CRAFTSMANSHIP+

FOSTERING A NEW AND COMPETITIVE APPROACH TO CRAFTS AND SEMI-INDUSTRIAL HIGH ADDED-VALUE SECTORS

The Art of Enamel on Metal

ESPAÑA

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CRAFTSMANSHIP+
THE ART OF ENAMEL ON METAL

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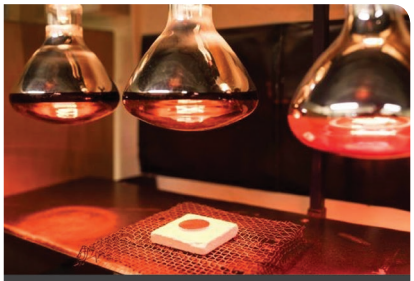
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THE ART OF ENAMEL ON METAL

TOOLS AND MATERIALS

Tools and materials used in making a copper enamel disc

Stencil with different shapes (in this case, circular)
this stencil will help to correctly shape the final piece. In the video, we see the artist uses a simple plastic stencil.

Jeweller's saw 1
the artist uses her jeweller's saw in order to cut the copper sheet into a 30mm circle.

File
used to eliminate burrs and imperfections on the edges and along the cuts of the piece.

Sandpaper
used to eliminate burrs and imperfections when finishing the final piece.
Dapping block and punch: tools used to give the metal used a specific form. In the video we can see that the artist uses both wooden and metal blocks to form the copper disc.

Rubber mallet 2
used to hit the dapping punch. The rubber mallet is used because it is softer than other types of hammers.

Water and soap
to clean the metal, in this case copper, between steps.

Sieve
used in the enameling process as a form of uniformly distributing the enamel when it is in a powder form.

Spray bottle 3
used to lightly apply distilled water to the piece.
Infrared light: used to dry out excess water after the enamel has been applied (both in the

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application of wet and dry enamel) before the piece is fired.

Mesh rack

formed into a table, the mesh is used to support the piece of jewellery while it is below the infrared light and in the kiln. It acts as a support and facilitates moving the piece.

Stick with a flat end 4

used to move the piece of jewellery when it is on the mesh rack.

Kiln

used to fire the piece, which will melt the enamel to the metal (in the video, the small kiln has a door and reaches 850º C).

Organic acid

used to clean the metal, in this case copper, where the metal has not been applied (in our case, after enamel has been applied to the back of the piece and the front has blacked). In the video, the artist uses a salt and vinegar solution.

Paint brushes

different sizes and shapes of brushes are used to get different quantities of enamel onto the piece.

Pallet knife

used to grab and control small quantities of enamel.

Tweezers:

used to manipulate small pieces of glass and apply them precisely.

Copper 5

this metal, used in sheets, provides a specific strength and flexibility desired by the artist for the final piece.
Powdered enamel: the powdered enamel is used in two different ways in the video, dry and wet.
Dry enamel is used to decorate the backside of the piece of jewellery and to apply a clear coat of enamel. Dry enamel is applied with distilled water.
Wet enamel is clearer when it is fired and is used to apply one or multiple colours in small spaces. To make wet enamel, powdered enamel is first cleaned in water, removing dirt particles.

Glass pieces

the artist uses other pieces to make the colours of the enamel stand out. These glass pieces will melt when fired.

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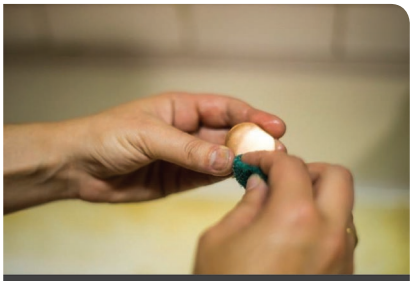

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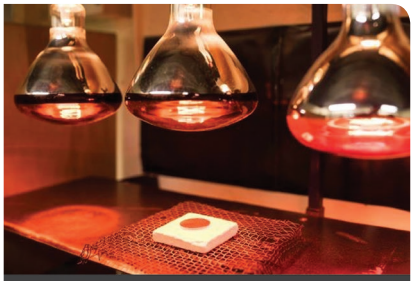

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THE ART OF ENAMEL ON METAL

CHARACTERISTICS

How does enamel work? 1

Enamel is a crystalline structure formed by meltable materials that can be applied to different base substances, in this case to copper. The most important characteristic of enamel is that it fuses with the base when it is heated to temperatures higher than 500º C. In addition, it lends itself to jewellery production due to several properties such as its hardness.

