

ABSTRACT

The use of an epoxy resin coloured fill when replacing porcelain losses is becoming more common place within the conservation profession. Much has been written on the benefits of these fills; with recommendations as to how they can be pigmented and applied. These recommendations will be interpreted by the conservator, and altered appropriately when treating an object with individual requirements.

This dissertation will look specifically at how a coloured fill can be applied to a substantial sized loss in porcelain. When applying a coloured fill, it is imperative that enough resin to fill the entire loss is prepared in one operation. This is due to the difficulties in achieving the exact colour match across multiple batches of resin. This necessity becomes difficult when large quantities of resin are needed, due the limited time in which they are workable. For this purpose, the manner in which these materials are usually prepared in the production of a coloured fill will need to be manipulated.

The possible ways this can be done to aid in this cause will be explored, focusing on the rate of an epoxy resin's reaction, and the techniques in which they are applied. Proposed techniques will be subjected to initial testing, to establish how they affect the curing of the resin. Those which appear successful will be applied to a case study; a substantial loss within a soft-paste porcelain vase. The results of these applications will be compared, with specific focus on how these methods could be successfully implemented in a practical context.

In addition, the reasons behind why epoxy resins are so commonly used within the conservation of porcelain will be discussed.

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1. PROJECT OUTLINE

The purpose of this research is to explore the possible ways coloured fills can be implemented in the replacement of substantial losses within porcelain objects. The complications of this process became personally apparent when commencing the treatment of a 19th century soft paste porcelain vase (appendix 1). Having been previously restored in a manner which opposes modern conservation outlooks, its condition before treatment was poor. Past restoration included the alignment of its breakages using the support of rivets, and the concealment of original surface through conspicuous retouching. Although visually unpleasant, the removal of these past repairs could be carried out with relative ease. It was through deliberating how the replacement of its substantial loss was to be carried out that technical difficulties arose. These will now be explained.

1.1: An Introduction to Porcelain Fills

For reasons which shall be outlined in chapter 2.4, losses within porcelain objects are predominantly filled using an epoxy resin. These resins are two part water white adhesives which produce a very hard and vitreous material on curing. To transform these resins into a paste suitable for filling, numerous bulking agents can be added.

It is common for ceramic fills to be matched in tone to the surface or body of the ceramic being treated; a process often referred to as colour-matching. When filling porcelain losses, colour-matching can be carried out using two alternative methods (Williams, 2002; 67):

1. The resin can be colour matched only to the extent that a pale coloured bulking agent is used. The fill will subsequently need to be painted; a method referred to as retouching.
2. In addition to a bulking agent, pigment can be included when mixing the resin to perfectly match the colour of the porcelain. This method will produce what is called a coloured fill.

1.1.1: Retouching

When using the method of retouching, paint will be applied in multiple layers upon the surface of the fill. In order for retouching to be inconspicuous, these layers should partially intrude onto the surrounding surface of the object (figure 1).

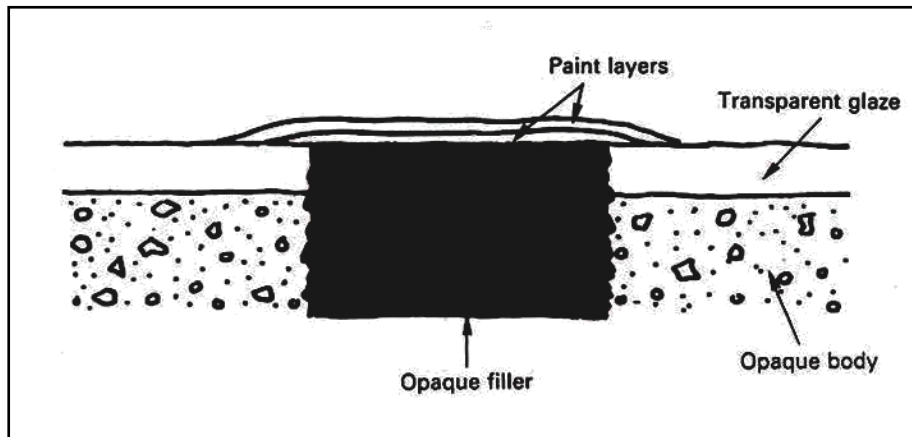


Figure 1 Diagram illustrating retouching upon the surface of a fill (Buys and Oakley, 1993: 120)

For the porcelain body to be effectively replicated when replacing an area of loss, the fill should not only be similar in tone. The characteristically transparent body and glossy surface of the porcelain object will additionally need to be imitated. To produce an appropriate shine through the method of retouching, the paint layers can be buffed using fine grades of abrasive paper and coated with an imitation glaze medium. It is in achieving transparency where the limitations of this method become apparent. The application of paint layers across the surface of the fill will prohibit the production of true transparency within this area. Therefore this quality can only be hinted at through an intelligent layering of colour. It is often suggested that decreasing the paint's opacity with each successive layer will aid in achieving this illusion.

1.1.2: Coloured fills

Depending on the opacity of the porcelain glaze, pigment can be added to replicate either the general look of the body or merely the glaze layer (Figure 2).

