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(54) ALUMINUM ALLOY HOUSING AND PREPARATION METHOD THEREOF

(57) Provided are an aluminum alloy housing and a preparation method for same. An external surface of the aluminum alloy housing has a convex portion and a concave portion, the convex portion has a convex oxide film and a convex electrophoretic decorative layer in turn, the concave portion has a concave oxide film or a concave electrophoretic decorative layer, surface of the convex electrophoretic decorative layer has a glossiness of 90-105, and surface of the concave oxide film has a glossiness of 5-25 or surface of the concave electrophoretic decorative layer has a glossiness of 0.5-5.

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Description

Technical Field

[0001] The present invention relates to the field of electronic product technologies, and in particular, to an aluminum alloy housing and a preparation method for same.

Related Art

[0002] With the development of electronic technologies, increasingly more electronic products appear in our life, for example, mobile phones, tablet computers, and e-readers. Most of these electronic products use plastic casings. However, as people have higher requirements on the quality of the electronic products, more and more electronic products use metal casings. On one hand, metal casings have better protection effects than plastic casings. On the other hand, the unique metal texture is also an important reason why the metal casings are becoming more popular.

[0003] Currently, surface treatment is performed on a metal casing of an electronic product mainly for the purpose of decorative and protective effects. In an existing method of performing surface treatment on a metal casing, anodic oxidation, micro-arc oxidation, and hard anodic oxidation on the surface of the metal casing can all achieve the foregoing two effects. However, in terms of the decorative effect, the metal casing after the treatment lacks diversity in appearance decoration and textures.

[0004] Therefore, a metal casing obtained by using the foregoing surface treatment technology lacks diversity in appearance decoration and textures. It is necessary to develop an aluminum alloy housing that has desirable appearance decoration and a solid texture, and a preparation method for same.

SUMMARY

[0005] In order to resolve the problem that a mobile phone housing in the prior art lacks diversity in appearance decoration and textures, the present invention is directed to provide an aluminum alloy housing and a preparation method for same. The aluminum alloy housing has a bumpy solid texture and has a glossy convex side and concave side.

[0006] In order to achieve the foregoing objective, the present invention provides an aluminum alloy housing. According to embodiments of the present invention, an external surface of the aluminum alloy housing has a convex portion and a concave portion, the convex portion has a convex oxide film and a convex electrophoretic decorative layer in turn, the concave portion has a concave oxide film or a concave electrophoretic decorative layer, surface of the convex electrophoretic decorative layer has a glossiness of 90-105, and surface of the concave oxide film has a glossiness of 5-25 or surface of the concave electrophoretic decorative layer has a glossiness of 0.5-5.

[0007] Preferably, a height difference between the convex portion and the concave portion is 0.05-0.2 mm.

[0008] Preferably, the convex oxide film and the concave oxide film have different colors.

[0009] The present invention further provides a preparation method for an aluminum alloy housing, which includes steps of:

step a: performing first anodic oxidation on the surface of the aluminum alloy housing substrate;

step b: forming a convex electrophoretic decorative layer on surface of the aluminum alloy housing substrate on which the first anodic oxidation has been performed via first electrophoretic treatment;

step c: performing mechanical polishing on the surface of the aluminum alloy housing substrate on which the first electrophoretic treatment has been performed;

step d: performing laser carving on a surface of the aluminum alloy housing substrate on which the mechanical polishing has been performed, so as to obtain a texture pattern having a convex-concave effect on the surface of the aluminum alloy housing substrate;

step e: performing second electrophoretic treatment or second anodic oxidation or hard anodic oxidation or micro-arc oxidation on portion of the texture pattern on the surface of the aluminum alloy housing substrate.

[0010] Preferably, wherein the first anodic oxidation and/or the second anodic oxidation comprises performing pretreatment on the surface of the aluminum alloy housing substrate and then forming an anode film by means of anodic oxidation.

