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From Cloisonné to Sgraffito: Exploring the Various Enamelling Techniques in Metalwork

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Abstract

This study explores the various enamelling techniques in metalwork, tracing their historical development from ancient civilizations to contemporary applications. Enamelling is a time-honoured process that involves applying coloured glass powder to metal surfaces and heating it at high temperatures to create durable, decorative coatings. The research examines six primary enamelling techniques: cloisonné, characterised by compartments formed with fine wires; champlevé, which involves carving recesses into metal surfaces; plique-à-jour, creating translucent effects similar to stained glass; basse-taille, combining engraving with translucent enamel; grisaille, using tonal gradation in monochromatic palettes; and sgraffito, a subtractive method involving scratching through enamel layers. The study investigates the historical evolution of these techniques from ancient Egypt and Mesopotamia through the Byzantine and medieval periods to the Renaissance and modern era. Additionally, the research examines the technical processes and materials involved, including enamel compositions, surface preparation methods, application techniques, and firing processes. The contemporary relevance of enamelling is explored through its applications in jewellery making, decorative metalwork, architectural elements, and industrial uses. The findings demonstrate that enamelling represents a remarkable intersection of art, science, and craftsmanship that continues to evolve while maintaining its fundamental principles, ensuring its relevance for future generations of artisans and researchers.

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Introduction

Enamelling is a time-honoured process whereby coloured glass is melted to metal by the use of heat producing decorative surfaces of great colour and permanence that have been the subject of fascination by artisans and collectors alike (Barnes, 2019) [4]. This is a complex form of art that infuses the virtues of colour, as well as the durability of metal, which creates objects that are not only striking to the eye but are also extremely durable. Maryon (2012) [21] opines that enamelling can be described as the process of applying powdered glass to a metal surface before heating it to very high temperatures that causes the glass to melt and merge with the underlying metal to create a smooth, coloured coating with no fading or wear resistance. Even the name of enamel is of old German origin, *smeltz*, translating to melt, as this is the general process that occurs in this work (Speel, 2018) [27].

According to Buckton (2002) [10], the history of enamelling dates back to ancient civilizations, in which traces of such a technique were also found in a number of archaeological discoveries in the Mediterranean and Near East. Fisher (2016) [15] performed technological examination of enamelling present on Roman glass objects that showed that the ancient Romans were one of the

first to develop advanced enamelling techniques, specifically the use of opacifying and decolourizing agents to create the desired visual activities. These early uses indicate how much technical expertise ancient craftsmen had because they knew the chemical characteristics of both glass and metals to such an extent that what they produced has been preserved as decoration elements even thousands of years later.

Cloisonné is one of the most renowned and famous methods of enamelling, which has been developed and used by different people in different eras. The method of this process is to form compartments or cells on the surface of the metal with fine wire or metal strips, which have been soldered or glued to make separate areas and then each area is filled with enamel powder of various colours. Cloisonné is a word which translates to partition in the French language and it perfectly defines the appearance of this technique (Barnes, 2019) [4]. The history reveals that the art of Cloisonné enamelling was extensively practiced throughout the Byzantine period when it was applied to produce exquisite works of religious art, such as the renowned Holy Crown examined by Buckton (2002) [10] which is one of the most remarkable examples of the art of Cloisonné enamelling. This method was most popular in the nineteenth century when the best craftsmen such as Clement John Heaton perfected and commercialised Cloisonné work in their new methods and outstanding masterpiece (Ceresole, 1996) [11].

Another notable method of the enamelling tradition, which contrasts Cloisonné, is champleve, in which the design is formed by cutting or engraving depressions into the metal surface instead of making compartments by raising wires. According to Barnes (2019) [4], champleve makes possible the larger spaces of colour, and often, the underlying metallic texture under the enamel, leaving a very particular visual effect that is particularly attractive to many craftsmen and enthusiasts. The method was especially widespread among the medieval, particularly the European, tradition, in the decoration of religious items, chiefly reliquaries, book covers, and liturgical vessels.

Although sgraffito is often used in reference to ceramic decoration and decoration of walls, it has also been utilized in enamelling of metalwork. Jagiełło (2022) [18] says that sgraffito is a technique that consists of applying an enamel layer in contrasting colours and scratching or carving the top layer off to expose the colour under it to form a complex design or pattern. This technique provides artists with more liberty in producing detailed imagery, and has been modified to be used in modern jewellery and decorative metalwork, and will show that the field of enamelling continues to evolve and experiment.