In the video, and in most cases, we see that artists will also apply enamel to the back of a piece (the face where the design will not be applied). This application is very important because enamel, due to the fact that it is made of meltable materials, will contract when it is cooled, and applying enamel to both sides of a piece will help balance out this contraction.

The colours in which we see enamels will vary depending on the metal oxides that it contains, and by adding other substances it is possible to customize the qualities of the enamel so that it fits the needs of the artist. For example, by manipulating the make-up of the enamel you can also change its opacity (to be opaque, translucent, or transparent), its melting temperature, its stability, etc.

Why does the artist use copper?

Metal-based enamelling is usually done on one of four different metals: platinum, goal, silver, and copper. However, the metal that is most used, for its quality-practicality-price, is copper.

This metal is easy to find in variety of different thicknesses and can be transformed into any type of shape and size. Because it is so important to use the proper thickness for the piece that has been designed, the sheet of metal is measured in tenths of millimetres, and, as a general rule, the bigger the dimensions of the final piece, the thicker the sheet should be.

In addition, copper is used because the way it expands and contracts is similar when used

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with all different types of enamel. However, due to the fact that copper oxidizes easily, sometimes the colours are not as bright as they might be when using other base metals. For example, when white is applied to copper, it might take on a green tinge, which is a sign of how the enamel is reacting to the copper.

Why is it necessary to clean the copper?

The cleaning process is very important when making enamel pieces because when surfaces are not properly cleaned the enamel might not stick properly. In the video the artist uses two types of cleaning:

* With water and soap the artist degreases the copper and makes sure that the surface is clean before applying the enamel. This process of washing the piece with soap and water is used several times during the making of the piece.
* With an organic acid, in this case vinegar and salt. This cleaning process is used after firing the piece for the first time and applying the enamel to the back of the piece. This cleaning process is important because when copper is fired without enamel on the surface it can oxidize or have small abrasive fragments (for example, the front of the piece when the enamel is applied to the back). If the surface is not cleaned, it can negatively impact the application of the enamel to this side.

* We would like to note here that many different cleaning processes exist and, although we underline the importance of maintaining a clean surface, the form that is used to clean the surface depends on the artist. 2

Why is the water evaporated from the enamel? 3

It is necessary to dry the agent used to adhere the enamel to the piece of jewellery (in this case, water) because this agent is no longer necessary. If the piece was fired without this drying process, the water would boil once placed in the kiln, making it more difficult for the enamel to fuse to the metal. The drying technique shown in the video is an infrared light that causes the water to evaporate. At the same time, you can use other ways to dry the piece out (such as letting it dry naturally).

How to fire the pieces: 4

There are different ways to heat the piece to a certain temperature once the enamel has been applied and the binding agent has been evaporated; however, the two most common ways are with a kiln or with a torch. Firing the piece with a torch is done by placing a flame on the underside of the piece (as this piece is supported by trivets, allowing access to the bottom of the piece). This type of firing is limited to small pieces of artwork, no bigger than 2.5 cm because a regular handheld torch is not capable of evenly firing larger pieces.

When using a kiln, the piece is placed within the kiln for a determined amount of time. The piece is not placed on the floor of the kiln, but on a platform to allow airflow around the piece and even heating (in the video, we see the artist uses a ‘table’ made out of mesh and takes it out using her stick). In the video showing this method, the artist uses a medium sized jewellery kiln. There are different types of jewellery kilns that are larger and smaller than the one that is shown in the video.

The way that the kiln is used during the firing time is also very important. Temperature control is essential to good firing practice because temperatures that are too high or two low will change the end results and not all enamels have the same melting points. It is also important to be aware that opening the kiln causes heat to escape, lowering the temperature.

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TECHNICS

Washing the enamel

Cleaning the enamel, removing impurities from the powder, before using it is important because it will affect the final results of the piece. At the same time, this cleaning is only necessary with the enamel that is applied wet, in small quantities, to obtain bright colours. When the enamel is applied dry to an entire face of the piece, washing the enamel is not necessary.
The washing process seen in the video is called decantation. This method is based on the idea that mixing powdered enamel with water in a container allows the impurities in the enamel to attach to the water, leaving the pure enamel at the bottom. A tall glass (made of glass) is the ideal container for this cleaning process.

Decantation has several steps:

1. Put a small amount of powdered enamel in a glass.
2. Add tap water on top of the enamel, opening the tap enough so that the pressure of the water mixes it with the enamel.
3. Let the mixture sit until the enamel once again settles at the bottom of the glass.
4. Carefully remove the water, pouring out the water without losing enamel.
5. Repeat the process until the water runs clear.