[0011] Preferably, the pretreatment comprises: performing alkali etching for 3-20s at a temperature of 50-70°C by using 50-60 g/L of sodium hydroxide, neutralizing for 10-20s a temperature of 15-25°C by using 200-300 ml/L of nitric acid, and performing chemical polishing for 5-20s at a temperature of 90-95°C by using a chemical polishing solution containing 650-750 ml/L of phosphoric acid and 350-250 ml/L of sulfuric acid.

[0012] Preferably, the anodic oxidation comprises oxidizing the surface of the aluminum alloy housing substrate for 15-50 min under an anode voltage of 13-17 V and at a temperature of 10-21°C by using 190-200 g/L of sulfuric acid.

[0013] Preferably, the first electrophoretic treatment and/or the second electrophoretic treatment comprises electrophoresing for 1-3min under a voltage of 140-200 V and at a temperature of 28-32°C by using an electrophoresing solution having a pH of 7-9.

[0014] Preferably, the hard anodic oxidation comprises oxidizing for 25-50min under a temperature of 5-12°C by using a hard anodic oxidation solution.

[0015] Preferably, the hard anodic oxidation solution includes 170-270g/L of sulfuric acid and 8-20g/L of oxalic acid.

[0016] Preferably, the micro-arc oxidation includes oxidizing for 40-100min under a temperature of 20-30°C by using a micro-arc oxidation solution.

[0017] Preferably, the micro-arc oxidation solution includes 0.02-0.05mol/L of sodium silicate and 0.03-0.07mol/L of sodium hydroxide.

[0018] By means of the foregoing technical solution, first anodic oxidation is firstly performed on the surface of the aluminum alloy housing substrate, then a convex electrophoretic decorative layer is formed via first electrophoretic treatment, and then mechanical polishing is performed on the surface of the aluminum alloy housing substrate on which the first electrophoretic treatment has been performed, then a texture pattern having a convex-concave effect on the surface of the aluminum alloy housing substrate is formed via laser carving, next, second electrophoretic treatment or second anodic oxidation or hard anodic oxidation or micro-arc oxidation is performed on portion of the texture pattern on the surface of the aluminum alloy housing substrate, thereby producing an aluminum alloy housing having a bumpy solid texture and having a glossy convex side and non-glossy concave side.

[0019] The additional aspects and advantages of the present invention will be provided in the following description, and some of the additional aspects and advantages will become clear in the following description or be understood through practice of the present invention.

DETAILED DESCRIPTION

[0020] Specific implementations of the present invention are described in detail below. It should be understood that the specific implementations described herein are merely used for illustrating the present invention rather than limiting the present invention.

[0021] An aluminum alloy housing is provided according to an embodiment of the present invention. An external surface of the aluminum alloy housing has a convex portion and a concave portion, the convex portion has a convex oxide film and a convex electrophoretic decorative layer in turn, the concave portion has a concave oxide film or a concave electrophoretic decorative layer, surface of the convex electrophoretic decorative layer has a glossiness of 90-105, and surface of the concave oxide film has a glossiness of 5-25 or surface of the concave electrophoretic decorative layer has a glossiness of 0.5-5. The inventor finds that, by forming a convex portion and a concave portion on the external surface of the aluminum alloy housing, the aluminum alloy housing can have a bumpy solid texture. In addition, by polishing the convex oxide film formed on the surfaces of the convex portion, the surfaces of the convex oxide film are glossy. In the present invention, the glossiness means how close the surface of the oxide film is to a mirror surface, and can be measured by using a method commonly known in the field, for example, measured by using a gloss meter.

[0022] In the present invention, a method for forming a convex portion and a concave portion on the external surface of the aluminum alloy housing, and a method for forming a convex oxide film on the convex portion and forming a concave oxide film on the concave portion will be described in the following preparation method for the aluminum alloy housing.

