Anodizing processes are provided for coloring a metal component in a random pattern with one or more colors. Positive effect anodizing process advantageously includes steps of preparing the metal component, repeatedly coloring the metal component, sealing the color(s) and stripping the sealant, followed by application of UV coating. Negative effect anodizing process advantageously includes steps of preparing the metal component, repeatedly sealing the metal component, stripping the sealant, and coloring the metal component, followed by application of UV coating.

10

15 Cleaning Raw Material

20 Chemical Buffing

25 Etching

30 Surface Preparation

35 Colorant Bath

40 Sealing

45 Sealant Stripping

50 Is Another Color Desired?

Y

N

55 UV Coating
Fig. 1

12
14
16

15  Cleaning Raw Material
20  Chemical Buffing
25  Etching
30  Surface Preparation
35  Colorant Bath
40  Sealing
45  Sealant Stripping

Is Another Color Desired? Y
N
50
55  UV Coating

Fig. 2

15  Cleaning Raw Material
20  Chemical Buffing
22  Logo Printing
25  Etching
30  Surface Preparation
35  Colorant Bath
40  Sealing
45  Sealant Stripping

Is Another Color Desired? Y
N
50
55  UV Coating

Fig. 3
Fig. 4

110 - Cleaning Raw Material
120 - Chemical Buffing
125 - Etching
130 - Surface Preparation
135 - Sealing
140 - Sealant Stripping
145 - Colorant Bath
150 - Is Another Color Desired?
155 - UV Coating

Fig. 5

110 - Cleaning Raw Material
120 - Chemical Buffing
122 - Logo Printing
125 - Etching
130 - Surface Preparation
135 - Sealing
140 - Sealant Stripping
145 - Colorant Bath
150 - Is Another Color Desired?
155 - UV Coating
MULTI-COLOR ANODIZING PROCESSES
CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application Ser. No. 60/501,768, filed Sep. 10, 2003.

BACKGROUND OF THE INVENTION

[0002] 1. Technical Field of the Invention

[0003] The present invention relates to the anodizing processes, particularly anodizing processes for adding one or more colors to raw material metal components.

[0004] 2. Description of the Related Art

[0005] Aluminum anodizing converts the surface of an aluminum component into aluminum oxide by an electrochemical process. Oxide forms naturally on untreated aluminum but the anodizing process produces a coating that is uniform, much harder, and denser than natural oxidation. By converting the surface to aluminum oxide, the component resists corrosion better, has increased durability, and resists wear. Generally in anodizing processes, a cathode is connected to the negative terminal of a voltage source and placed in the solution in which the aluminum component is submerged. The aluminum component is connected to the positive terminal of the voltage source and also placed in the solution. When the circuit is turned on, the oxygen in the anodizing solution will be liberated from the water molecules and combine with the aluminum on the part forming the aluminum oxide coating.

[0006] The anodic film is formed by converting the surface of the component into aluminum oxide, as described herein. The anodizing process can be used to add colors to aluminum components, instead of painting the aluminum components. Unlike paint, which can flake off if not applied properly, anodized finishes are actually formed from the original material and cannot flake off. The aluminum oxide finish is very hard and exceptionally wear resistant. The finish can also be impregnated with materials, such as fluorphoropolymer resins like Teflon®, to further enhance resistance to wear. Many current processes only allow for the metal components to be colored with an all-over single color.

[0007] A need exists for a process that would provide a multi-colored metal components, without having to resort to painting. It would also be advantageous to provide metal components that are aesthetically pleasing for use in consumer products.

SUMMARY OF THE INVENTION

[0008] In order to meet one or more of these goals, the present invention advantageously includes a process for colorizing metal components that provides for at least one color to be applied to a metal component without resorting to painting the component. The process can be varied depending upon how many different colors are desired. The process can be used to produce such items as multi-colored makeup brushes, bottle caps, and a variety of other products.

[0009] In one embodiment of the present invention, an anodizing process for coloring a metal component in a random pattern with one or more colors is provided. This process advantageously includes preparing the metal component for coloring; dipping the metal component in a colorant bath to apply a color to the metal component; dipping the metal component in a sealant to seal the color applied to the metal component with a direct electrical current passing through the metal component; stripping the sealant away from the metal component in a random pattern; and repeating the steps of dipping the metal component in a colorant bath followed by dipping the metal component in a sealant and stripping the sealant away if additional colors are desired. After the desired number of colors has been added to the metal component, UV coating is added to the metal component with a direct electrical current passing through the metal component.

