

Hot Enamel and Visual Communications in the Far Eastern Region

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Abstract. The article presents the analysis of Russian and foreign experience in the development of artistic enamel. Hot enamel is a craft and art simultaneously. This kind of creativity unites craftsmen, artists, designers and art historians from different countries: Limoges (France), Cincinnati (USA), La Kurun (Spain), Emalis (Yaroslavl), and others. The union of glass, metal and fire is the area where a master manages to grade up with nature in beauty and deep naturalness. Historical demands of ancient technology determined the indefatigability of the experiment: from the icons and books frames of XV-XVI centuries up-to-date art objects of visual communication in the 21st century. Particular attention is paid to the development of hot enamel in the Far East. It is in the enamel art where the Far Eastern masters, modern artists and designers have developed their own plastic language. It is of special interest to disclose the graphic, expressive, technological properties of the author's technology of hot enamel, which gives special depth and expressiveness to historical and mythological themes developed by the artists. Modern technology of hot enamel is the example of modernization of traditional type of decorative art and applied art. Unpredictability of the process of creating the most complicated alloy invariably requires from the master instant improvisations, innovation in decorative and technological moments.

1. Introduction

The term "emal" comes from the Frankish word "smeltan" that means "melting". The art of hot enamel is an eternal art based on time-tested technology. Metal, fire, glass and the artist's skills and thoughts are the main components of the work of art in the technique of hot enamel.

The flourishing of enamel art in each of the epochs was not only a return to past historical experience, but it was also accompanied by constant innovation in the field of genre, decorative and technological moments.

In the Far East in Japan and China household items were decorated with enamel. In Europe, the most famous are French (Limoges), Hungarian (Kecskemmet) and German (Coburg) enamels. [6] Rostov enamel (finifft) is widely known in Russia. The basis of the welded on white beads was used in Rostov enamel before the beginning of the XX century with the aim of creating strong and durable products. [5]

Currently, enamel is successfully used in various spheres: in architecture, in interior design, in jewelry, objects of visual communications environment. In the artistic practice along with the most valuable results in jewelry, in iconography, in miniature paintings also confirmed the right of existence on experiments in the hot enamel, which safely and successfully entered the artistic and visual space of Russian Far East. New principles of art-making and spatial constructions, proposed and mastered by enamel artists and artist-designer helped the birth of the union of decorative and picturesque beginning, applied and easel art gave hot enamel coloristic subtlety of watercolor, discipline of graphics, iridescence of Russian print style, compositional completeness of stained glass.

Thanks to the initiative of artists and designers from Moscow and St. Petersburg, since 1986 in the Russian Far East, the traditional art of enamel has been actively developed and spread.



Currently modern masters have a large range of materials, that help to experiment to create a strong and durable coatings in artistic and decorative works in the technique of hot enamel, and their implementation in the conditions of extreme continental climate of the Far Eastern region.

2. Main body

Preparation the product for enamel:

As a material for enamelling copper grade M1 is used. The metal plate is cleaned of various contaminants, oxide films, and the like for better bonding of copper with enamel. This is done by mechanical cleaning on the scratchbrushes (brass or nylon), followed by degreasing and etching in nitric acid or bleaching in a weak solution of sulfuric acid. When enameling copper or tombac products, the cleaned preform is heated in the furnace until the finest, oxide film (from the contact of the hot metal with the oxygen of the air) appears on the surface of the metal. This film is connected to the metal and promotes strong connection of the enamel with the metal during the firing process.

The product thus processed is removed from the oven, allowed to cool, and then the enamel is applied.

Enamel application.

Foreign manufacturers supply enamel in the form of comminuted powder, that allows to obtain thin overflows on the surface of products. The Russian industry produces enamel in the form of tiles. Likino-Dulevskaya enamel has a weight of tiles of 250-300 grams (Figure 1).