[0023] In the preparation method for the aluminum alloy housing according to an embodiment of the present invention, preferably, the convex oxide film and the concave oxide film are of different colors. By making the convex oxide film and the concave oxide film have different colors, the aluminum alloy housing has film layers of different colors.

[0024] A preparation method for an aluminum alloy housing according to an embodiment of the present invention sequentially includes:

step a: performing first anodic oxidation on the surface of the aluminum alloy housing substrate;

step b: forming a convex electrophoretic decorative layer on surface of the aluminum alloy housing substrate on which the first anodic oxidation has been performed via first electrophoretic treatment;

step c: performing mechanical polishing on the surface of the aluminum alloy housing substrate on which the first electrophoretic treatment has been performed;

step d: performing laser carving on a surface of the aluminum alloy housing substrate on which the mechanical polishing has been performed, so as to obtain a texture pattern having a convex-concave effect on the surface of the aluminum alloy housing substrate;

step e: performing second electrophoretic treatment or second anodic oxidation or hard anodic oxidation or micro-arc oxidation on portion of the texture pattern on the surface of the aluminum alloy housing substrate.

[0025] In the preparation method for an aluminum alloy housing according to the embodiment of the present invention, in order to obtain a glossy effect of the aluminum alloy housing, mechanical polishing is performed on the surface of the aluminum alloy housing substrate on which the first electrophoretic treatment has been performed. The anodic oxidation film layer on the surface of the aluminum alloy housing substrate is polished by using a mechanical polishing machine, to reduce the overall thickness of the anodic oxidation film layer by approximately 2 μm, so that the surface of the anodic oxidation film is glossy and can reflect light, and a glossy surface having a high glossiness is formed, and then laser carving is performed so as to obtain a convex-concave difference on surface of the aluminum alloy housing substrate, thus to obtain a bumpy solid texture.

[0026] The aluminum alloy housing substrate used in the present invention is not particularly limited. Various aluminum alloy housing bodies can be used, for example, a product of industrial standard 1000-7000 series, a die-casting aluminum alloy, and a pressure-casting aluminum alloy. The aluminum alloy housing substrate in the present invention is an aluminum alloy housing body of various shapes and structures that are commonly used by a person skilled in the art, and is not particularly limited in the present invention. The various shapes and structures of the aluminum alloy housing substrate can be accomplished by mechanical processing. The aluminum alloy housing can be used as a housing of a mobile phone, a tablet computer, an e-reader, or the like.

[0027] In the preparation method for an aluminum alloy housing according to the embodiment of the present invention, in step a, before first anodic oxidation is performed on the surface of the aluminum alloy housing substrate, blasting and drawing treatment can be performed on the surface of the aluminum alloy housing substrate in advance. In the present invention, the blasting can be performed by using a method commonly known in the field. For example, after the surface of the aluminum alloy housing substrate is sanded by using a sander, blasting treatment is performed on the surface of the aluminum alloy housing substrate by using a ceramic sand of 80-400 meshes under a pressure of 0.1-0.24 MPa, so that the surface of the aluminum alloy housing substrate feels sandy. The drawing treatment can be performed by using a method commonly known in the field. For example, the surface of the aluminum alloy housing substrate can be drawn by a drawing machine with No. 400 to No. 1200 drawing wheels to achieve the required brushed texture from coarse to fine.

[0028] In the preparation method for an aluminum alloy housing according to the embodiment of the present invention, preferably, the first anodic oxidation and/or the second anodic oxidation may include performing pretreatment on the surface of the aluminum alloy housing substrate and then forming an anode film by means of anodic oxidation. There is no special requirement on the thickness of the formed anode film, and the thickness is usually 6-10 μm.

[0029] In the preparation method for an aluminum alloy housing according to the embodiment of the present invention, preferably, the pretreatment is performed to make the surface of the aluminum alloy housing substrate clean and ensure that a uniform anode film is formed on the surface of the aluminum alloy housing substrate by means of anodic oxidation. The pretreatment may include: performing alkali etching for 3-20s at a temperature of 50-70°C by using 50-60 g/L of sodium hydroxide, neutralizing for 10-20s a temperature of 15-25°C by using 200-300 ml/L of nitric acid, and performing chemical polishing for 5-20s at a temperature of 90-95°C by using a chemical polishing solution containing 650-750 ml/L of phosphoric acid and 350-250 ml/L of sulfuric acid.

