ABSTRACT
Methods for treating aluminum for providing a tactile sensation of surface softness are provided. In this regard, a representative method includes: providing an aluminum component having a surface; exposing the surface to a first media blasting; exposing the surface to a second media blasting; and, after the second media blasting, chemical etching and anodizing the surface.
FIG. 1A

FIG. 1B

FIG. 2

PROVIDE AN ALUMINUM COMPONENT

EXPOSE A SURFACE OF THE COMPONENT TO A FIRST MEDIA BLASTING

EXPOSE A SURFACE OF THE COMPONENT TO A SECOND MEDIA BLASTING

CHEMICAL ETCH AND ANODIZE THE SURFACE
FIG. 7

1. PROVIDE AN ALUMINUM COMPONENT
2. EXPOSE A SURFACE OF THE COMPONENT TO A FIRST MEDIA BLASTING
3. EXPOSE A SURFACE OF THE COMPONENT TO A SECOND MEDIA BLASTING
4. ANODIZE THE SURFACE
5. CHEMICAL ETCH THE SURFACE

FIG. 8
METHODS FOR TREATING ALUMINUM SURFACES

TECHNICAL FIELD

[0001] The present disclosure generally relates to treatment of aluminum surfaces.

BACKGROUND

[0002] Handheld electronic devices (such as smartphones and tablet computers) typically include an outer casing or housing, within which various components are mounted. Various types of materials are used to form such housings. By way of example, some housings are formed of plastic, whereas others are formed of metal. As is known, such materials exhibit different characteristics. For instance, metal (e.g., aluminum) is relatively light weight compared to its mechanical strength, and plastic is relatively easy to form with various surface textures.

SUMMARY

[0003] Methods for treating aluminum for providing a tactile sensation of surface softness are provided. Briefly described, one embodiment, among others, is a method comprising: providing an aluminum component having a surface; exposing the surface to a first media blasting; exposing the surface to a second media blasting; and, after the second media blasting, etching and anodizing the surface.

[0004] Other systems, methods, features, and advantages of the present disclosure will be or may become apparent to one with skill in the art upon examination of the following drawings and detailed description. It is intended that all such additional systems, methods, features, and advantages be included within this description, be within the scope of the present disclosure, and be protected by the accompanying claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] Many aspects of the disclosure can be better understood with reference to the following drawings. The components in the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the present disclosure. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

[0006] FIG. 1A is a schematic diagram of an example embodiment of a handheld electronic device, showing the front thereof.

[0007] FIG. 1B is a schematic diagram of the example embodiment of FIG. 1A, showing the back thereof.

[0008] FIG. 2 is a flowchart depicting an example embodiment of a method for treating aluminum for providing a tactile sensation of surface softness.

[0009] FIG. 3 is a cross-sectional, schematic view of an example embodiment of a housing.

[0010] FIG. 4 is a cross-sectional, schematic view of the embodiment of FIG. 3 after a first media blasting.

[0011] FIG. 5 is a cross-sectional, schematic view of the embodiment of FIG. 4 after a second media blasting.

[0012] FIG. 6 is a cross-sectional, schematic view of the embodiment of FIG. 5 after chemical etching.

[0013] FIG. 7 is a schematic diagram of an example embodiment of a portion of an assembly line.

[0014] FIG. 8 is a flowchart depicting another example embodiment of a method for treating aluminum for providing a tactile sensation of surface softness.

DETAILED DESCRIPTION

[0015] Having summarized various aspects of the present disclosure, reference will now be made in detail to that which is illustrated in the drawings. While the disclosure will be described in connection with these drawings, there is no intent to limit the scope of legal protection to the embodiment or embodiments disclosed herein. Rather, the intent is to cover all alternatives, modifications and equivalents included within the spirit and scope of the disclosure as defined by the appended claims.

