Cheraghian, G. & Wistuba, M., 2021. Effect of Fumed Silica Nanoparticles on Ultraviolet Aging Resistance of Bitumen. Nanomaterials, 11(2), p. 454.

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