In order to be able to use this ‘wet’ enamel more easily, it is recommendable that it is placed in a container which is flatter and has a wider opening than the tall glass. This container should be plastic or glass (but never metal because metal can oxidize and contaminate the enamel).

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Applying the enamel

Stencilled technique 3

to apply the enamel to the back of the piece or the transparent layer below the design on the front of the piece, the stencilled technique is recommended. This technique is seen in the video as divided into four steps:

1. Use a spray bottle to apply a small amount of distilled water to the surface of the piece.
2. Apply powdered enamel using a small sieve. This allows for a uniform layer of powdered enamel to be applied.
3. Repeat the application of water with the spray bottle.
4. Repeat the application of powdered enamel with the sieve.

It is very important to make sure that the layers of the water and the enamel are sufficient, but not too much (something that takes practice to get down).

Applying 'wet' enamel 4

to create different designs, and when the colour of the enamel should be brighter, wet enamel is applied using a paintbrush. The first step of this technique is to carefully wash the dry enamel, making sure that it is damp but not too watery. In the video, we can see that the artist uses a small pallet knife to pick up small amounts of enamel and have it close by.
Every time that a different colour is applied, it is important to clean the paintbrush. Having a glass of water on hand is useful when applying different colours. In addition, adding a little bit of water can help create a uniform application of enamel if it is not going onto the piece smoothly.

Like we saw it the second chapter of this practice, it is very important, in both techniques mentioned, to make sure that all the excess water is evaporated from the piece before firing it.

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DESIGN AND PREPARATION

Preparing the materials

Before beginning the enamelling process, it is important to go through these steps in order to have the best possible outcomes.

1 Designing the piece: taking into account factors like the size, the colours, the type of metal, etc. In the video we see that the artist designs a copper circle filled with green and red enamel, adding details with coloured glass balls.

2 Preparing the metal for the base of the piece: this step requires cutting the metal (in this case copper) into the predetermined size and shape. In addition, it is important to file and sand the surfaces and edges, and shape the metal with the dapping block and punch. 2 3

3 Once the copper is shaped into the form we desire, it is important to clean and degrease the piece.

4 In this phase, we also prepare the enamel, washing it wish water in a decantation process, in order to achieve better transparency and brighter results. In the case seen in the video, the artist washes lime green and red enamels. 4 5

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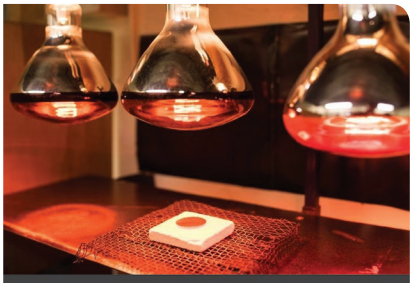

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BASE

Before applying the colour and the design to the piece, it is important to apply a base coat.

1 The first step of this preparation is to apply enamel to the back of the piece, the back being whatever side that will not receive the design. In the video, the artist chooses the convex side of the piece as the back. For this application, the stencilled technique should be used. First a layer of distilled water is applied, then a layer of enamel, repeated by another layer of distilled water, and finished with a final layer of enamel. 1

2 It is necessary to let the excess water dry out. In the video, the artist uses infrared lights to make this process go faster. 2

3 In a kiln heated to 850ºC, the piece in fired for two minutes, until the enamel of the piece is completely melted to the metal and has a shiny surface. 3

4 Once the piece has cooled, the oxidation on the side which does not have enamel must be cleaned off. In the video we see how the artist uses natural acids, in her case vinegar and salt. Once again it is necessary to degrease the piece with water and soap to allow for the application of enamel on the other side. 4

5 This process of stencilled enamelling should be repeated on the other side (in the video, the concave side) of the piece with transparent enamel. This coat of enamel will serve as the base for the coloured design. The same technique used above should be implemented here; the only different is to allow the piece to fire for three minutes instead of two. 5

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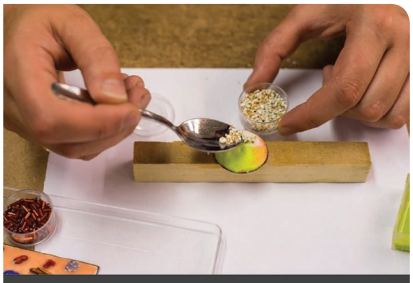
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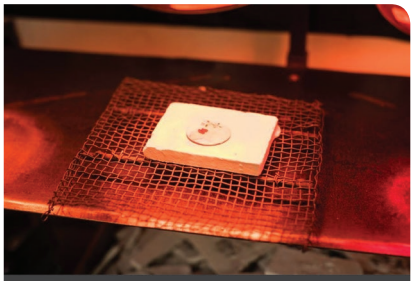
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APPLICATION OF THE DESIGN

Once the piece has been prepared, it is time to apply the design.