Enamelling is a process that involves a number of essential steps that involve a sense of skill, accuracy, and patience. Akberdiev (2022) [1] explains the technical details of enamelling by discussing in the context of industrial use how enamels of various compositions need to be fused at a particular temperature without destroying the metal underneath or making the colours run or bubble. Preparation of surface is equally important where the metal should be well groomed and, in some cases, pre-treated so that the enamel can stick well. The enamel powder application may be achieved in different ways as well as with the help of wet packing or dry dusting or with special tools that will allow putting the enamel into the specified places.

To sum up, the study on enamelling is a great place where art, science, and craftsmanship meet each other and which have been developed throughout centuries without losing the main principles of the process. Since the interwoven web of Cloisonné to the sculptural patterns of champleve and the artistic potential of sgraffito, the methods continue to influence the present-day artisans and pass the traditional knowledge to the next generations. The timeless nature of enamelled metalwork is the fact that it has turned the most mundane of objects into a colourful piece of art that leaves the evidence of the human ingenuity and mastery in the hands of the craftsmen throughout the ages.

Historical Development and Evolution of Enamelling Techniques

Enamelling is a craft technique whose history is long and varied with numerous variations and techniques employed over the centuries. Enamelling is an art whose history is very extensive and interesting and which acquired different forms throughout thousands of years of development that started with the use of simple forms of its decoration in antique civilizations and culminated in the sophisticated methods of modern jewellery and metalwork. Fisher (2016) [15] notes that enamelling is among the most ancient of the decorative arts, as early practitioners, both in ancient Egypt and Mesopotamia, had found out that powdered glass could become permanently bonded to metal surfaces to produce bright, permanent colours. This finding brought on a new artistic tradition that would extend to develop and grow with generations and cultures.

The earliest known types of enamelling were fairly primitive, the craftsmen using coloured glass to decorate metal objects mostly of a religious and ceremonial nature. With the evolution of technologies, craftsmen started working on more advanced techniques of producing complicated patterns and designs. Rossi, Russo, and Compagnoni (2020) [26] introduce the history of the development of porcelain enamel as a decorative material and then spread to technical and industrial implementations, showing how enamelling developed over time to be used not only in works of art but also in architecture, cookware, and industrial machinery. This change is an indication of the malleability of the enamelling procedures, as well as their applicability in terms of artistic as well as practical usage.

Enamelling gained considerable development during the medieval period, especially in Europe with religious institutions commissioning elaborate liturgical items that were decorated in enamel work with a variety of colours. Much medieval metalwork, Brownsword (2004) [9] presents an analytical work on the metalwork, he notes that objects made of copper-alloy during this time often had a champleve and Cloisonné work, and religious imagery and decorative patterns became prominent during this era. The Byzantine Empire was especially significant in maintaining and developing enamelling methods and some of the finest medieval examples of enamel work are publicly regarded as master craftsmen and still provide the motivation of modern artists.

The Renaissance era marked a period of revitalization of enamelling with artists attempting to integrate the ancient art into artistic experimentation. The craftsmen started playing with various metal substrates, colour combinations and firing techniques and gave rise to new styles and techniques. Bates (2011) [5] further states that formal enamelling workshops were also founded during this period and techniques documented in instructional literature to preserve this

knowledge and allow transmission over generations of craftspeople.

More recently, enamelling has still continued to develop with changes in technology and alterations in artistic sensibility. Postlmayr (2021) [23] speaks about the creation of enamelled steel, a modern implementation of classic enamelling rules into the factory and architecture. This innovation is evidence of how old ways can be transformed to suit modern requirements and resources. Equally, Li (2023) discusses how modern craft professionals are stretching the limits of the traditional enamel techniques, specifically plique à jour, with new techniques that are hybrid, involving both old and new techniques.

The modern enamelling has been shaped by the cross-cultural interactions and the interwoven artistic traditions as well. Alayar and Alrashidi (2024) [3] discuss the use of Islamic art patterns and etching techniques in contemporary metalwork and jewellery to form new combinations to show respect to the traditional craftsmanship and adopt modern aesthetics. Such a fusion of cultural influence places emphasis on the mobility of enamelling as an arts practice that retains a dynamic and adaptive quality based on the shifting trends in the arts and the technological abilities.