[0030] In the preparation method for an aluminum alloy housing according to the embodiment of the present invention, the method of the anodic oxidation can be an anodic oxidation method commonly known in the field. Preferably, the anodic oxidation may include oxidizing the surface of the aluminum alloy housing substrate for 15-50 min under an anode voltage of 13-17 V and at a temperature of 10-21°C by using 190-200 g/L of sulfuric acid.

[0031] In the preparation method for an aluminum alloy housing according to the embodiment of the present invention, an electrophoretic decorative layer is formed on surface of the aluminum alloy housing substrate via the first electrophoretic treatment and/or the second electrophoretic treatment, which may protect the aluminum alloy housing effectively and provide a decorative effect. The first electrophoretic treatment and/or the second electrophoretic treatment may include electrophoresing for 1-3min under a voltage of 140-200 V and at a temperature of 28-32°C by using an electrophoresing solution having a pH of 7-9. The electrophoresing solution could be any electrophoresing solution commonly used in the art, as long as the electrophoretic decorative layer could be formed on surface of the aluminum alloy housing substrate. For example, the electrophoresing solution may contain a flat lacquer (WNO-1) of Shimizu Corporation (Japan) and a varnish (NNO-4) of Shimizu Corporation (Japan); the weight ratio of the flat lacquer to the varnish is 7:3, and a content of a solid composition in the electrophoresing solution is 13wt%; the varnish (NNO-4) includes 50wt% of acrylic resin, 6wt% of 2-butoxy ethanol, 20wt% of ethylene glycol monoisobutyl ether, 18wt% of diethyl diol butyraldehyde, and 6wt% of other composition; the flat lacquer (WNO-1) includes 50wt% of acrylic resin, 10wt% of 2-butoxy ethanol, and

40wt% of other composition.

[0032] In the preparation method for an aluminum alloy housing according to the embodiment of the present invention, a texture pattern having a convex-concave effect on the surface of the aluminum alloy housing substrate could be obtained by laser carving a surface of the aluminum alloy housing substrate on which the mechanical polishing has been performed. A method of the laser carving could be any method of laser carving commonly used in the art, for example, the laser carving may carried out through a laser carving machine, so as to expose the aluminum alloy substrate and to obtain a texture pattern having a depth of 0.1m.

[0033] In the preparation method for an aluminum alloy housing according to the embodiment of the present invention, preferably, the hard anodic oxidation may include oxidizing for 25-50min under a temperature of 5-12°C by using a hard anodic oxidation solution. More preferably, the hard anodic oxidation solution may include 170-270g/L of sulfuric acid and 8-20g/L of oxalic acid. Electrical parameters of the hard anodic oxidation may include: forward square wave pulse, duty ratio of 60%-80%, frequency of 500-1000Hz, electric current density of 3-7A/dm^2.

[0034] In the preparation method for an aluminum alloy housing according to the embodiment of the present invention, preferably, the micro-arc oxidation may include oxidizing for 40-100min under a temperature of 20-30°C by using a micro-arc oxidation solution. More preferably, the micro-arc oxidation solution may include 0.02-0.05mol/L of sodium silicate and 0.03-0.07mol/L of sodium hydroxide. A oxidation forward voltage of the micro-arc oxidation may be 400-600V.

[0035] The preparation method for an aluminum alloy housing according to the present invention is further described below by using exemplary embodiments. However, the present invention is not limited to the following exemplary embodiments.

Embodiment 1

[0036] This embodiment is used to describe the aluminum alloy housing of the present invention and a preparation method for same.

