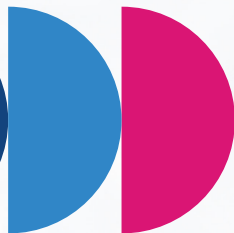


# Simple Enamelling

a complete guide



# Simple Enamelling

## Introduction:

Precise records of where and when enamelling first began are unavailable, however, it is thought that the craft originated in one of the western European civilizations. Egypt and China, too, have contributed greatly to the enamelling knowledge over the centuries. Most of the enamelling executed before the middle of the 12th Century was done in opaque enamel only, and it was not until the 14th Century that transparent enamel came into extensive use. Craftsmen using new and advanced methods were creating treasures of indescribable beauty. Swords, chalices and even crowns were adorned with the excellence of enamel.

The popularity of enamelling has declined this century until recent years when it has undergone a revival among individual craftworks and educational circles. The reliability of modern enamels has enabled both professional enamellers to advance techniques and the complete beginner to develop an understanding of this rewarding craft.

## Contents:

3	You Will Need
4	General Care and Safety
5	Types of Enamel
6	Metals for Enamelling
6-8	Preparation of Materials for Enamelling
8	The Application of Enamels
9-10	The Basic Firing Method
11-13	Decorative Enamelling Techniques
14	Faults and Their Causes
15	Enamelling Supplies

## You will need:

- 1 Kiln of Your Choice
- 2 Wire Mesh Firing Support
- 3 Sieve
- 4 Pair of Tweezers
- 5 Palette Knife
- 6 Copper Blanks of Assorted Sizes
- 7 Enamel Powders - Opaque powders preferable for beginners
- 8 Adhesive Medium (Optional)

### Decoration Materials:

- 1 Threads
- 2 Millefiori
- 3 Pencil/Match Stick



# General care and safety

1. Since the temperatures necessary for firing enamel are very high, children **MUST** be supervised at all times when the kiln is in use.
2. Once the kiln has been switched on, no part other than the door handle should be touched.
3. The kiln must be placed on a heat protective surface and it is advisable to place your enamels on here to place items as they are withdrawn from the kiln
4. Children should be instructed to keep enamel powders away from their mouths and eyes. Masks should be worn when sifting dry powders.

## Kilns for Enamelling

Although enamelling may be executed by using a blow torch or Bunsen Burner, in order to get consistently good results, it is advisable to use a kiln. It is essential to have a working temperature of not less than 800°C rising to 850°C or more in order to fuse the glass to the metal. Quick firing at a high temperature produces a better result than firing the objects at a lower temperature for a longer time.

Most kilns do not have a regulating device, therefore with small kilns it is advisable to switch off the kiln at hourly intervals for a period of approximately three to five minutes. This prevents the muffle (firing chamber) overheating and firing the enamels too quickly, and extends the life of the kiln's heating elements.

You can attach a regulator into the back of some kilns, which regulates the amount of electricity being fed to the kiln.



It is not a thermostat. When starting up, set the regulator to 10 (maximum setting). The regulator enables you to reduce the temperature by reducing the power input when pausing between loading. This should reduce heating up time.

Should the floor of the muffle become sticky with molten enamel, this can be coated with powdered kaolin to form a fresh base. The kiln is then heated to firing temperature and left to cool again before use.

When buying a kiln, carefully consider the size you will need. Buying a kiln large enough to fire plaques and dishes is a waste of money if you intend to fire jewellery pieces and small articles, since the kiln would not be used to capacity. The firing chamber should be deeper than its width to prevent excessive heat loss.

## Types of enamel



Opaque



Transparent



Opalescent

Enamelling is basically the art of fusing powdered glass onto metal. This glass is composed of a frit which determines its hardness, clarity and brilliance, and various metal oxides which determine colour. These metal oxides have approximately the same melting point as the glass, so when fired they adhere to the metal.