To sum up, the history of enamelling processes can serve as a testament of the fascination of humanity with the idea of colour combination with light and metal to produce beautiful and stable objects. Since early days of ancient enamelling up to the era of medieval sophistication and the modern innovation, enamelling has been a very diverse art and has stood the test of time and will continue to attract both the artisans and the collectors.

Types and Characteristics of Enamelling Techniques

One of the most fascinating and lasting of all the arts in the history of decorative metalwork is enamelling, which joined the brilliance of coloured glass with the permanence of metal to produce objects of the greatest possible beauty and longevity. One of the most incredible diversity of techniques used in this ancient craft has its unique qualities and effects which create the unique effects on sight and serve various artistic and practical functions. The craft of using coloured glass on metal surfaces has been developed over a long period of time; it has evolved to be more decorative as well as the more elaborate techniques that are still in use today by contemporary artisans and collectors around the world. Fisher (2016) [15] argues that the choice of a specific enamelling method is subject to many factors, such as the visual effect one wants to achieve, the characteristics of the metal base, the level of the professionalism of a worker, and the purpose of the completed object. This extensive discussion focuses on the principal forms of the enamelling methods, their peculiarities, and the steps of their implementation.

Cloisonné

Among the most familiar and popular techniques of enamelling is known as Cloisonné and typified by the distinguishing characteristic of bright colours detached with fine metal strips or wires. It is named so because when the French language is translated the word partition is used, and this is the impression that is expressed due to the use of this technique in a graphical way (Bates, 2011) [5]. The Cloisonné technique consists of braiding the refined wires, bending and working the wires to some pattern in order to form compartments or cells in which case the design is to be filled with a new colour, and the compartments are to be filled with enamel powder. It is a highly sensitive process which requires much skill and time because before any enamel is applied, one should have everything planned in the wirework (Figure 1). According to Brownsword (2004) [9], the popularity of Cloisonné was specifically popular during the medieval era in Europe and the Byzantine Empire as Cloisonné was widely applied in producing religious and liturgical objects (Figure 2) that were ornate in nature. Once the design is done it is fired on high levels to fuse the enamel to the metal surface after which one undertakes the process of grinding and polishing to come up with a smooth and level finish.

The history of Cloisonné enamelling dates back to ancient Egypt and Mesopotamia, where the ancient artisans first learnt the art of bonding coloured glass to metal surfaces (Hetherington, 2024) [17]. Nevertheless, the art reached its highest level in the Byzantine era, as the most advanced master craftsmen invented more and more advanced techniques of producing delicate designs with gold and silver wires. The Byzantine craftsmen had taken cloisonné to an art level, creating some of the most beautiful religious icons, reliquaries and imperial items which a person cannot but admire even nowadays. The method then expanded to other regions in Europe and Asia where various cultural practices adapted and changed the fundamental processes to meet their artistic sense of taste (Liban & Mitchell, 2012) [20].

Cloisonné needs very high precision and patience throughout the execution process. The craftsman will start by developing a detailed design which will be transferred on the metal base plate. Neatly-bent and shaped fine wires (usually of gold, silver or copper) are used to trace the outlines of the pattern forming three-dimensional walls inside which will go the enamel (Colomban, 2022) [12]. The connection of these wires to the base can be done by soldering or by heat resistant adhesive basing on the project requirement. When the wire structure is totally built then the compartments are filled with the enamel powder in one colour at a time, allowing each colour to dry before the next. Several firings are necessary because the enamel layers need to be fired separately in order to provide the required depth and colour saturation.

The completed Cloisonné work is subjected to a lot of finishing techniques to give it its typical smooth finish. The process of grinding takes away the surplus enamel and flattens the surface whereas polishing brings out the brightness of the colours and the shine of the metal wires. the outcome is an eye-catching, strong surface, a blend of glitter of the colour glass, with the beauty of some of the most precious metal, producing the objects of extreme beauty which have filled the palaces, temples, and domestic collections of every age.