1 The design is applied on top of the clear coat applied to the concave part of the piece. First, the wet enamel that was previously prepared is applied. In the video, we see that the lime green enamel covers most of the surface of the piece and that the red enamel covers a smaller part. 1

2 Adding little glass balls or other meltable elements will make the colours of the design pop. In the video, the artist adds several coloured glass balls to increase the contrast of the colours of the piece, and, therefore, amplifying their intensity. 2 3

3 In the same way that the excess water in the base coats was evaporated off, it is necessary to dry the enamel. In the video we see that the artist uses the infrared lights to evaporate the excess water before firing the piece in the kiln at 850º for five and a half minutes. 4 5

4 When the piece comes out of the kiln, it is important to let it cool. Once cool, the edges should be filed and sanded, resulting in a disc that is ready to be added to a pendent or other piece of jewellery. 6

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GLOSSARY

Stencil in different shapes:
a piece of material (paper, plastic, metal, etc.) that is used as a guide for drawing outlines or cutting out different shapes.

Jeweller's saw:
used to cut the metals that are the base of this project, although different tools could be used for this task. When choosing a tool to cut metal, it is important to think about: 1) the type of metal you plan to use, 2) the thickness of the material, and 3) the shape that you wish to cut (depending on the difficulty of the shape, the type of saw, the blades used, etc. could be different).

File:
this tool is used to smooth different materials (for example: metal, plastic, or wood). When choosing a file, you should consider three important factors:

1. the type of material you are working with,
2. the shape of the file in regards to the piece you are working on, and
3. the size and quantity of the teeth.

Various types of files can be used in one project, so you might want to have more than one. However, you should try and choose files that are the most fitting to the final product that you wish to achieve.

Sandpaper:
this piece of paper has different adhesive materials stuck to it and it is used to smooth the surfaces of other materials, removing small fragments from the surfaces which could be cutting the material, applying substances, etc. The different roughness of the paper is measured in grits and there are many different types of sandpaper, from very rough to very fine.
To choose sandpaper that best fits your project you should keep in mind the following characteristics:

1. the grit of the paper,
2. the material/surface that you wish to sand, and
3. the smoothness that you hope to achieve with the final piece.

If you are trying to change a very rough surface to a very smooth one you might have to use different several different types of sandpaper with different grits.

Dapping blocks and punches:
although they go together, this tool is divided in two: a block or die with forms where the metal should be placed and a punch that will create the other side of the shape. These tools can be wood or metal.

Wood dapping blocks: are used when working with think sheets of metal without scratching the surface.

Metal dapping blocks: provide a base which is much harder, resulting in a more precise outcome than a wooden block. However, working with metal dapping blocks is more difficult than wooden ones, and will require practice.

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Dapping blocks come in various different sizes and it is important that each artist finds the block(s) that fit his or her needs. If you are working on many different projects that require dapping blocks, you will most likely need more than one kind. This tool should be used with a rubber mallet, lightly hitting the punch.

Rubber mallet:

these hammers are made of plastic and are specifically used when working with metal sheets. These mallets cause less distress to the metal base used than other hammers.

Sieve:

there are many different types and sizes of sieves that are used in many different contexts. In jewellery making, and specifically when doing enamelling, a small sieve is used to for two things:

1. spread the powdered enamel in a uniform way, and
2. guarantee that all the particles applied in the enamelling are of similar size.

Infrared light:

using infrared light bulbs is one way to evaporate excess water in a quick and efficient way. This helps the enamel particles to harden and create a hard-wearing coat of enamel.

Mesh:

a semi-rigid material formed by intertwined fibres. This material allows for airflow between and around the fibres. In the video, a strong but flexible platform is created out of mesh, and the piece of jewellery is placed on top of it. This allows for even drying and firing, and facilitates the movement of the piece during the process.

Kiln:

the kiln is a specific tool used to fire the piece. For jewellers, these kilns are specific to working with small pieces (as opposed to kilns used to fire pottery, etc.). There are different sizes and shapes of kilns to fit different needs. Depending on what you want from your kiln, you should adapt your purchase to specific qualities and characteristics.

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