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The use of patinated panels in curtain walling

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Introduction

Patinas occur in everyday life all around us. A patina is a film formed on copper, bronze and other metals or alloys by natural weathering or by artificial treatment with chemicals. The change of an object's surface is a result from oxidation over a period of time. Different metals oxidize or tarnish in different ways and the raw shiny metal takes on a new character. Normally this process is a result of natural ageing producing a brown, green, or reddish coloration. A green patina is developed on objects outside due to the environment. A chemical patina is also possible and the advantage is that it can be produced in a short time with a predictable appearance. The aim of chemical patination is to create an atmosphere or environment for the process to occur quickly.

For the project One Hyde Park, London, Scheldebouw B.V. was involved in developing patinated panels having a natural look with variable texture and color. Patination is usually applied for art objects and the original method is not suitable for large quantities of panels because it is time consuming. An alternative automated patination process has been then developed, in collaboration with an artist (Mr. Dieleman), to use patinated panels in curtain walling. The developed automated patination process and the use of patinated panels in curtain walling are unique. Scheldebouw B.V. is the first company which has an automated patination method for panels.

This technical paper concerns the developed patination process and the use of patinated panels in curtain walling. The different steps of the developed method are described in this paper. The process is developed for a specific red / brown color and specific texture specified by the client. For other specific color and texture the main principles should be the same, but some steps and / or products would have to be modified. During the development several difficulties came up. The use of patinated panels in curtain walling has an impact on the design, production, installation and maintenance. The risk assessment of using patinated copper alloy as an aesthetic panel in curtain walling is discussed.

KEYWORDS

1= Patination; 2= Panels; 3= New method

Aims

An automated patination process is developed to make patination, which is usually applied for art objects, suitable for large quantities. The developed process should make it possible to get a constant quality of the patinated panels. For the project One Hyde Park patinated spandrels and fins are developed. The patination process itself will be the same. However the shape will influence some steps of the total process, for example on the design of the crates.



Figure 1: One Hyde Park



Figure 2: Spandrels and fins

Description process

The developed process could be divided in several steps:

1. Cleaning

After removing the protection sheet, the panel should be degreased. Special attention should be given to oil residues. If any oil residue is present on the back, it should be cleaned. Even oil residues on the back of the plate give a strong disturbance on the patinated plate at the front because they pollute the immersion baths.

2. Sanding

The applied disc of the sander determines the final texture of the panel. Random sanding is needed to get a homogeneous structure without any pattern. A hand-sanding machine must be used to avoid straight lines and it is recommended to exchange people after each different step of sanding to avoid recognizable patterns. All traces of mechanical operations must be sanded. At the last stage, surface finishing, there should be absolutely no pollution on the plate. One must provide clean gloves, clothes and materials to the workers. A dust extraction system must be used to limit the quantity of polluted air. The chemicals in combination with polluted air will cause danger for explosions by static electricity.



Figure 3: Hand-sanding

3. Patination

Storage is not allowed after sanding the panels because a new oxide surface will occur. The patination process should start immediately. Also the patination process itself should be a continuous process. A good alignment of the immersion baths is necessary. Some steps are time consuming; this should also be taken into account. For the project One Hyde Park brass, which is an alloy of copper and zinc, is used. The aluminium clams supporting the plate during the whole process provide discoloration at the corners and the places of the clams due to the different potential of the metals. It is recommended to use screws with the same material.



Figure 4: Immersion baths (6 meter)

The different steps of the patination process are summarized in the following table.

Activities	Equipment	Product
1. Degrease	Immersion bath	Elodal*
2. Rinse	Immersion bath	Tap water
3. Decapation	Immersion bath	Elodal*
4. Rinse	Immersion bath	Demi water
5. Heating	Immersion bath	Hot demi water (80°C)
6. 1st colouring	Manually - spray	Elodal*
7. Rinse and cooling	Immersion bath	Tap water
8. 2nd colouring	Immersion bath	Elodal*
9. Rinsing	Immersion bath	Tap water
10. Colorstabilisation	Immersion bath	Hot demi water (80°C)
11. Washing	Manually - brush	Running tap water

* The specific product type will not be mentioned in this paper

The panel is predisposed to the patina-color process by decapation, because it is removing the external oxidized layer. This is an essential step in the total process and determines the end result. The color of the patinated panel is dependent on the time and the quality of the bath. The time and immersion bath concentration should be followed strictly, otherwise differences in color will occur. In this specific case, where a brass plate is used, the zinc on the surface will be removed by decapation and this gives the reddish color to the patina. If this step takes longer, a redder patina will be formed.