(Studio work, 2024)

Fig 1: Cloisonné fish design

(Studio work, 2024)

Fig 2: Cloisonné leaf design

Champlevé

Another method, the second method, champleve, is a simple technique of the enamelling tradition and this method is fundamentally different in the manner in which it creates the compartments in which the enamel is laid. According to Boyd (1999) [8], champleve is a technique of making a hole on the surface of the metal rather than nailing or engraving raised wire in order to make holes. These recesses are then filled with enamel powder forming a pattern of which the spaces between the different colours are filled by the metal itself. The technique enables higher weight of colour and tends to reveal the texture and colour of the metal underneath the transparent layers of enamel. During the Romanesque and Gothic period in Europe, champleve attained an unusually noble status, and was applied in large quantities to ornament the reliquaries, book covers, and ecclesiastical ornaments. Champleve work is very much reliant on the care that was taken in preparing the metal surface since the depth and precision of the engraving is the determinant of the final appearance of the work (Röhrs *et al*., 2019) [25].

Champleve is a technique whereby the design is made by cutting away metal as opposed to wire Cloisonné. This method gives the artisans the opportunity to use larger regions of colour and produces a unique visual impact of the underlying metal playing a part in the general look of the work. It was a very popular method of the Romanesque and Gothic periods in Europe, where it is used to adorn religious items like reliquaries, liturgical vessels and illuminated manuscript covers. The formation of the metal surface is key in champleve work because the depth and accuracy of the engraving determines the result of the product as well as the longevity of the finished work (Figure 3). The depth of the recesses has to be regulated by craftsmen with the help of which the enamel should fill in the spaces in a way that they will be kept even with the rest of the metal. The products are the beauty of coloured glass with the natural lustre of the metal, and objects of astonishing visual interest, which have survived as important examples of the art of the middle- ages.

Source: Deborah Read (2000)

Fig 3: Engraved metal with Champlevé design

Plique-à-Jour

Plique-à-jour is generally believed to be one of the most challenging ways of enamelling and the findings are identical to stained glass due to their transparent nature (Figure 4). This can be defined as a process in which the enamel is applied to the surfaces of metals without having some backing that creates a transparent layer that can be compared to glass through which the light passes through the enamel layers (Li 2023). During the Art Nouveau period, there was a resort of this technique as jewellery makers embraced its lightness to create the beautiful decorative jewellery (Akkerman, 1984) [2]. Ostoia (1945) [22] provides a helpful discussion on the late medieval plaque-à-jour work, but he notes that the method was extremely hard because the craftsperson had to work with unsupported enamel that was supported by friction when being fired. The finished products are of high luminosity and depth and they are quite favourable to the collectors and jewellery lovers.

The name plaque-a-jour can be translated in English to mean letting in daylight and this best explains the main feature of this method. In contrast to the other enamelling techniques, where the enamel is laid over a solid backplate of metal, plique-à-jour produces a light effect where the light is seen to pass through the enamel into the windows, just like in the stained glass. This special trait causes objects of extreme beauty that appear to radiate themselves, reflecting and refracting light with such characteristics to form continuously changing visual effects with changes in viewing point and lighting conditions.

The technical requirements of plaque-a-jour are significant and it is one of the most challenging techniques of enamelling that needs to be mastered. The craftsman must use enamel which has no support behind it, and when firing the glass has to be supported only by surface tension. This needs very high expertise in the use of enamel as well as the management of firing temperatures. Excessive heat may lead to the enamel running or bubbling up whereas the lack of adequate heat may lead to low adhesion and opaque instead of translucency. The error margins are so small and even trained workers tend to make several trials before they can come up with satisfactory results.

Plique-a-jour can be traced back to medieval Europe where it was applied to religious items and small decorative items. Nevertheless, plaque-a-jour enjoyed the artistic heights of the Art Nouveau of the late nineteenth and early twentieth centuries. The technique was adopted by famous jewellery designers like René Lalique and Louis Comfort Tiffany who produced exquisite jewellery which embodied the surreal beauty of nature. The motifs in their work were gentle floral figures, dragonflies and other organic shapes that appeared to move when light went through the transparent enamel. The specific popularity of plique-à-jour in Art Nouveau jewellery is recorded by Akkerman (1984) [2], where the designers capitalised on the special characteristics of the technique to make ornaments appear to weigh practically nothing even when made of precious metals.

Even now, the possibilities of plique-à-jour are still being investigated by contemporary practitioners, who adjust traditional techniques to meet the needs of modern taste and materials. Li (2023) looks into how modern craftspeople are pushing the limits of this method by using hybrid approaches that incorporate the use of traditional materials and technologies. These inventions have created new directions in the artistic expression without losing the qualities that have made plique-à-jour so unique.