The two main types of enamel are:

- Opaque, though which light cannot pass.
- Transparent through which light will easily pass.

Apart from these two main types, there are also Translucent enamels which allow some light to pass through them, giving an effect similar to that of a stained glass window. There is also Opalescent enamels which vary in translucency and opacity.

# Metals for enamelling



Enamelling may be executed on various metals including, fine silver and gold, which can be quite expensive. Gilding Metal, which is hard and difficult to work with, and stainless steel which requires special enamels.

Copper is the most common, cheapest and probably the easiest metal to enamel and is best to begin by either buying copper blanks (pre-cut shapes) or by using copper sheet which can be cut, shaped and formed to the required design.

## Preparation of materials for enamelling

Cleanliness is a most important factor in enamelling. A separate area of approximately two square feet should be designated for sifting the enamel powder onto the blank. This area must be away from the kiln and the area used for the cleaning of the metal to prevent contamination from dust and copper particles. The work surface should be covered with clean paper, and a fresh sheet of paper used for each colour. Enamel colours should not be mixed with each other.

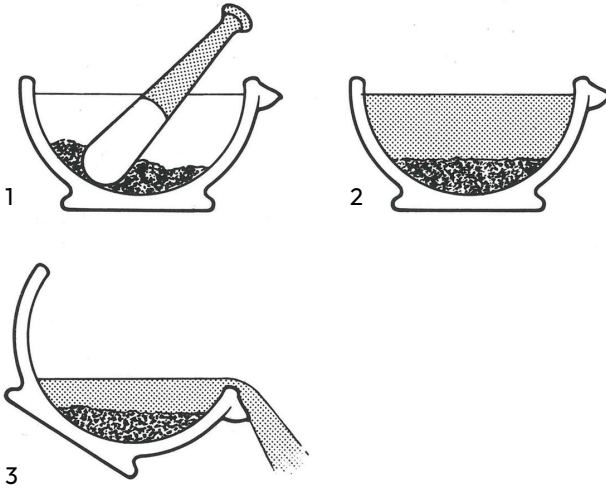
Store the powders in air-tight containers of glass or plastic in a dry room away from humidity and impurities.

## Preparing the Enamels

If enamels are to be stored for a long time, it is best to buy them in lump form. Before use, these lumps must be ground to a fine powder by means of a mortar and pestle. Transparent enamels should be ground fine enough to pass through a 60 mesh/inch sieve, and opaque enamels ground to pass through an 80 mesh/inch sieve.

The enamel, even if supplied in powder form, should be washed in small quantities using distilled water. The enamel and distilled water mixture is stirred, and when the enamel has settled on the bottom, the cloudy water is poured off and replaced by clean water. This procedure is repeated until the distilled water remains clear. Transparent enamels generally need several thorough washings to ensure maximum transparency.

To dry enamels, place in a clean receptacle covered with blotting paper and leave near to the warm kiln. When they are completely dry, sieve and store in airtight containers until required.



1. The enamel is ground with a pestle and mortar
2. It is then washed in distilled water until the water turns cloudy.
3. The cloudy solution is then poured off.

## Preparing the Metal Blanks

Care must be taken in the cleaning of the metal as poor results may occur due to grease and dirt on the surface of the blank.

There are several ways of cleaning the metal, but many include the use of acids, making them unsuitable for children.

The simplest method is to clean the metal on both sides with an abrasive sponge or steel wool, removing all visible dirt and grease. Then, place the blank in a solution of 250ml of vinegar and a tablespoon of salt for about ten minutes until it appears pink and bright.

Using tweezers, remove the metal blank and rinse under running water. Do not touch the blank with the fingers as grease will be deposited on the surface.

# The application of enamels

When the materials have been prepared it is now time to apply the enamels and begin the firing process.