[0037] A pressure-casting aluminum alloy rear housing substrate (purchased from BYD Co., Ltd.) for use in a P8-model mobile phone is used as an aluminum alloy housing substrate of the this embodiment.

[0038] At a temperature of 50°C, the aluminum alloy housing substrate was subjected to alkali etching for 10s in a sodium hydroxide aqueous solution with a concentration of 55 g/L, and was cleaned twice with deionized water. Then, at a temperature of 15°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water. Next, at a temperature of 90°C, the aluminum alloy housing substrate was subjected to polishing for 10s in a chemical polishing solution containing 650 ml/L of phosphoric acid and 350 ml/L of sulfuric acid, and was cleaned twice with deionized water. Then, at a temperature of 15°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water. Next, the aluminum alloy housing substrate was dried for 20 min at a temperature of 80°C in a drying oven, to obtain the cleaned and dried aluminum alloy housing substrate.

[0039] An anode film was formed on a surface of the cleaned and dried aluminum alloy housing substrate by means of anodic oxidation. Conditions of the anodic oxidation include: using sulfuric acid with a concentration of 190 g/L as a bath solution, an anode voltage being 15 V, a temperature being 19°C, and an oxidation time being 35 min.

[0040] The aluminum alloy housing substrate on which the anodic oxidation has been performed was subjected to electrophoretic treatment to form an electrophoretic decorative layer on surface of the aluminum alloy housing substrate. Conditions of the electrophoretic treatment include: a temperature of 30°C, a voltage of 160V, a electrophoresing time of 2 min, a pH of 7.8, using a electrophoresing solution containing a flat lacquer (WNO-1) of Shimizu Corporation (Japan) and a varnish (NNO-4) of Shimizu Corporation (Japan); the weight ratio of the flat lacquer to the varnish is 7:3, and a content of a solid composition in the electrophoresing solution is 13wt%; the varnish (NNO-4) includes 50wt% of acrylic resin, 6wt% of 2-butoxy ethanol, 20wt% of ethylene glycol monoisobutyl ether, 18wt% of diethyl diol butyraldehyde, and 6wt% of other composition; the flat lacquer (WNO-1) includes 50wt% of acrylic resin, 10wt% of 2-butoxy ethanol, and 40wt% of other composition.

[0041] The electrophoretic decorative layer on the surface of the aluminum alloy housing substrate was polished by using a mechanical polishing machine, to reduce the overall thickness of the electrophoretic decorative layer by approximately 2 μm, so that the surface of the electrophoretic decorative layer is glossy and can reflect light.

[0042] The surface of the aluminum alloy housing substrate on which the mechanical polishing has been performed was subjected to laser carving via a laser carving machine, so as to expose the aluminum alloy substrate and to obtain a texture pattern having a depth of 0.05mm and a convex-concave effect on the surface of the aluminum alloy housing substrate.

[0043] Then, at a temperature of 50°C, the aluminum alloy housing substrate after being laser carved was subjected to alkali etching for 10s in a sodium hydroxide aqueous solution with a concentration of 55 g/L, and was cleaned twice with deionized water, and then, at a temperature of 15°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water.

[0044] Then, the cleaned aluminum alloy housing substrate was subjected to electrophoretic treatment to form an electrophoretic decorative layer on surface of the aluminum alloy housing substrate, thereby obtaining the aluminum alloy housing of the present invention. Conditions of the electrophoretic treatment include: a temperature of 30°C, a voltage of 160V, an electrophoresing time of 2 min, a pH of 7.8, using an electrophoresing solution containing a flat lacquer (WNO-1) of Shimizu Corporation (Japan) and a varnish (NNO-4) of Shimizu Corporation (Japan). The weight ratio of the flat lacquer to the varnish is 7:3, and a content of a solid composition in the electrophoresing solution is 13wt%; the varnish (NNO-4) includes 50wt% of acrylic resin, 6wt% of 2-butoxy ethanol, 20wt% of ethylene glycol monoisobutyl ether, 18wt% of diethyl diol butyraldehyde, and 6wt% of other composition; the flat lacquer (WNO-1) includes 50wt% of acrylic resin, 10wt% of 2-butoxy ethanol, and 40wt% of other composition.