Source: Antique Jewellery (2026) [30]

Fig 4: Plique-à-jour earrings design

Basse-Taille

Basse-taille is a process that implies carving or stamping the surface with clear enamel with the aim to achieve the effects of layers within it (Figure 5). In this technique, the design is first etched or embossed on the metal surface with a design and finally the surface is covered with a clear color enamel (Richter, 1994) [24]. The designs engraved are even viewed behind the enamel giving a perception of depth and brightness that varies with the view angle. Goldman (2010) [16] writes of the current applications of basse-taille and how the current craftsmen have altered the technique to include newer methods such as polymer etching to create complicated patterns that would otherwise have been difficult to create using alternative techniques such as traditional engraving. This was at its best in the fourteenth and fifteenth centuries, and the Royal Gold Cup of the Kings of France and England is a capital illustration of the basse-taille work of the fifteenth century (Bimson and Freestone, 1983) [7]. The French term basse-taille can be translated to mean low cut referring to the shallow cut made in the engraving that defines

the method. In comparison with champleve, where deeper recesses are cut in the metal, basse-taille employs much shallower cuts, which are coated with a colorless enamel. The outcome is the slight interplay of the engraved design and the enamel that is overlaid to form visual effects that vary depending on the viewer moving in the piece or the lighting conditions changing.

The method was at its zenith of popularity in the late medieval and early Renaissance eras when European courts and religious organizations commissioned elaborate objects in basse-taille enamel. One of the best surviving examples of this technique in the fourteenth century, having been the subject of many studies carried out by Bimson and Freestone (1983) [7], is the Royal Gold Cup of the Kings of France and England. This great object illustrates the full possibilities of basse-taille, with the combinations of complex patterns of engraved designs to be seen through layers of translucent enamel in various hues of blue, green, and red.

Basse-taille is carried out with great attention to the engraving process and enamelling. The artisan has to first design it by either engraving or embossing and this has to consider the way the transparent enamel will feel in the finished work. The incisions can be made deep or shallow, and wide or narrow enough, depending on the amount of underlying pattern that will be visible through the enamel, and the effect that light will have on the finished surface. According to Richter (1994) [24], the production of basse-taille is technically analyzed, particularly the interaction between the engraving and the application of the enamel is the key to the visual effects that exhibit the intended effect. The technique of basse-taille has been modified by modern craftsmen in modern techniques and materials. Goldman (2010) [16] talks about how the underlying designs have been done using polymer etching, making it possible to be more precise and complex than the traditional hand engraving. This breakthrough has allowed artists to experiment with the possibilities of the new aesthetics, without losing the key features that make basse-taille a unique technique of enamelling.

Source: (Studio work, 2024)

Fig 5: Basse-taille bracelet design

Grisaille

Grisaille is a painted enamel technique, which forms fine imagery by the use of a range of layers of transparent enamels, mostly in sepia or grey hues, over a dark background. The method allows the artist to create dramatic depth and contrast in the tones which reminds the subtle effects of charcoal drawings or classical oil paintings (Figure 6). Grisaille is one of the most developed methods of painted enamel, which demands great skills since each layer is applied and fired one after another, and the painter creates an image step by step, balancing the application of colours carefully (Fisher, 2016) [15]. The resulting pieces have some amazingly smooth gradations and details which are not provided in other forms of enamelling and result in images of unbelievable subtleness and visual richness.

The term grisaille is based on the French designation of grey, which fits aptly the style of palette of this technique, which is monochromatic. Although others use vibrant and saturated colour schemes in their enamelling techniques, grisaille uses colour variations to the minimum to give the image the qualities of black and white photographs or charcoal drawings. According to Bates (2011) [5], this conscious limitation to a narrow tonal palette compels the artist to pay attention to the primitives of composition, light and shadow and the work is created that has an antique quality to it and classical beauty. The method was most popular in the renaissance era where artists aimed to reproduce the tonality effects of painting on the medium of enamel that they adapted the concepts of chiaroscuro and the perspective of the atmosphere to the qualities of the vitreous medium.

Grisaille is a very delicate and challenging task and it takes much care and control during execution. Brownsword (2004) [9] points out that each of the layers of enamel should be applied to the surface and fired one by one, and the painter should paint in a logical order of the darkest colors to the lightest ones. The artist then starts by applying the dark ground enamel, which gives the most vivid colours and gives the groundwork to the whole composition. This is then repeated with layers of the successively lighter enamel with each firing creating a greater tonal range in the work. The result is an image of enormous depth and refinements, in which the harmonies of tones are so gentle and gradual as to

appear brushstrokes of a masterful artist.