## Dry Application by Dusting

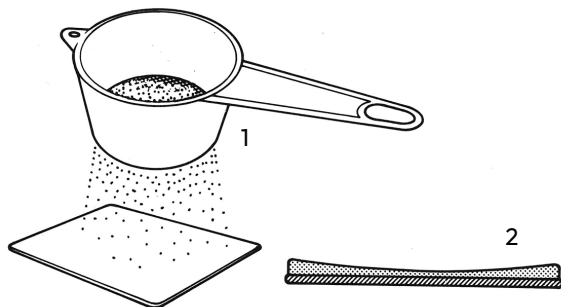
Place the metal blank on a clean sheet of paper. Pour a small quantity of enamel powder into the sieve. Holding the sieve over the outer edges of the blank, gently tap the side so that a layer of powder, approximately  $\frac{3}{4}$  the thickness of the blank falls onto the surface. Ensure that the powder lies deepest at the edges. Slip a palette knife under the metal piece and lift it onto the panning mesh (firing support).

**DO NOT TOUCH THE BLANK WITH YOUR FINGERS**

Any surplus enamel on the paper should be returned to the container.

1. Applying dry enamel powder with a sieve.

2. Ensure that the powder lies deepest at the edges.





## Wet Application

Smaller objects may be enamelled by wet application, although it is advisable to gain experience in firing enamels by first using the dusting method.

Apply the thoroughly washed enamel by means of a fine brush or spatula as evenly as possible upon the metal surface. Absorb any surplus water by pressing blotting paper or absorbent rag to the edges of the enamel coat. Using a palette knife, place the metal near to the warm kiln until perfectly dry, and then lift onto the panning mesh.

DO NOT TOUCH THE BLANK WITH YOUR FINGERS

# The basic firing method

It is often convenient to switch on the kiln before the materials are prepared. as the kiln can take up to 45 minutes to reach the required temperature of about 900°C.

If your kiln does not have a temperature indicator. the colour of the heat is a very good guide as it should glow a bright cherry red. Before actually firing your work it is a good idea to make a few tests on small pieces of copper to make sure that the kiln is hot enough. This will be a be a good opportunity to test the enamel colours. as the colour of the powder before firing is not always the same as the resultant fired colour.

Having placed the piece to be fired on the panning mesh, with the help of a firing fork. put the mesh in the centre of the muffle. which should glow a bright cherry red. and close the door. After about one minute the door should be opened carefully to see if the enamel has melted. When it is thoroughly molten and appears bright smooth and glossy, remove the piece from the firing chamber and place on a heat proof mat at the side of the kiln to cool.

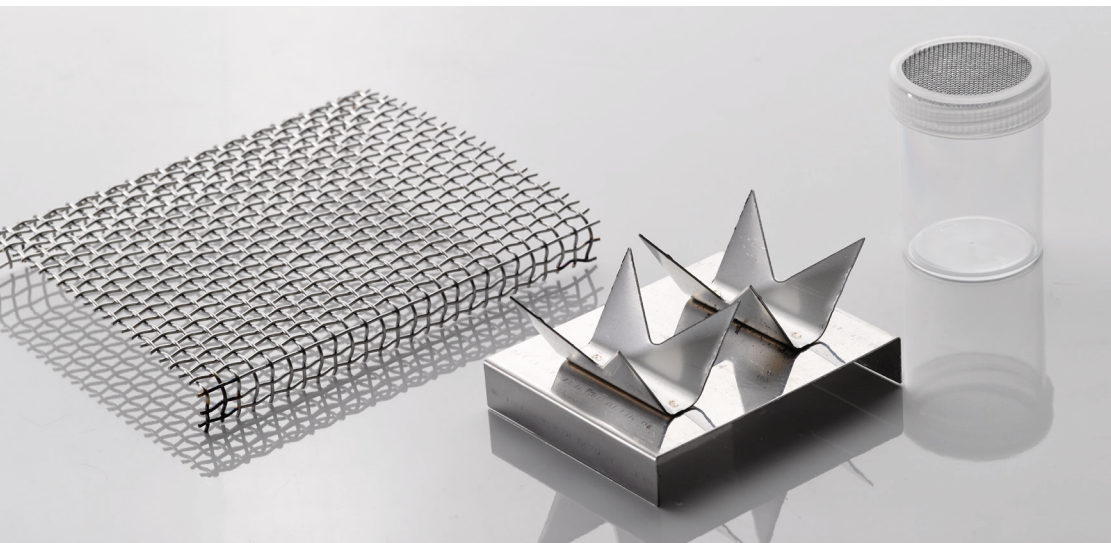
The firing should take between one and three minutes. If it takes less than one minute the kiln is too hot and should be switched off for a short time to cool. If the firing takes longer than three minutes. the kiln is not hot enough; this results in a dull and bumpy finish to the enamel. If the enamel is uneven when the piece has fully cooled, more powder may be applied and the metal re-fired.