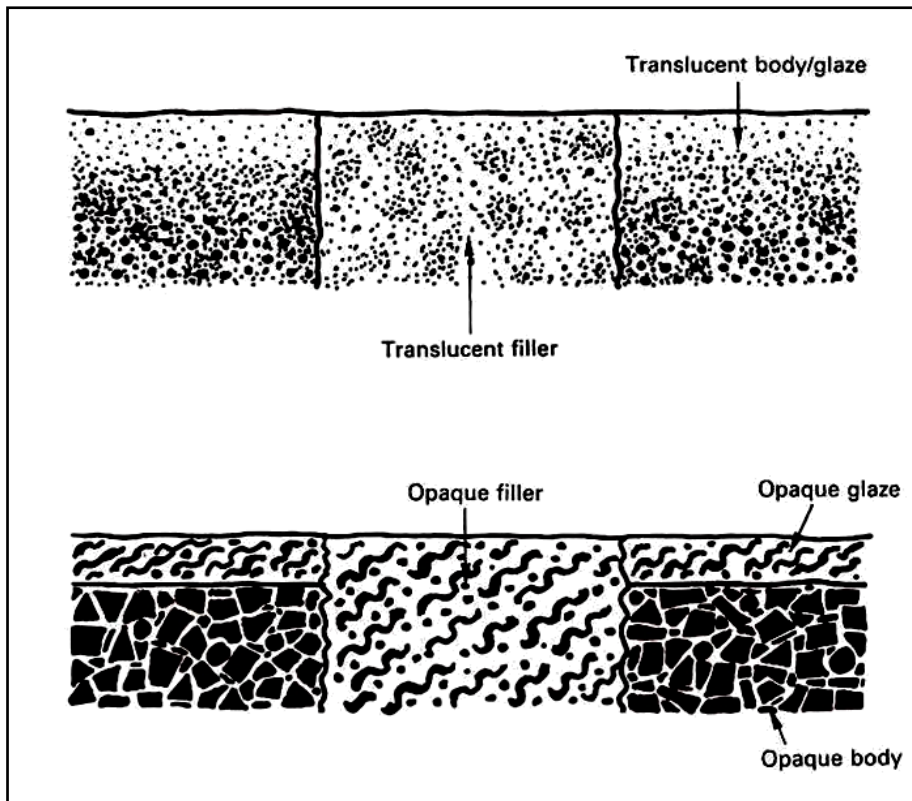


Figure 2 Diagram illustrating the methods of pigmenting a coloured fill (Buys and Oakley, 1993; 120)

If the colour match is successful, paint will not need to be applied across the surface of the fill. Therefore if applying a coloured fill, the tone, gloss *and* transparency of the porcelain can be replicated efficiently. Unlike retouching, the surrounding surface of the ceramic will not need to be concealed to create an inconspicuous restoration. It is for these reasons that conservators are more commonly implementing this method when filling losses within porcelain objects.

The main disadvantage of using a coloured fill is that it can require a higher level of skill to produce a perfect colour match (Williams, 2002; 110). It is also more likely that if the resin should significantly discolour with age, the fill will need to be removed. This can then result in further damage occurring to the ceramic. If discolouring appears across a retouched fill, it would only be necessary to remove the aged paint layers. If the fill has suffered no considerable damage, it could be reused by merely replacing the retouching above. However if the full removal of a fill is treated following appropriate methods, these concerns will be minimised.

1.2: Preparing a Coloured Fill; the Universal Approach

Within this research, the ‘preparation’ of the resin within the context of coloured fills is a phrase which will be used to describe collectively the processes of bulking and pigmenting. When commenting on the application of the resin, this will specifically be in reference to the physical addition of filling material to the area of loss.

The exact method of preparation will ultimately be dependant on the preferences of the conservator who is carrying out the process, but there appears to be a basic method illustrated similarly in many publications which demonstrates the most universal approach. The progression of the following application has been noted from *‘Repairing Pottery and Porcelain’* by Lesley Acton and Paul McAuley (2003; 58-60).

Firstly the chosen epoxy resin must be mixed with exact precision according to the instructions given by the manufacturer. A small amount should be additionally prepared than what is necessary, as this can be used to correct any possible faults across the surface of the cured fill. The resin can then be dispensed onto a suitable mixing palette. A white porcelain tile is commonly chosen for this purpose when handling epoxies, as its colour and glazed surface are ideal. The resin should be divided through removing small amounts correlating to the number of chosen pigments, and placing these to one side of the tile. Each pigment will then be added to one smaller section. The remaining resin should be bulked with an aggregate until the appropriate transparency and tone is accomplished. Colour-matching is achieved through the gradual addition of pigmented resin to the main pool. Once satisfied, this mixture should be left untouched for a minimum of ten minutes to allow the aggregates to become fully absorbed. It can then be applied to the area of loss and left to cure for the required amount of time. Shaping or cutting back is best performed just before the resin has fully cured, as it will retain a slight softness.