Grisaille in France for example, Giorgio Vasari in the sixteenth century worked in Limoges where the craft of grisaille was particularly prominent and the number of examples of this technique grew to satisfy the needs of religious and secular clients. History shows that the method was widely used to give us elaborate narrative compositions and portrait miniatures, which exhaust the expressiveness of enamel. The technique was particularly used to recreate already existing paintings, Beltran *et al*. (2020) note that the tonal technique was particularly effective to reproduce the chiaroscuro and depth effects of oil paintings and the use of the atmosphere perspective. This application illustrated how enamel was incredibly versatile as a medium with the ability to produce the gentle effects of other artistic traditions and retain its own unique characteristics.

These peculiarities of grisaille have been used to make it remain relevant in the modern practice of enamelling. The possibilities of the technique are still exploited by modern artists to create images of an unbelievable subtlety and richness, adapting the methods of the past to the needs of the modern subject and sensibilities. Colomban *et al*. (2020) [13] refer to the fact that with the use of tonal gradation and soft transitions between light and dark, the technique remains popular among artists who want an alternative to the bright colours used in other enamelling methods. The implicit value of grisaille is that the images can be produced in such a manner that they have the timeless nature and do not allow associating these images only with decorative connotations commonly attributed to the object decorated with colourful enamels.

Source: (1st Dibs, 2026)

Fig 6: Grisaille bracelet design

Sgraffito

Sgraffito is where wet or dry enamel is applied to a surface and scratched through to show the contrast colour of the surface underneath in fine details and figures. Ellis (2014) [14] talks about the different applications of sgraffito in contemporary enamelling, specifically the use of liquid enamel, copper oxide, stenciling, sifting, painting etc. This process gives artists a lot of room to develop in-depth designs and has been effectively transferred into both ancient and modern uses. The spontaneous and expressive mark-making of sgraffito is a hallmark of the technique compared to more of the enamelling techniques, and provides a distinctive method of decorative metalwork.

Sgraffito has its name in the Italian word sgraffire meaning to scratch, which is a good characterization of the basic action of sgraffito. Sgraffito is unlike other enamelling techniques that add layers of colour, but is created by cutting through enamel applied in reverse to create a contrast of colour beneath (Figure 7). Jagiełło (2022) [18] gives some historical background to this technique, which emerged in the field of architectural decoration and then was modified to be used with metals. This is a subtractive method that gives the impression of being more spontaneous and intuitively based on the creation, as the artist is free to react to the formed design in the course of work. The method dates back to the decorative arts, where it was widely applied in both the production of ceramics and the decoration of buildings prior to being applied to metalwork and jewellery pieces.

The use of sgraffito in enamelling normally entails a step of coating up several layers of enamel in different colours to a metal surface. The most fundamental layer, which will subsequently be uncovered by the scratching process is coated first and left to dry, or partially fire. Layers are then put on top of the basis with the artist applying them when the enamel is still wet or when it has assumed a certain consistency to be scratched. The artisan draws the images, pattern or abstract design by scratching through the top layers with specialised tools like styluses, needles, or fine brushes to expose the colour beneath. Ellis (2014) [14] analyses the various ways sgraffito is used in modern enamelling work and how the technique has been pushed by artists to new limits. The introduction of liquid enamel has enabled more flowing and expressive mark-making and the introduction of copper oxide gives it a unique green and brown color upon firing. Stencil and sifting techniques have been modified to form more accurate geometric patterns, which offer contrast to the more natural marks left by freehand scratching. These inventions show how sgraffito could be used as a versatile technique that could be adapted to both premeditated designs and improvised expression.

Spontaneity of sgraffito is what makes sgraffito especially attractive to artists who want expressive, organic effects. Sgraffito, in contrast to the more exact methods like Cloisonné or champleve, in which the design is predetermined, and worked out in a systematic manner, permits chance effects that may spur further creative choices. The trait has enabled this technique to be popular amongst the current day enamellist who embrace improvisation and

chance in their work. These are the results which in most cases are dynamic and are the reflection of movement and drama of the hand of the artist. Sgraffito has also been used in conjunction with other enamelling methods with the establishment of a layered technique that uses the special properties of each technique. Artists can include sgraffito features within an item that also has Cloisonné compartments and or champleve recesses or painted areas of enamel, and produce sophisticated works that are technically adept and imaginative. Conclusively, sgraffito is a unique style of enamelling which focuses on spontaneity and mark making and provides the artists with unusual opportunities in developing detailed images and patterns.