Once the finished piece is cool, the reverse side and any exposed edges are cleaned with a carborundum stone and abrasive sponge, followed by the salt and vinegar solution.

## Counter Enamel

Flat pieces of metal often warp and curve as they cool. This may be prevented by applying a coat of enamel on the reverse side. although this need not be done if the metal is more than 1 mm thick. This counter enamel layer diminishes the tensions resulting from the repeated firing and cooling procedure and prevents the enamel from cracking.

Counter enamel should be applied before the firing of the top side. using the basic firing method and dusting application. The counter enamel may be made from a mixture of several colours. or a single colour. and is fired in the same way as previously described. After the metal has cooled. the right side is prepared for firing in the usual way. When the piece is positioned on the panning mesh ready to go into the firing chamber. the previously counter enamelled side must rest on a still so it does not stick to the mesh.



## Opaque Enamel

It is best to begin by using opaque enamels. They are less prone to cracking and chipping. and fire more easily than transparent colours. Opaque enamels do not always require counter enamel on the reverse side as they are not as brittle as the transparents.

They are very suitable as a solid colour background for decoration. When experience of firing these colours has been gained. experimentation with other types of enamels is recommended in order to explore the more varied qualities which can be produced.

# Decorative enamelling techniques

Having mastered the technique of firing basic enamel colours, there are many forms of applied decoration which can be used singly, or together in experimentation.

Several books are available from libraries and bookshops with detailed information of the more complex ones such as cloisonne and champeve, but many of the simpler techniques are suitable areas of exploration for the relative beginner.

## Thread Enamel

Threads are thin rods of enamel colours, available in opaque and transparent colours, which can be used for linear designs. Using tweezers, the threads can either be placed on the enamel powder prior to firing, or the fired enamel coated with Tramil (water-based gum) and the threads applied, dried and refired.

In the latter method, the enamel may become overtired and the threads broaden out. If it is underfired, however, the threads will be raised in low relief.



## Lump and Shot Enamel

Pleasant designs can be created using lumps or chips of enamel of various colours against a plain background. A secondary layer of the enamel colour, the same colour as the first, should be sifted over the pre-fired base coat and the lumps, chips or shot, with the aid of tweezers placed in the required design. The piece is then refired.

As various sized lumps will take longer to fire, try to choose similar sized lumps. With this technique you have the choice of allowing the lumps to either completely melt into the base coat or to stand out in low relief.

## Millefiore or Ventian Beads

These colourfully patterned beads keep their designs when fired. Firstly, counter enamel the metal. Using a stilt to support the piece, fire a base colour of your choice. When it has cooled, sift on the same opaque enamel or any transparent colour. Place the millefiore onto this second coating and fire in a hot kiln.

The beads are hard firing and require several minutes to melt into the enamel surface. The longer they are fired, the further the pattern broadens out.