[0010] In another embodiment of the present invention, an anodizing process used for coloring a metal component in a random pattern with one or more colors is provided. This process advantageously includes preparing the metal component for coloring; dipping the metal component in a sealant with a direct electrical current passing through the metal component; stripping the sealant away from the metal component in a random pattern; dipping the metal component in a colorant bath to apply a color to the metal component; and repeating the steps of dipping the metal component in a sealant followed by stripping the sealant away and dipping the metal component in a colorant bath if additional colors are desired. After the desired number of colors has been added to the metal component, UV coating is added to the metal component with a direct electrical current passing through the metal component.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] So that the manner in which the features, advantages and objects of the invention, as well as others which will become apparent, may be understood in more detail, more particular description of the invention briefly summarized above may be had by reference to the embodiment thereof which is illustrated in the appended drawings, which form a part of this specification. It is to be noted, however, that the drawings illustrate only a preferred embodiment of the invention and is therefore not to be considered limiting of the invention’s scope as it may admit to other equally effective embodiments.

[0012] FIG. 1 is a perspective view of each step within the anodizing process in accordance with an embodiment of the present invention;

[0013] FIG. 2 is a simplified block diagram of an anodizing process for adding one or more colors to an aluminum component, known as positive effect anodizing, in accordance with an embodiment of the present invention;

[0014] FIG. 3 is a simplified block diagram of an anodizing process for printing a logo on an aluminum component followed by adding one or more colors to the aluminum component, known as positive effect anodizing, in accordance with an embodiment of the present invention;

[0015] FIG. 4 is a simplified block diagram of an anodizing process to add one or more colors to an aluminum component, known as negative effect anodizing, in accordance with an embodiment of the present invention; and

[0016] FIG. 5 is a simplified block diagram of an anodizing process for printing a logo on an aluminum component.
followed by adding one or more colors to the aluminum component, known as negative effect anodizing, in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0017] As illustrated in FIGS. 1-5 and as further described herein, the present invention advantageously provides a process for colorizing metal components with one or more colors without resorting to painting the component.

[0018] As an embodiment of the present invention, the process for colorizing metal components with one or more colors advantageously includes preparing the metal component for coloring. A raw material metal component, typically made of aluminum or any other suitable metal known to those skilled in the art, is first immersed into an acid-based cleaning solution. The cleaning solution generally comprises a cleansing material, such as Al Clean Paste; oil of vitriol, or sulfuric acid; and water. The metal component is then chemically buffed, which is performed by dipping the metal component into a mixture of phosphoric acid, hydrogen nitrate, and oil of vitriol, or phosphoric acid, hydrogen nitrate, and sulfuric acid. Once the metal component is buffed, the surface of the metal component is then etched, which changes the finish of the metal component to a matte finish. The metal component surface is further prepared to enhance the adhesion of color to it by dipping the metal component in a mixture of oil of vitriol and water with a direct electrical current passing through the metal component in accordance with general anodizing processes.

[0019] In this embodiment, as another feature, the process can be modified by including a logo on the metal component. The logo can be advantageously printed on the metal component with a strong ink following the step of buffing and prior to the step of etching. The metal component is then baked to enhance the adhesion of the ink to the metal component.

[0020] Once the metal component has been prepared for coloring, the process advantageously includes dipping the metal component in a colorant, or dye, and water bath to apply a color to the metal component. The colorant is a viscous material with a consistency resembling syrup. Water is added to the colorant until the desired consistency of the colorant is achieved.

[0021] After the color has been applied to the metal component, the process advantageously includes dipping the metal component in a sealant to seal the color applied to the metal component with a direct electrical current passing through the metal component. The sealant advantageously comprises Top Seal DX-200 and water.

[0022] Following the step of sealing, the process for coloring metal components in a random pattern with one or more colors advantageously includes stripping the sealant away from the metal component in a random pattern by dipping the metal components in pure oil of vitriol for less than one second. It is important to ensure that the metal component is completely vertical to prevent the acid from collecting inside the metal component. The acid will cause corrosion within the metal component if the acid is allowed to remain within the metal component. The oil of vitriol will burn, or strip away, portions of the sealant and color in a random pattern to allow the original metal color of the metal component to show through. This provides a two-tone color effect on the metal component. For example, if the dye chosen was red and the original metal component was a silver colored metal component, the finished metal component would be two-toned that was primarily red overall with silver randomly swirled within the red color.