Source: (BrownWren, 2026)

Fig 7: Sgraffito earrings design

Enamelling Technical Processes and Materials

The present theme is devoted to the technical side of enamelling, and it is the materials, processes, and scientific principles which support this ancient art. Enamelling is the process where powdered glass is applied onto metal and then high temperatures are applied until the glass melts and fuses with the metal to form a permanent, coloured surface. Fisher (2016) [15] notes that enamelling need not be done well without the deep knowledge of the characteristics of both enamel materials and the metal substrates and the fine control of firing. This theme examines the technical knowledge and the practical skills needed to create high quality work of enamelling.

Enamelling is mainly carried out using enamel powders, finely ground glass particles that are coloured and metal substrates that provide the base on which the enamel would be applied. Enamel powders consist of silica, and other different metal oxides which give colour and other characteristics. Various enamel blends possess varying firing characteristics and temperatures necessitating artisans to choose suitable material to use in their application. Rossi, Russo, and Compagnoni (2020) [20] explain the impact of the chemical composition of enamel on its behaviour during firing, and such variables as transparency, oxygen, colour stability, and thermal expansion. Metal substrate should be chosen to correspond to the levels of thermal expansion of the enamel in order to avoid cracking or crazing during firing.

The process of surface preparation is one of the most important processes in the process of enamelling as it directly influences the outcome of the process. The metal should be well cleansed of oils, oxides or any other contaminants that could inhibit the adhesion of the enamel. As Bates (2011) [5] notes, this cleaning usually follows several processes which include the process of de-greasing, rinsing as well as occasionally adding coating to avoid oxidation as the heating process goes on. Texturing or scoring of the metal surface is also incorporated in the preparation of the metal surface in order to enhance the mechanical bond between the enamel and the metal. The preparation of the surface to receive the enamel also includes an engraving or carving of recesses, in which the enamel will be placed, e.g. in champleve.

The methods of application are different depending on the process of enamelling that is being used. Enamel powder can be applied in several different ways such as wet packing, in which the powder can be combined with a wet substance, such as water, or a binding agent and applied with a brush or spatula, dry dusting, in which powder is placed through a sieve, and sifting, where the powder can be more controlled. According to Ellis (2014) [14], other application techniques in modern enamelling include the application of liquid enamel in painting techniques as well as stencil application in creating exact patterns. The density and distribution of the enamel depends on application method and this has an impact on appearance of the fired piece.

Firing process is the most critical process in enamelling and it needs temperature control and proper timing. The piece is heated in a kiln up to temperatures usually between 750 and 850 degrees Celsius, again, based on the particular enamel composition one is using. Postlmayr (2021) [23] stresses that various enamel blends have different temperature ranges to undergo adequate fusion without harming the underlying metal or causing the colours to run or bubble. The firing process should be monitored attentively whereby the enamel should have attained the right level of fusion without

overheating and discolouring or even damaging the piece.
One of the areas of enamelling that needs to be considered in any complete study of the technical processes is safety. Risks of burns are also presented by the high temperature of firing, and the fine particles of enamel powder may be detrimental in case of an inhalation. Safe handling procedures, protective equipment and ventilation of the working environment are the key factors in ensuring a safe working environment. Moreover, chemicals involved in certain enamelling activities need to be handled and disposed as required by the environment regulations.
In enamelling the technical difficulties may include cracking, crazing and lack of adhesion due to incorrect matching of thermal expansion between the enamel and metal, improper surface preparation or wrong firing temperature. Knowledge in the science of these issues helps the artisans to diagnose and eliminate problems so that they can produce good work of quality work always.