[0016] In this regard, methods for treating aluminum that provide a tactile sensation of surface softness are provided. As will be described in detail, an example embodiment involves modifying the texture of an aluminum surface so that the surface feels interestingly soft to a user without the use of an applied surface coating. In some embodiments, multi-pass media blasting is used to prepare the surface, which is later chemically etched to reduce surface peaks formed during the media blasting. The particular combination of blasting media, associated pressures and other parameters has been found to produce a surface effect that is remarkably pleasing to users when compared to other surfaces formed with deviations from the prescribed parameters.

[0017] FIGS. 1A and 1B are schematic diagrams of an example embodiment of a handheld electronic device that is manufactured in accordance with an embodiment of such a method. In particular, device 100 is configured as a smartphone, with a display (front) side 102 being shown in FIG. 1A and a back side 104 being shown in FIG. 1B. Device 100 incorporates a housing 106, within which various components (not shown) are mounted. In this embodiment, the housing is formed of aluminum and includes an outer surface 110. As will be described in detail, surface 110 is treated to enhance the feel or tactile sensation of the housing.

[0018] FIG. 2 is a flowchart depicting an example embodiment of a method for treating aluminum, such as surface 110 of FIGS. 1A and 1B. As shown in FIG. 2, the method may be construed as beginning at block 120, in which an aluminum component having a surface is provided. By way of example, the component may be a housing for a handheld electronic device (e.g., device 100). A representative aluminum component is depicted in FIG. 3. Specifically, FIG. 3 is a cross-sectional, schematic view of an example embodiment of an aluminum housing of a handheld electronic device. In this embodiment, the thickness (x) of the aluminum component 100 is between approximately 1.0 mm and approximately 2.0 mm.

[0019] Returning to the flowchart of FIG. 2, in block 122, the outer surface of the component is exposed to a first media blasting that modifies the surface such as by forming depressions and associated ridges. In some embodiments, the blast media is approximately #150 grit (e.g., between approximately #100 grit and approximately #200 grit) that is directed at the surface using a blast pressure of approximately 3.0 kg/cm² (e.g., between approximately 2.0 kg/cm² and approximately 4.0 kg/cm²). In some embodiments, the blast media is steel, round blast media.

[0020] In this regard, FIG. 4 is a cross-sectional, schematic view of component 100 of FIG. 3, showing detail of surface
After a first media blasting. Notably, surface 110 exhibits various depressions (e.g., depression 134) and ridges (e.g., ridge 136).

After the first media blasting, the process proceeds to block 124 of FIG. 2, in which the surface of the component is exposed to a second media blasting. In this regard, FIG. 5 depicts surface 110 after a second media blasting. Notably, the surface exhibits a greater depth of the surface features as the distance from a peak of a ridge (e.g., peak 138) to a bottom of a depression (e.g., bottom 140) tends to be greater after the second media blasting. It should also be noted that a multi-pass blasting process is preferred over a single pass in order to produce the desired surface effects.

After the second media blasting, the process proceeds to block 126, in which chemical etching and anodizing of the surface is performed. In some embodiments, the anodizing is performed prior to the chemical etching.

FIG. 6 is a cross-sectional, schematic view of the embodiment of FIG. 5 after chemical etching. This view also corresponds to section line 6-6 of FIG. 1B. As shown in FIG. 6, the chemical etching removes the harsh peaks and generally tends to smooth the surface 110. As a result, the tactile sensation of surface softness is exhibited by the component without a coating being provided on the surface.

It is noted that variations in the above parameters have been shown to result in less than desirable tactile sensations. For instance, samples made by the aforementioned process were selected as feeling the most pleasant when compared with samples made by altering the parameters by as little as 1.0 psi, 25 grit size, or 30 sec. etch time.

FIG. 7 is a schematic diagram of an example embodiment of a portion of an assembly line that may be used in performing an embodiment of a method. As shown in FIG. 7, assembly line 150 includes a conveyor 152 that uses a continuous belt 154, which moves work pieces (e.g., housings) from position A to position C. Along an intermediate portion of the conveyor, a media blasting zone 156 is located (position B is located within this zone).