Embodiment 2

[0045] This embodiment is used to describe the aluminum alloy housing of the present invention and a preparation method for same.

[0046] A pressure-casting aluminum alloy rear housing substrate (purchased from BYD Co., Ltd.) for use in a P8-model mobile phone is used as an aluminum alloy housing substrate of the this embodiment.

[0047] At a temperature of 70°C, the aluminum alloy housing substrate was subjected to alkali etching for 20s in a sodium hydroxide aqueous solution with a concentration of 60g/L, and was cleaned twice with deionized water. Then, at a temperature of 20°C, the aluminum alloy housing substrate was subjected to neutralization for 20s in nitric acid with a concentration of 300 ml/L, and was cleaned twice with deionized water. Next, at a temperature of 93°C, the aluminum alloy housing substrate was subjected to polishing for 20s in a chemical polishing solution containing 700 ml/L of phosphoric acid and 300 ml/L of sulfuric acid, and was cleaned twice with deionized water. Then, at a temperature of 20°C, the aluminum alloy housing substrate was subjected to neutralization for 20s in nitric acid with a concentration of 300 ml/L, and was cleaned twice with deionized water. Next, the aluminum alloy housing substrate was dried for 20 min at a temperature of 80°C in a drying oven, to obtain the cleaned and dried aluminum alloy housing substrate.

[0048] An anode film was formed on a surface of the cleaned and dried aluminum alloy housing substrate by means of anodic oxidation. Conditions of the anodic oxidation include: using sulfuric acid with a concentration of 195 g/L as a bath solution, an anode voltage being 17 V, a temperature being 10°C, and an oxidation time being 50 min.

[0049] The aluminum alloy housing substrate on which the anodic oxidation has been performed was subjected to electrophoretic treatment to form an electrophoretic decorative layer on surface of the aluminum alloy housing substrate. Conditions of the electrophoretic treatment include: a temperature of 32°C, a voltage of 200V, a electrophoresing time of 1 min, a pH of 7, using a electrophoresing solution containing a flat lacquer (WNO-1) of Shimizu Corporation (Japan) and a varnish (NNO-4) of Shimizu Corporation (Japan); the weight ratio of the flat lacquer to the varnish is 7:3, and a content of a solid composition in the electrophoresing solution is 13wt%; the varnish (NNO-4) includes 50wt% of acrylic resin, 6wt% of 2-butoxy ethanol, 20wt% of ethylene glycol monoisobutyl ether, 18wt% of diethyl diol butyraldehyde, and 6wt% of other composition; the flat lacquer (WNO-1) includes 50wt% of acrylic resin, 10wt% of 2-butoxy ethanol, and 40wt% of other composition.

[0050] The electrophoretic decorative layer on the surface of the aluminum alloy housing substrate was polished by using a mechanical polishing machine, to reduce the overall thickness of the electrophoretic decorative layer by approximately 2 μm, so that the surface of the electrophoretic decorative layer is glossy and can reflect light.

[0051] The surface of the aluminum alloy housing substrate on which the mechanical polishing has been performed was subjected to laser carving via a laser carving machine, so as to expose the aluminum alloy substrate and to obtain a texture pattern having a depth of 0.2mm and a convex-concave effect on the surface of the aluminum alloy housing substrate.

[0052] Then, at a temperature of 7°C, the aluminum alloy housing substrate after being laser carved was subjected to alkali etching for 20s in a sodium hydroxide aqueous solution with a concentration of 60g/L, and was cleaned twice with deionized water, and then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 300 ml/L, and was cleaned twice with deionized water.