Figure 1. Enamel in ingots, transparent and opaque

To work it must be turned into a powdered state. The powder should be sufficiently fine (up to 0.01 mm), since large particles are difficult to distribute evenly over the surface of the metal. Opaque enamel is ground to a fine powder, and transparent - to fine grains, since this determines the strength of the glow of the enamel. However, a very fine powder after firing on products forms cloudy spots (especially with regard to transparent enamels). It is very important that the grains in the ground enamel are approximately the same size, as the fine grains melt much faster and can burn out before the largest grains start to melt. As a result, the color of the enamel becomes dull, and sometimes dirty (especially with transparent enamels). Therefore, to remove excessively fine (pulverized) particles formed during grinding, the powder is washed with water. The ground enamel is repeatedly stirred in water - large particles quickly settle on the bottom, and fine dusty in the form of turbidity merge. In each case, the enamel must be washed the way that the water remains clean. With opaque enamel, water can be slightly cloudy. Small porcelain cups are filled with enamel mass and the enamel number is marked. If the enamel is not all used on the same day, the residue is stored in water to avoid drying out. Cups are placed under a glass cap, so that the enamel is not dusty. [1]

In large factories, enamel is ground on ball mills (Figure 2), and in laboratories it is pounded in mortars made of strong materials (jasper or agate). Pestles for mortars are also made of stone (jasper or agate) inserted into a wooden handle. Glass mortars and pestles can also be used but they are quickly scratched, but the glass particles that enter the enamel do not harm it. One can also use a porcelain mortar. [2]

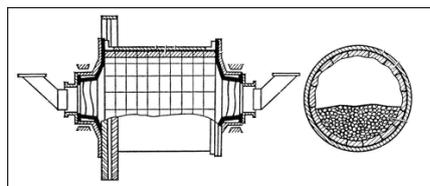


Figure 2. Ball mill

To eliminate conflict color combinations that lead to the cracking of enamels, it is necessary to make color probes (Figure 3).



Figure 3. Color probes

There are two ways of applying enamel on the product: manual and machine. The manual method consists in the following: the ground enamel is mixed with water and in the form of a gruel impose on the product with the help of brushes or a special tool - a narrow metal spatula. To level the enamel layer, the product is lightly shaken. The manual method is usually used when applying enamel on small surfaces of complex configurations and profiles, for example, in stamping or jewelry. [3]

The work is carried out in the following order. Using a damp brush from the artificial column №№ 00, 0, 1-6, a little enamel is taken from the porcelain cup and applied to the prepared metal surface, leveled with a light tapping along the edge of the product. When firing, individual colors can change color: so, red after many firing can become black. During the firing process, the paint layer may lag behind the metal surface. This may occur due to insufficient defatting of the metal, insufficient melting point. In order to exclude such errors it is necessary to take into account the characteristics of the paints: refractory and low-melting.

Sometimes in work it is necessary to get such decorative effect as crazings. To do this, it is possible to use Dyulevskaya and Cherepovets (technical) enamel. The prepared surface is first applied with a Dulev enamel of at least 1 mm, firing is carried out, then liquid technical enamel is applied. After the paint layer has dried, the firing is repeated. Due to the difference in temperature and the removal of excess moisture, the paint layer breaks and further penetrates to obtain a beautiful decorative effect of the crack (the effect of aging). The firing temperature of the Dulev enamel is 740 ° C, the Cherepovets technical enamel is 810 ° C.

Enamelling of flat surfaces enamel is simultaneously applied to both sides of the plate. And the enamel applied to the reverse side of the product is called counter-enamel and serves to prevent warping of the product, which is inevitable due to the different coefficient of linear expansion of enamel and metal.

After the application of the enamel, the product is carefully dried, as the remaining water boils when the enamel is fired, and there can be a fault in the product in the form of bubbles, voids, etc. (Figure 4).

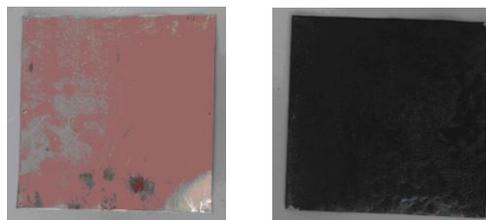


Figure 4. Counter-enamel

To apply counter-enamel ready-made soil of the Cherepovets plant "Severstal" is used, or it is made by hand, when ready-made soil is applied in 2-3 mm, allow to dry and burn at a temperature of

800-810 ° C. The product is taken out of the oven at a temperature of 800 ° C and pressed down to the full cooling. It is necessary to prevent the surface of the product from deformation.

As with septate and with the champléve enamel depressions or cells are not completely filled, since some enamel varieties become cloudy and dull if they are applied too thickly. The total height of the enamel layer is achieved by gradually filling the cell and sometimes requires from two to four consecutive firing.