Applications and Contemporary Relevance of Enamelling

practical applications of enamelling in jewellery making, decorative metalwork, architectural elements, and industrial uses. Enamelling has evolved from a purely decorative art form to encompass a wide range of applications that extend beyond traditional jewellery and decorative objects. According to Fisher (2016) [15], the versatility of enamelling as a technique has ensured its continued relevance in contemporary design, where it is employed in everything from fine jewellery and decorative art objects to architectural elements and industrial components. This theme explores how enamelling is used in modern contexts, the commercial viability of different techniques, and the preservation of traditional skills.
In the realm of jewellery making, enamelling remains a highly valued technique that allows artisans to create unique, personalized pieces that combine colour, texture, and metalwork. Li (2023) examines how contemporary craftspeople are expanding the boundaries of traditional enamel techniques, particularly plique-à-jour, through hybrid approaches that combine old methods with contemporary materials and technologies. This innovation has opened new possibilities for artistic expression while maintaining the essential qualities that make enamel jewellery distinctive. The demand for handcrafted, unique jewellery pieces has created a market for enamel artists who can offer custom designs that mass-produced items cannot replicate.
Decorative metalwork represents another significant application of enamelling, with artists creating functional and sculptural objects that showcase the aesthetic possibilities of the technique. Alayar and Alrashidi (2024) [3] explore how Islamic art patterns combined with acid etching techniques are enriching contemporary metalwork and jewellery, demonstrating how traditional decorative motifs can be adapted for modern audiences. This blending of cultural influences highlights the dynamic nature of enamelling as an art form that continues to evolve in response to changing artistic movements and technological capabilities.
Architectural applications of enamelling have expanded significantly in recent years, with enamel being used for both interior and exterior decorative elements. Rossi, Russo, and Compagnoni (2020) [26] trace the evolution of porcelain enamel from purely artistic applications to its widespread use in technical and industrial contexts, demonstrating how enamelling has expanded beyond decorative objects to serve practical purposes in architecture and design. Building facades, elevator panels, and interior decorative features increasingly feature enamel elements that combine durability with aesthetic appeal.
Industrial applications of enamelling represent a significant sector that extends far beyond decorative art. Postlmayr (2021) [23] discusses the development and use of enamelled steel in industrial applications, where the technique provides durable, corrosion-resistant coatings for equipment and infrastructure. This technical application demonstrates how traditional craft knowledge has been adapted for modern industrial requirements, with enamel coatings providing protection and aesthetic qualities in demanding environments.
The preservation of traditional enamelling skills represents an important aspect of cultural heritage conservation. Many organisations and educational institutions have established programmes to teach traditional techniques, ensuring that these skills are not lost to future generations. The market for handcrafted, artisanal products has created renewed interest in traditional methods, with collectors and consumers seeking authentic, hand-made pieces that reflect the skill and artistry of the craftsman. The future prospects of enamelling appear promising, as contemporary designers continue to explore the creative possibilities of this ancient technique while adapting it for modern materials and applications. The combination of traditional craftsmanship with contemporary design sensibilities ensures that enamelling will remain a vibrant and relevant art form for generations to come.

Conclusion

Enamelling represents one of the most remarkable intersections of art, science, and craftsmanship in the history of decorative metalwork. This ancient art form has demonstrated remarkable resilience and adaptability, evolving from simple decorative applications in ancient civilizations to sophisticated techniques employed in contemporary jewellery, architectural elements, and industrial applications. The journey through the various enamelling techniques, from the intricate wirework of cloisonné to the spontaneous mark-making of sgraffito, reveals a rich tapestry of cultural exchange, technical innovation, and artistic expression that spans millennia.
The historical development of enamelling demonstrates humanity's enduring fascination with combining colour, light, and metal to create objects of exceptional beauty and durability. From the earliest examples in ancient Egypt and Mesopotamia through the Byzantine and medieval periods to the Renaissance revival and contemporary innovations, enamelling has continuously evolved while maintaining its fundamental principles.
The diverse range of enamelling techniques examined in this study each offers unique possibilities for creative expression. Cloisonné produces vibrant, precisely defined colour fields, while champlevé allows for larger areas of colour revealing underlying metal texture. Plique-à-jour creates translucent, glass-like effects, and basse-taille combines engraving with translucent enamel for subtle visual effects. Grisaille achieves remarkable depth through tonal gradation, while sgraffito offers spontaneous, expressive mark-making. The technical processes involved in enamelling require thorough understanding of materials, precise surface preparation, careful application techniques, and controlled firing

processes. The contemporary relevance of enamelling extends beyond traditional jewellery to architectural applications, industrial coatings, and integration with other artistic techniques.

As contemporary practitioners continue to explore the possibilities of this ancient technique while adapting it for modern materials and applications, the future of enamelling appears bright and promising. The combination of traditional craftsmanship with contemporary design sensibilities ensures that enamelling will remain a vibrant and relevant art form for generations to come.

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