[0053] Then, the cleaned aluminum alloy housing substrate was subjected to electrophoretic treatment to form an electrophoretic decorative layer on surface of the aluminum alloy housing substrate, thereby obtaining the aluminum alloy housing of the present invention. Conditions of the electrophoretic treatment include: a temperature of 32°C, a voltage of 200V, an electrophoresing time of 1 min, a pH of, using an electrophoresing solution containing a flat lacquer (WNO-1) of Shimizu Corporation (Japan) and a varnish (NNO-4) of Shimizu Corporation (Japan). The weight ratio of the flat lacquer to the varnish is 7:3, and a content of a solid composition in the electrophoresing solution is 13wt%; the varnish (NNO-4) includes 50wt% of acrylic resin, 6wt% of 2-butoxy ethanol, 20wt% of ethylene glycol monoisobutyl ether, 18wt% of diethyl diol butyraldehyde, and 6wt% of other composition; the flat lacquer (WNO-1) includes 50wt% of acrylic resin, 10wt% of 2-butoxy ethanol, and 40wt% of other composition.

Embodiment 3

[0054] This embodiment is used to describe the aluminum alloy housing of the present invention and a preparation method for same.

[0055] A pressure-casting aluminum alloy rear housing substrate (purchased from BYD Co., Ltd.) for use in a P8-model mobile phone is used as an aluminum alloy housing substrate of the this embodiment.

[0056] At a temperature of 50°C, the aluminum alloy housing substrate was subjected to alkali etching for 10s in a sodium hydroxide aqueous solution with a concentration of 55 g/L, and was cleaned twice with deionized water. Then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water. Next, at a temperature of 95°C, the aluminum alloy housing substrate was subjected to polishing for 10s in a chemical polishing solution containing 650 ml/L of phosphoric acid and 350 ml/L of sulfuric acid, and was cleaned twice with deionized water. Then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water. Next, the aluminum alloy housing substrate was dried for 20 min at a temperature of 80°C in a drying oven, to obtain the cleaned and dried aluminum alloy housing substrate.

[0057] An anode film was formed on a surface of the cleaned and dried aluminum alloy housing substrate by means of anodic oxidation. Conditions of the anodic oxidation include: using sulfuric acid with a concentration of 190 g/L as a bath solution, an anode voltage being 15 V, a temperature being 19°C, and an oxidation time being 35 min.

[0058] The aluminum alloy housing substrate on which the anodic oxidation has been performed was subjected to electrophoretic treatment to form an electrophoretic decorative layer on surface of the aluminum alloy housing substrate. Conditions of the electrophoretic treatment include: a temperature of 30°C, a voltage of 160V, a electrophoresing time of 2 min, a pH of 7.8, using a electrophoresing solution containing a flat lacquer (WNO-1) of Shimizu Corporation (Japan) and a varnish (NNO-4) of Shimizu Corporation (Japan); the weight ratio of the flat lacquer to the varnish is 7:3, and a content of a solid composition in the electrophoresing solution is 13wt%; the varnish (NNO-4) includes 50wt% of acrylic resin, 6wt% of 2-butoxy ethanol, 20wt% of ethylene glycol monoisobutyl ether, 18wt% of diethyl diol butyraldehyde, and 6wt% of other composition; the flat lacquer (WNO-1) includes 50wt% of acrylic resin, 10wt% of 2-butoxy ethanol, and 40wt% of other composition.

[0059] The electrophoretic decorative layer on the surface of the aluminum alloy housing substrate was polished by using a mechanical polishing machine, to reduce the overall thickness of the electrophoretic decorative layer by approximately 2 μm, so that the surface of the electrophoretic decorative layer is glossy and can reflect light.

[0060] The surface of the aluminum alloy housing substrate on which the mechanical polishing has been performed was subjected to laser carving via a laser carving machine, so as to expose the aluminum alloy substrate and to obtain a texture pattern having a depth of 0.1mm and a convex-concave effect on the surface of the aluminum alloy housing substrate.

