

PERFORMANCE SHEET

HOUGHTO-COLOR® PSC

Overview

HOUGHTO-COLOR® PSC is an electrolytic color product for use after the tin electrolytic color process, HOUGHTO-COLOR® A-580, to create a variety of copper colors. With proper control of both the copper and tin electrolytic color tanks, HOUGHTO-COLOR® PSC gives a broad range of colors from a light earthy copper, through adobe brick and a rich mahogany, to a deep, vibrant Bordeaux color. With a base of tin electrolytic color and proper sealing chemistries, products colored with HOUGHTO-COLOR® PSC are stable to UV light and other environmental factors.

Benefits

- Metallic process
- Colorfast when used with tin electrolytic color base, unlike organic dyes
- Wide array of colors depending on tin and copper electrolytic color parameters.
- Electrolytically applied
- Reproducible color
- Meets or exceeds AAMA 611 specifications
- With proper preventative maintenance, bath life can be measured in years

Copper versus copper-anodized aluminum in architecture

HOUGHTO-COLOR® PSC is used to impart a variety of copper colors to anodized aluminum. Copper has been used for millennia in architectural applications, especially in buildings in the past century because of its range of colors not available in other traditional metals, and relatively low corrosion under ideal conditions. Two main drawbacks of using copper in architecture are: (1) the color changes over time, going from raw copper-red through red-brown to black or the famous grayish-green patina; and (2) the copper corrodes significantly in the presence of acid rain, and it induces galvanic corrosion in other metals.

Properly anodized and sealed aluminum colored with HOUGHTO-COLOR® PSC is stable to the environment when a base layer of electrolytic color using a product such as HOUGHTO-COLOR® A-599 is used. This stability allows the designer to capture a particular color range that, to maintain on copper metal, would require either a clearcoat which would require periodic reapplication or regular cleaning and maintenance, which would be both time-consuming and also introduce dissolved copper, which is toxic to marine life, into



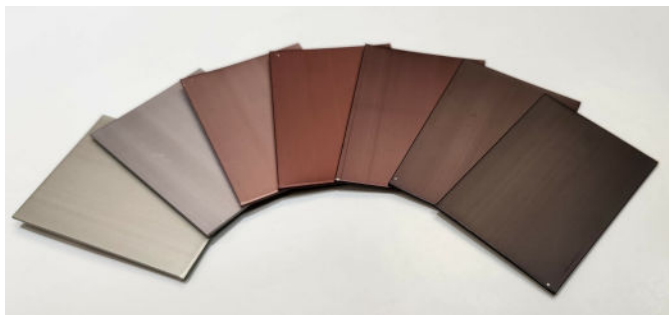
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any cleaning effluent generated. The range of colors achievable using HOUGHTO-COLOR® PSC is much greater and more controllable than for copper metal.

Copper-colored anodized aluminum is advantageous in other respects. It has less than half the density of copper metal, allowing for more flexible use from an engineering perspective. The price of aluminum is lower and more stable than copper's.

Copper Color Range

In general more tin leads to browner, earthier tones, and more copper leads to red and even purple tones. The perception of the desired color can be further optimized by controlling the matteness. A non-exhaustive list of colors achieved includes: weathered penny, brick red, adobe brick, bordeaux, milk chocolate, dark chocolate, café au lait, cedar, and mahogany, in addition to warmer versions of the 2-step champagne to bronze.



Copper anodize process and specification

Copper-colored anodized aluminum is achieved through a three-step electrolytic process. In the first step, porous anodic aluminum oxide is formed, which can develop some amount of color depending on the alloy. Then, tin is electrolytically deposited in the pores, as is the case for a typical two-step color process. In the two-step process, the range of colors is functionally a one-dimensional line, ranging from champagne to bronze to black.

With the addition of a third step, the range of color becomes a two-dimensional plane, where the axes represent the amount of tin and copper deposited, greatly expanding the palette of colors available to the anodizer, with more vibrant colors developed when using less tin. With more tin, the colors tend towards more muted, earthier tones, similar to those specified and used in sporting and military applications.

The final color of the copper-colored anodized aluminum is sensitive to the amount of tin deposited, especially at the more vibrant end of the color palette. As a result, the range of acceptable colors for copper-colored aluminum should be more broad than two-step electrolytically colored parts. Even staying within that broad range can be difficult if the anodize line operation is inconsistent. Therefore, HOUGHTO-COLOR® PSC is recommended only for anodizers with robust operations, that result in a consistent product.



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Examples of HOUGHTO-COLOR® PSC in architecture

HOUGHTO-COLOR® PSC was trialed on customers using a competitor copper product. Initial panels and extrusions colored with HOUGHTO-COLOR® PSC displayed vibrant even colors, and immediately passed AAMA-611 specifications for corrosion and appearance. The tank has been in use for four years without dumping, only being periodically transferred out of the tank for regular preventative maintenance. Extrusions and sheets colored in HOUGHTO-COLOR® PSC are on a number of buildings, many with interesting architectural designs.

One example is the Mountain View Corporate Center in California's Silicon Valley. Two types of panels are colored with HOUGHTO-COLOR® PSC: one resembling plank wood paneling and the other reminiscent of wood acoustic paneling. The range of colors displayed on a single building goes from a light sandy copper to a richer brown color, in the same way, that wood has variations in color.

Another example, The Mississippi Arts building exploits the broad perceptible range of anodized copper in its design. The anodized aluminum panels colored to a light copper are arranged in a standard running bond pattern used for brick, doubling the red brick below but at a much greater scale.