[0023] Additional colors can be added to the metal components by repeating the above coloring, sealing and sealant stripping steps, if desired. To add an additional color, the metal component is submerged into a second colorant bath having a different color than the first colorant bath. The metal component is then sealed again. The sealant on the metal component is then stripped again with the pure oil of vitriol. This process can be repeated for as many additional colors are desired.

[0024] Once the desired number of colors has been added to the metal component, UV coating is then applied to the metal component with a direct electrical current passing through the metal component. This is to prevent deterioration of the colors on the metal component. The UV coating can be an acrylic-based coating. Other coatings will be known to those skilled in the art and are to be considered within the scope of the present invention.

[0025] This process can be used for making multi-colored products including multi-colored makeup brushes and multi-colored bottle caps. The resulting multi-color product is a multi-colored metal component that comprises random patterns of dominant dyed color intermingled with subordinate base color of the metal component. This process is referred to as positive effect anodizing.

[0026] As another embodiment of the present invention, the process can be varied slightly to produce a different effect on the coloring of the metal component. This second embodiment is referred to as negative effect anodizing. The effect of the negative effect anodizing process is that the base color of the metal component is dominant with the dyed colors being subordinate to the metal base color.

[0027] In this second embodiment, the metal component is cleaned, buffed, etched, and the surface is prepared, as in the first embodiment. Once the surface is prepared, the metal component is sealed with a sealant. The sealant is then burned, or stripped away, by submerging the component in pure oil of vitriol for less than one second. The stripping step exposes random portions of the component that will be receptive to receiving one of more dyes. The component is then dyed in a colorant bath.

[0028] Still in this second embodiment, as another feature, the process can be modified by including a logo on the metal component. The logo can be advantageously printed on the metal component with a strong ink following the step of buffing and prior to the step of etching. The metal component is then baked to enhance the adhesion of the ink to the metal component.

[0029] Additional colors can be added to the component in this process. If additional colors are desired, the component is sealed after the colorant bath, the sealant is then stripped away, and then another color is added with another colorant bath using a different color. This process can be repeated for as many additional colors are desired. Once the number of
desired colors has been added, a UV coating is then added to the metal component to protect the colors.

[0030] In each step of each embodiment of the present invention, the mechanism to perform each step of each process embodiment is essentially the same, as shown in FIG. 1. A metal component 12 is submersed, or dipped, into a solution 16 contained within a reservoir 14. Solution 16 varies for each step of the processes, as described herein. An electrical current may also be passed through metal component 12 in various steps throughout each embodiment of the present invention in accordance with general anodizing processes. In each step requiring the use of electricity, it is important to maintain a constant electrical current.

[0031] FIG. 2 illustrates a first embodiment of the present invention that advantageously includes a process for colorizing metal component 12. This process provides for more than one color to be applied to metal component 12 without resorting to painting the component 12. The process 10 can be varied depending upon how many different colors are desired. The process 10 can be used to produce such items as multi-colored makeup brushes, bottle caps, and a variety of other products.

[0032] As an embodiment of the present invention, the process 10 advantageously includes the step of immersing a raw material metal component 12 into an acid-based cleaning solution (block 15). Metal component 12 is typically made of aluminum or any other suitable metal, which will be known to those skilled in the art. The acid-based cleaning solution generally comprises a cleansing material, oil of vitriol, and water. A suitable cleansing material can be AL Clean Paste produced by Dong Nam Chemical Co., Ltd. in Korea. Other suitable cleansing materials will be known to those skilled in the art and are to be considered within the scope of the present invention.

[0033] Metal component 12 is then chemically buffed (block 20). The buffing step (block 20) is performed by dipping the metal component into a mixture of three acids, phosphoric acid, hydrogen nitrate, and oil of vitriol, or sulfuric acid.

[0034] Once metal component 12 is buffed, metal component 12 is then etched (block 25). The etching step (block 25) generally comprises dipping, or submersed, metal component 12 into a solution comprising ammonium hydrogen fluoride and water. The etching step (block 25) changes the surface of metal component 12 to a matte finish. The surface of metal component 12 is then prepared to enhance the adhesion of color to it by dipping metal component 12 in a mixture of oil of vitriol and water (block 30) with an electrical current passing through metal component 12.