1.2.1: Limitations in its Application to a Substantial Loss

If following this method when applying a coloured fill to a loss of substantial size, difficulties will predictably arise. These are as follows:

1. The preparation of the resin is usually the most time consuming process in the production of a coloured fill. The time it takes for its completion will inevitably increase when using larger weights of resin.
2. This in turn will reduce the remaining period allowed for its application within the open time¹ of the resin. Likewise the time needed for its application will also increase when using larger weights of resin.
3. The reaction of an epoxy resin is exothermic, which means its rate of reaction will increase alongside an increase in weight. This will then further minimise the time which can be dedicated to the preparation and application of the resin before it becomes unworkable.

The factors outlined above will limit the amount of resin which can be mixed for immediate use. This will mean that when treating a substantially sized loss, it will have to be filled in sections using different batches of resin. If these batches vary only slightly between tone and translucency, joining lines across the fill will become apparent. However, Nigel Williams in *Porcelain repair and restoration* states that when applying a coloured fill 'it is essential to mix enough resin to replace the whole of the missing area in one operation, because of the difficulty in achieving exactly the same colour a second time' (2002; 76). These difficulties will now be outlined.

1.3: The Difficulties of Colour Matching

The difficulty of colour matching is a subject which many have attempted to explain on both a practical and scientific level. Yet the successful act of colour matching is a skill which can take several years for the conservator to become fully comfortable with; it is a skill which can only be improved through practise. Some will be able to look at the tone of an object and systematically interpret the specific shades of colour it contains. Some will find a closely matching pre-mixed colour medium and alter it accordingly, whereas others will merely fall across the correct match through experimentation.

¹ The open time of an adhesive is the period between when the resin is mixed, to when it begins to harden.

Within ceramic conservation, difficulties in colour matching usually derive from the differences in how colour is perceived within or upon the filling material compared to the original object. This is due to how the eye interprets colour, as it will have to distinguish separately the numerous ways in which its characteristics can vary. These are hue, saturation, brightness and lightness (Brommelle, 1955; 76). To create a successful colour match, it is important for the conservator to recognise these variables and attempt to interpret how their brain responds to them. Hue describes the differences between how the groups of colour such as red, green purple etc are perceived. Conservators who are more in tune with this variable will be able to visually distinguish the different colours within the surface or body being replicated, and usually then be able to transfer this visualisation into choosing an appropriate palette. Saturation is the judgement of the proportion of colourfulness, and finally brightness or lightness represents the intensity of ‘luminous sensation’, or how the amount of surface reflection is judged. These variables, especially the latter, can cause great difficulty when pigmenting a coloured fill. An epoxy resin whilst fluid will never reflect light in the same manner as the porcelain, so it can sometimes be hard to tell if a correct colour match has been achieved. The ‘brightness’ and ‘lightness’ of a material will also vary depending on the type of light it is viewed under. For this reason, creating the exact colour across multiple batches of resin is a skill which is extremely difficult, as only slight variations in lighting or shadow will induce the eye to perceive the colour of the object differently.

1.3.1: Implications

As noted, the concern in producing a coloured fill for an area of substantial loss ultimately derives from the limited open time of the resin. It can be argued that the seventy-two hours in which the epoxy resin Hxtal NYL-1 is workable would give sufficient time for these processes to be carried out. Although this may be the case, its seven day curing deems this specific epoxy unsuitable for this purpose. Not only is this quality time consuming, it also heightens the possibility of misshaping occurring within the fill. Other available resins for conservation are Araldite 2020 and a more recent addition to the market, Fynebond. The latter is considerably more expensive than other resins within its group, so many would avoid its use in large quantities. This leaves Araldite 2020, a resin which is workable for forty-five minutes and cures within twenty-four hours at room temperature. This short open time compared to Hxtal will limit the amount which can be prepared in one operation.

1.4: Purpose

Therefore the purpose of this research is to investigate the possible ways the conventional methods of preparing and applying a coloured fill can be manipulated. This ‘manipulation’ will focus on how or if these methods can be altered to allow large quantities of Araldite 2020 to be prepared successfully in one operation. For this to be possible the following factors will be investigated:

1. Whether the rate of reaction between the components of Araldite 2020 can be reduced, to allow the open time of the resin to be extended.
2. If the manner in which it is physically applied to the loss can sufficiently reduce the amount of resin needed. This in turn may allow the traditional method of its preparation to be left unaltered.

The properties of porcelain and the reasons behind why the materials used for filling its losses are chosen will also be discussed.

1.5: Aims and Objectives

The main aims of this research are:

1. To offer alternative methods of preparing a coloured fill to allow its successful application to a loss of substantial size.
2. To couple these methods with modern application techniques to aid in achieving aim 1.

To achieve these aims current methods of application will be explored to deliberate which can be used most successfully to aid in this research. The basic science behind the reaction of Araldite 2020 will also be discussed, and possible methods of how its rate of reaction can be reduced will be predicted. These predicted methods will be subjected to initial testing in order to establish whether they are plausible (i.e. that the resulting product does not differ visually

from that produced using the traditional method). The tested methods which prove successful will be applied to a case study; the soft past porcelain vase illustrated in appendix 1. The use of this case study will establish more realistically as to whether the explored techniques could be implemented in a practical context.