The first coloring is done manually. The plate is in horizontal position on a tilt table. A variable amount of color liquid is sprayed on the hot plate. The color liquid is applied as spray, drips, dab and with a cloth or brush. This manner of applying the liquid color creates an organic-variable image on the plate. This determines the visual nature of the plate and where necessary or desirable, to manipulate. The temperature of the metal and the concentration of the color liquid determine the color of the panel. Solid plates, without holes, remain hot longer and will color faster. This should be taken into account by using different types of panels.

The second coloring is a short (20 to 40 seconds) immersion of the plate. This short period is sufficient to complete the coloring and to produce the color desired. It is essential to move the plate quickly in and out of the immersion bath, otherwise the coloring will occur unequally. The correct speed prevents a continuous darker coloring on the bottom. A mechanical adaptation is necessary.

An unambiguous interpretation of the concepts of color and structure is needed and sample boundaries should be defined.



Figure 5: First colouring (manually)



Figure 6: Second colouring

The daily production capacity is driven by the throughput of the patination step in the overall process.

4. Conservation

A protective layer is applied on the panel as weather protection. In this case a wax is manually applied on the panel, first on the back. The back should be treated to prevent run off tracks to the construction. Then a Renaissance Wax Polish is applied on the front in several layers. After this step, the panel is ready for assembly.

5. Assembly

Special instructions should be given to fix the back structure manually. Contact of the plate with the skin should be avoided. The acids and salts that are present on the skin affect the plate. Latex gloves together with cotton gloves should be worn. The latex gloves to avoid sweat (acid and salt) on the plate and cotton gloves to prevent scratches. Further special tools are necessary for fixing the back structure, because the patinated surface should not come into contact with anything.



Figure 7: Assembly



Figure 8: Final conservation

6. Final conservation

The final wax layer is applied manually after assembly.

7. Storage

The patinated panels should be handled with care. After conservation storage is only possible if the patina surface is 100% free, stacking with something soft between them is not possible. Special crates are developed to store the panels. For the project One Hyde Park different crates are used for the spandrels and the fins. A special system is developed for transportation of fins so that the fins would be kept hung. Moreover after the final conservation the patina should not be touched with hands, even with the use of gloves touched places should be treated.

In practice, the material is particularly sensitive to cement. This in combination with water gives irreparable stains. Individual packaging could protect the patinated panels during storage, transportation and installation.



Figure 9: Storage spandrels



Figure 10: Storage fins

8. Installation

As with the previous steps, special attention should be given to the patinated panels. Moreover special tools are necessary during the installation. All fins are designed so that the patina layer will not go into contact with other metals. This should also be taken into account during installation, otherwise contact corrosion occurs.

9. Maintenance

The maintaining of the patina depends on the climate. UV and ageing tests were made. However patinated panels in curtain walling are not commonly used and there are no standards available for patinated panels. The tests are done according to the standard for anodizing. Discolorations will occur and no guarantees will be given. The real behavior of the patinated panels during the years is dependent on the climate and on the applied wax. The color of the patina will darken as a result of ageing. Because of the patina, the natural green copper oxide could not appear. If the windows are washed or the façade is cleaned, one must take into account the patinated panels. The used cleaning installation or cleaning agents could damage the patinated panels. Cleaning or rewaxing the patinated panels itself should be done according to the method given by the wax's manufacturer.

Conclusions

The developed automated patination process is unique and is suitable for large dimensions (6 meter immersion baths) and large quantities of panels. However some steps must be done manually, but the manually first coloring is a special step in the total process which gives the panels a natural look with variable texture and color. This is not possible if this step is automated. The color and structure will be plain and it will look more like an anodized surface. With the developed process a constant quality of the panels is possible if all times and concentrations are followed and maintained strictly. The patination process should be a continuous process, which make a good alignment of the immersion baths necessary. The process is very sensitive to impurities, for example contaminated immersion baths, dirty equipment, dirty gloves and cleaning cloths, contamination by skin contact, packaging. Special attention is necessary during the whole process. People should be aware of the quality and character of the material. Special tools should be developed to avoid contact of the plate with the skin. Storage is only allowed if the patina surface is not into contact with anything. In some cases new crates should be developed dependent on the shape of the panel. The use of patinated panels has impact on design, production, installation and maintenance.