[0035] A first color is then added to the component by dipping the metal component in a colorant, or dye, and water bath (block 35). The colorant is a viscous material with a consistency resembling syrup. Water is added to the colorant until the desired consistency of the colorant is achieved. A sealing material is then added to metal component 12 by dipping metal component 12 into the sealing material (block 40) to seal in the color on metal component 12. Sealing material comprises a sealant, such as Top Seal DX-200 produced by Okuno Chemical Industries Co., Ltd. in Japan, and water. Other suitable sealants will be known to those skilled in the art and are to be considered within the scope of the present invention.

[0036] Metal component 12 is then dipped into pure oil of vitriol for less than one second (block 45). It is important to ensure that metal component 12 is completely vertical to prevent the acid from collecting inside metal component 12. The acid will cause corrosion within metal component 12 if the acid is allowed to remain within metal component 12. The oil of vitriol will burn, or strip away, portions of the sealant color in a random pattern to allow the original metal color of metal component 12 to show through. This provides a two-tone color effect on metal component 12. For example, if the dye chosen was red and metal component 12 was silver colored aluminum, the finished metal component 12 would be two-toned, with a primary, or dominant, color of red overall with silver randomly swirled within the red color.

[0037] Additional colors can be added to the aluminum component, if desired (block 50). To add an additional color, metal component 12 is submerged into a second colorant bath having a different color than the first colorant bath (block 55). Metal component 12 is then sealed again (block 40). The sealant on metal component 12 is then stripped again with the pure oil of vitriol (block 45). This process can be repeated for as many additional colors are desired.

[0038] Once the desired number of colors has been added to metal component 12, a UV coating is then applied to metal component 12 to prevent deterioration of the colors on metal component 12 (block 55). The UV coating can be an acrylic based coating. Other coatings will be known to those skilled in the art and are to be considered within the scope of the present invention. An electrical current passing through metal component 12 is required in the step of adding the UV coating.

[0039] The result of this process is a multi-colored metal component 12 that has random patterns of colors intermingled with the base color of metal component 12. The dyed color is dominant with the base color of the metal component being subordinate. This process is referred to as positive effect anodizing.

[0040] Alternatively, a logo can be put on the metal component 12 along with multi-coloring as illustrated in FIG. 3. In detail, after the metal component 12 is cleaned (block 15) and chemically buffed (block 20), a logo can be printed on the base color of the metal component 12 with a strong ink and the metal component 12 further baked to ensure the adhesion of the ink thereto (block 22). Following the logo printing, the metal component 12 is then etched (block 25).

[0041] As described in FIG. 4, another embodiment of the present invention is advantageously provided. In this embodiment, the first embodiment process is varied to produce a different effect on the resultant coloring of metal component 12. This second process embodiment 110 is referred to as negative effect anodizing. The effect of the negative effect anodizing process is that the base color of metal component 12 is dominant with the dyed colors being subordinate to the metal component base color.

[0042] In this second embodiment 110, metal component 12 is cleaned (block 115), buffed (block 120), etched (block 125), and the surface is prepared (block 130), as in the first embodiment 10. Once the surface is prepared, metal component 12 is sealed with a scaling solution (block 135). The
Sealant is then burned, or stripped away, by submerging metal component 12 in pure oil of vitriol for less than one second (block 140). The stripping step exposes random, unsealed portions of the surface of metal component 12 that will be receptive to receiving one of more dyes, or colorants. Metal component 12 is then dyed in a colorant bath (block 145).

Additional colors can also be added to metal component 12 in this process. If additional colors are desired (block 150), metal component 12 is sealed again after the colorant bath (block 135), the sealant is then stripped away again (block 140), and then another color is added with another colorant bath using a different color (block 145). This process can be repeated for additional colors, as desired. Once the number of desired colors has been added, a UV coating is then added to metal component 12 to protect the colors (block 155).

Alternatively, a logo can be put on the metal component 12 along with multi-coloring as illustrated in FIG. 5. In detail, after the metal component 12 is cleaned (block 115) and chemically buffered (block 120), the logo can be printed on the base color of the metal component 12 with a strong ink and the metal component 12 further baked to ensure the adhesion of the ink thereto (block 122). Following the logo printing, the metal component 12 is then etched (block 125).

The use of electricity in the second process embodiment is required in the same steps of the process that required electricity in the first process embodiment. If a step that requires electricity is repeated, electricity is required each time the step is repeated.

As an advantage of the present invention, the metal components will be aesthetically pleasing to consumers. The metal components can be used on numerous consumer goods, such as makeup brushes, bottles, caps, and numerous other consumer goods.

As another advantage, each finished metal component will have a "one-of-a-kind" color scheme applied to it. Since the sealant is randomly stripped away, the portions that have been stripped away will not be the same on any two metal components. Once the color adheres to the stripped away portions of the metal component, the color scheme will be different on each metal component. Each finished product metal component will be unique.