In operation, a housing (e.g., housing 160) is placed on the conveyor and conveyed into the media blasting zone, in which an outer surface of the housing is exposed to media blasting. In some embodiments, a housing is exposed to media blasting for approximately 30-300 seconds.

After receiving a first media blasting, the housing is conveyed to position C, in which it may be manually relocated to position A so that a second pass through the media blasting zone may be made. As should be understood, various other configurations may be used in other embodiments.

FIG. 8 is a flowchart depicting another example embodiment of a method for treating aluminum for providing a tactile sensation of surface softness. As shown in FIG. 8, the method may be construed as beginning at block 180, in which an aluminum component having a surface is provided. In some embodiments, the component may be formed by stamping the component from a sheet of aluminum.

In block 182, the outer surface of the component is exposed to a first media blasting to begin deforming the surface. Then, as depicted in block 184, the outer surface is exposed to a second media blasting. In some embodiments, the second media blasting step is performed identically to the first media blasting step.

After the second media blasting, the surface is anodized (block 186). Thereafter, such as depicted in block 188, chemical etching of the surface is performed.

It should be emphasized that the above-described embodiments are merely examples of possible implementations. Many variations and modifications may be made to the above-described embodiments without departing from the principles of the present disclosure. All such modifications and variations are intended to be included herein within the scope of this disclosure and protected by the following claims.

At least the following is claimed:

1. A method for treating aluminum for providing a tactile sensation of surface softness, the method comprising: providing an aluminum component having a surface; exposing the surface to a first media blasting; exposing the surface to a second media blasting; and after the second media blasting, chemical etching and anodizing the surface.

2. The method of claim 1, wherein the anodizing is performed prior to the chemical etching.

3. The method of claim 1, wherein the tactile sensation of surface softness is exhibited without a coating being provided on the surface.

4. The method of claim 1, wherein exposing the surface to the first media blasting comprises: providing first blast media of approximately #100-200 grit; and using a blast pressure of approximately 2.0-4.0 kg/cm².

5. The method of claim 4, wherein the first blast media is steel, round blast media.

6. The method of claim 4, wherein exposing the surface to the second media blasting comprises: providing second blast media of approximately #100-200 grit; and using a blast pressure of approximately 2.0-4.0 kg/cm².

7. The method of claim 6, wherein the second blast media is steel, round blast media.

8. The method of claim 6, wherein the first blast media and the second blast media are steel, round blast media.

9. The method of claim 1, wherein exposing the surface to the first media blasting comprises exposing the surface to the first media blasting for approximately 30-300 seconds.

10. The method of claim 9, wherein exposing the surface to the second media blasting comprises exposing the surface to the second media blasting for approximately 30-300 seconds.

11. The method of claim 1, wherein exposing the surface to the first media blasting comprises: placing the aluminum component on a conveyor; and conveying the aluminum component through a media blasting zone.

12. The method of claim 11, wherein exposing the surface to the second media blasting comprises conveying the aluminum component through the media blasting zone for a second time.

13. The method of claim 1, wherein the aluminum component is at least a portion of a housing for a handheld electronic device.

14. The method of claim 1, wherein the aluminum component is at least a portion of a housing for a smartphone or a tablet computer.

15. The method of claim 1, wherein providing an aluminum component comprises: providing a sheet of aluminum; and forming the component from the sheet.
16. The method of claim 15, wherein the sheet has a thickness of between approximately 1 mm and approximately 2 mm.

17. The method of claim 15, wherein forming the component from the sheet comprises stamping the component form the sheet.

18. The method of claim 15, wherein the aluminum component exhibits a thickness, measured from the surface, of between approximately 1 mm and approximately 2 mm.

19. A handheld electronic device comprising a housing formed by the method of claim 1.

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