## Embedding

Off-cuts of copper, mosaics, chain and wire make attractive abstract designs. Counter enamel the metal blank as described. Having cleaned the exposed surface. sift on a layer of enamel and lay the metal pieces on top of the powder. Fire the blank in the usual way. When it has cooled. clean the embedded metal pieces with the abrasive sponge or carborundum stone.

## Sgraffito

This is a method of scratching through a thin coating of enamel powder to expose a pre-fired base in a contrasting colour. Fire a basecoat of opaque enamel. When this has cooled. sift on a layer of contrasting opaque colour. Using a sharp pointed object e.g. a pencil or matchstick. draw the design, exposing the pre-fired base coat. Refire the metal blank until smooth.

## Scrolling

This popular technique can be executed using enamel threads. lumps, shot. millefiore or just two contrasting colours. Onto a pre-fired base place the chosen decoration or second colour, and put into the hot kiln. When the decoration begins to melt use the scrolling tool to draw through the molten enamel. If the tool sticks to the piece. the enamel is not sufficiently molten. As the kiln door remains open when using the scrolling tool, great care should be taken at all times.

## Pencil Drawings

To achieve this simple technique. fire a base coat of white opaque enamel. then using a carborundum stone under running water, roughen the surface of the enamel until it appears matt. Draw a design with a pencil and re-fire the metal.



# Faults and their causes

Successful enamelling depends on the correct execution of the preliminary work, i.e. the cleaning of the metal and the preparation of the enamels. Any resultant defects in the finished piece can often be attributed to this incorrect preparation.

## Pinholes and Pores in the Enamel Surface:

These appear as a result of air bubbles rising to the surface during firing. This may be due to incorrect treatment of enamel or metal. Take care that:

1. The metal is properly cleaned.
2. The enamel has been thoroughly washed in distilled water.
3. The enamel has been perfectly dry when stored.
4. The first enamel coat must not be too thick and has not been overfired.

## Blackened Edges:

This may occur for two reasons.

1. The kiln is too hot causing the edges to burn. The muffle should appear cherry-red for firing opaque enamels, and bright red to orange for transparent enamels.
2. The enamel around the edges of the metal may be too thin. A little extra enamel should be sifted on as during the firing, the enamel shrinks towards the centre of the metal causing the exposed edges to oxidise and blacken.

## Spots on the Enamel Surface:

Green or black spots and other discolorations are mainly due to a long firing in a high temperature. This fault frequently happens with white opaques, and is caused by copper particles dissolved in the heat. The kiln muffle, panning meshes, and stilts must be kept as clean as possible. Spotted areas also occur where the enamel coating is too thin or the enamel has been ground coarsely.

## Cracking and Chipping off:

Because of the expansion and contraction during the firing and cooling procedures, cracking and chipping often occur. The tensions can be reduced by counter enamelling or by using a thick grade of metal. Often the enamel will chip off at soldering points on the reverse side. This may be overcome by using epoxy resin to attach fittings to the metal.

## De-Enamelling:

To remove the enamel coating from an object, refire it, remove from the kiln and drop it immediately into a basin of cold water. The enamel will partly chip off, or at least be cracked. The cracked coat can then be removed by repeating this procedure. When all the enamel has been chipped off, the blank must be thoroughly cleaned before it can be enamelled again.

# Enamelling supplies

Muffle or Element kiln: Available for use with or without a kiln regulator and pyrometer.

Opaque Enamel Powders: 50g tubs available in a range of colours.

Sieve Pot: 50g shaker tub with mesh

Wire Mesh Firing Support: Size 113 x 110mm

Adhesive Medium (Tramil Gym): 50ml tub. Fire once dry

Millefiori: Available in 35g and 250g packs

Copper Blanks: Available in assortments of 100 and in novelty shapes.

Copper Offcuts: Available in a 1kg pack

Enamel Threads: Mixed colours in a pack of 25g

Curved Point Tweezers: 160mm length





For more information on our range of  
enamelling supplies including kilns,  
copper blanks and enamel powders,  
contact us via:

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