While the invention has been shown or described in only some of its forms, it should be apparent to those skilled in the art that it is not so limited, but is susceptible to various changes without departing from the scope of the invention. For example, different types of metals that can be anodized can be used as the metal component. Different sealants and UV coatings can also be used within the process embodiments. Suitable substitutions will be known to the skilled in the art and are to be considered within the scope of the present invention.

We claim:

1. An anodizing process for coloring a metal component in a random pattern with one or more colors, comprising the steps of:
   (a) preparing the metal component for coloring;
   (b) dipping the metal component in a colorant bath to apply a color to the metal component;
   (c) dipping the metal component in a sealant to seal the color applied to the metal component with a direct electrical current passing through the metal component;
   (d) stripping the sealant away from the metal component in a random pattern;
   (e) repeating steps (b)-(d) to apply additional colors to the metal component if more than one color is desired; and
   (f) adding UV coating to the metal component with a direct electrical current passing through the metal component.

2. The process of claim 1, wherein the metal component comprises aluminum.

3. The process of claim 1, wherein the step of preparing the metal component for coloring further comprising the steps of:
   (a) cleaning the metal component in an acid-based solution;
   (b) buffing the metal component chemically;
   (c) etching the surface of the metal component; and
   (d) dipping the metal component in a mixture to further preparation the surface of the metal component with a direct electrical current passing through the metal component.

4. The process of claim 3, following step (b) prior to step (c), further comprising the steps of:
   (a) printing a logo on the metal component; and
   (b) baking the metal component.

5. The process of claim 3, wherein the step of buffing comprises dipping the metal component in a mixture of phosphoric acid, hydrogen nitrate, and oil of vitriol or a mixture of phosphoric acid, hydrogen nitrate, and sulfuric acid.

6. The process of claim 3, wherein the mixture used for further preparing the surface of the metal component comprises oil of vitriol and water.

7. The process of claim 1, wherein the sealant comprises Top Seal DX-200 and water.

8. The process of claim 1, wherein the step of stripping comprises dipping the metal component in pure oil of vitriol for less than one second.

9. The process of claim 1, wherein the UV coating comprises an acrylic based coating.

10. The process of claim 1, wherein the process is used for making multi-colored products including multi-colored makeup brushes and multi-colored bottle caps, the multicolor products comprising random patterns of dominant dyed color intermingled with subordinate base color of the metal component.

11. An anodizing process for coloring a metal component in a random pattern with one or more colors, comprising the steps of:
   (a) preparing the metal component for coloring;
   (b) dipping the metal component in a sealant with a direct electrical current passing through the metal component;
   (c) stripping the sealant away from the metal component in a random pattern;
   (d) dipping the metal component in a colorant bath to apply a color to the metal component;
(e) repeating steps (b)-(d) to apply additional colors to the metal component if more than one color is desired; and
(f) adding UV coating to the metal component with a direct electrical current passing through the metal component.

12. The process of claim 11, wherein the metal component comprises aluminum.

13. The process of claim 11, wherein the step of preparing the metal component for coloring further comprising the steps of:
   (a) cleaning the metal component in an acid-based solution;
   (b) buffing the metal component chemically;
   (c) etching the surface of the metal component; and
   (d) dipping the metal component in a mixture to further prepare the surface of the metal component with a direct electrical current passing through the metal component.

14. The process of claim 13, following step (b) and prior to step (c), further comprising the steps of:
   printing a logo on the metal component; and
   baking the metal component.

15. The process of claim 13, wherein the step of buffing comprises dipping the metal component in a mixture of phosphoric acid, hydrogen nitrate, and oil of vitriol or a mixture of phosphoric acid, hydrogen nitrate, and sulfonic acid.

16. The process of claim 13, wherein the mixture used for further preparing the surface of the metal component comprises oil of vitriol and water.

17. The process of claim 11, wherein the sealant comprises Top Seal DX-200 and water.

18. The process of claim 11, wherein the step of stripping comprises dipping the metal component in pure oil of vitriol for less than one second.

19. The process of claim 11, wherein the UV coating comprises an acrylic-based coating.

20. The process of claim 11, wherein the process is used for making multi-colored products including multi-colored makeup brushes and multi-colored bottle caps, the multi-color products comprising random patterns of dominant base color of the metal component intermingled with subordinate dyed color.

* * * * *