Another manual method of applying enamel is applying the enamel ground into the powder onto the prepared surface.

The machine method is used to enamel large flat surfaces. Milled, well-sieved enamel is mixed with water, into which dextrin, urea additives (2-2.5 g per 1 liter of slip) and others are added and applied to the surface with a special airbrush, while ensuring that the layer is uniform and not fat.

3. Firing enamel

It is desirable to burn the enamel immediately after applying the enamel - the unbaked enamel is fragile and unstable. First, it is necessary to remove (suck) the water, attaching a piece of paper to the edge of the product. Then the prepared objects are dried, putting them on top of the heated muffle, until the powder becomes dry (the steam will cease to stand out). If a piece of enamel disappears when drying or when planting, a raw enamel should not be added, since at this place dull spots are obtained. This place should be fixed with dry enamel powder. One can also burn the whole object and fix it after baking, or remove the whole powder and apply it again. [4]

The enamels are burned at a temperature of 600-800 ° C. It is best to use electric ovens with open spirals. Such furnaces are very efficient and economical. Small jewelry is placed in a conventional electric oven - laboratory-type muffles with a closed winding. For burning enamel it is possible to use both a gas flame and other sources of heat. However, in all cases, the flame should not come into contact with the enamel surface, as soot, getting into the enamel, can spoil the product. Therefore, usually an open flame is sent to the reverse side of the product.

Every object that is burned in a furnace must be placed on a special stand, the quality of which largely depends on the success of the burning.

The stand must meet the following requirements:

- a) do not change the shape when heated;
- b) do not join the molten enamel cover;
- c) should not stick to enamel;
- d) do not form scales on its surface.

The best stands are made of nickel or nickel alloys, as well as from heat-resistant (chromium-nickel) steel, as they are less deformed and oxidized when heated. Asbestos stands are also used, but they can be used only when the enamel is not on the surface, but inside. On stands made of simple steel with high heating, scale is formed, which easily falls off, fused into the enamel and leaves black spots. To avoid this, an old, tried-and-true method is used: the steel stands are carefully rubbed with chalk so that scale does not form. The forms of the stand are determined by the shape.

Different enamels have different melting points, therefore, before embedding the enamel on the product, it is necessary to check the temperature range of melting of the most fusible and the most refractory enamels chosen for work. For this, on a small plate of the same metal as the product itself, all enamels to be tested are applied and, after drying, they begin to heat. If the range of melting temperatures of enamels is small, the results are positive and one can proceed to the enamel coating of the product. However, sometimes as a result of the test, it is found that fusible enamels burn out at the melting temperature of refractory enamels. In this case, they are either completely excluded from production, or proceed as follows: first, all refractory enamels are burned, and then the missing fusible colors are added and burned again at a lower temperature.

As the surface of the enamel is heated, it becomes even and acquires a glassy sheen. After that, the product is quickly removed from the oven and it gradually cools down.

Products are burnt in a certain order. The furnace is heated to a certain temperature. The dried product on the stand is pushed into the oven with special crucibles. First, the enamel is caked in a spongy mass, becomes viscous; when the surface becomes smooth and red, the product is removed from the oven.

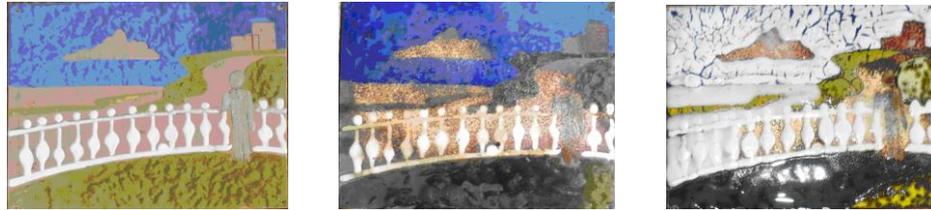


Figure 5. Stages of the work in the technique of hot enamel using Dulevskih paints

Figure 5 shows the stages of obtaining products with the Far Eastern theme in the technique of hot enamel.

Conclusion

The use of artistic and jewelry enamels of Russian manufacturers allows not only to improve the color of products, but also to increase the strength of the enamel coating (temperature resistance, moisture resistance and durability). Decorative characteristics allow to expand the possibilities of creating products of art. The offered materials are accessible from an economic point of view and allow the designer to apply artistic enamels not only as a material, but also a means of visual communication.

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