[0061] Then, at a temperature of 50°C, the aluminum alloy housing substrate after being laser carved was subjected to alkali etching for 10s in a sodium hydroxide aqueous solution with a concentration of 55 g/L, and was cleaned twice with deionized water, and then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water.

[0062] Then, the cleaned aluminum alloy housing substrate was subjected to anodic oxidation to form an anode film on a surface of the cleaned aluminum alloy housing substrate, thereby obtaining the aluminum alloy housing of the present invention. Conditions of the anodic oxidation include: using sulfuric acid with a concentration of 190 g/L as a bath solution, an anode voltage being 15 V, a temperature being 19°C, and an oxidation time being 5 min.

Embodiment 4

[0063] This embodiment is used to describe the aluminum alloy housing of the present invention and a preparation method for same.

[0064] A pressure-casting aluminum alloy rear housing substrate (purchased from BYD Co., Ltd.) for use in a P8-model mobile phone is used as an aluminum alloy housing substrate of the this embodiment.

[0065] At a temperature of 50°C, the aluminum alloy housing substrate was subjected to alkali etching for 10s in a sodium hydroxide aqueous solution with a concentration of 55 g/L, and was cleaned twice with deionized water. Then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water. Next, at a temperature of 95°C, the aluminum alloy housing substrate was subjected to polishing for 10s in a chemical polishing solution containing 650 ml/L of phosphoric acid and 350 ml/L of sulfuric acid, and was cleaned twice with deionized water. Then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water. Next, the aluminum alloy housing substrate was dried for 20 min at a temperature of 80°C in a drying oven, to obtain the cleaned and dried aluminum alloy housing substrate.

[0066] An anode film was formed on a surface of the cleaned and dried aluminum alloy housing substrate by means of anodic oxidation. Conditions of the anodic oxidation include: using sulfuric acid with a concentration of 190 g/L as a bath solution, an anode voltage being 15 V, a temperature being 19°C, and an oxidation time being 35 min.

[0067] The aluminum alloy housing substrate on which the anodic oxidation has been performed was subjected to electrophoretic treatment to form an electrophoretic decorative layer on surface of the aluminum alloy housing substrate. Conditions of the electrophoretic treatment include: a temperature of 30°C, a voltage of 160V, a electrophoresing time of 2 min, a pH of 7.8, using a electrophoresing solution containing a flat lacquer (WNO-1) of Shimizu Corporation (Japan) and a varnish (NNO-4) of Shimizu Corporation (Japan); the weight ratio of the flat lacquer to the varnish is 7:3, and a content of a solid composition in the electrophoresing solution is 13wt%; the varnish (NNO-4) includes 50wt% of acrylic resin, 6wt% of 2-butoxy ethanol, 20wt% of ethylene glycol monoisobutyl ether, 18wt% of diethyl diol butyraldehyde, and 6wt% of other composition; the flat lacquer (WNO-1) includes 50wt% of acrylic resin, 10wt% of 2-butoxy ethanol, and 40wt% of other composition.

[0068] The electrophoretic decorative layer on the surface of the aluminum alloy housing substrate was polished by using a mechanical polishing machine, to reduce the overall thickness of the electrophoretic decorative layer by approximately 2 μm, so that the surface of the electrophoretic decorative layer is glossy and can reflect light.

[0069] The surface of the aluminum alloy housing substrate on which the mechanical polishing has been performed was subjected to laser carving via a laser carving machine, so as to expose the aluminum alloy substrate and to obtain a texture pattern having a depth of 0.1mm and a convex-concave effect on the surface of the aluminum alloy housing substrate.

[0070] Then, at a temperature of 50°C, the aluminum alloy housing substrate after being laser carved was subjected to alkali etching for 10s in a sodium hydroxide aqueous solution with a concentration of 55 g/L, and was cleaned twice with deionized water, and then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water.

[0071] Then, the cleaned aluminum alloy housing substrate was subjected to hard anodic oxidation by using a hard anodic oxidation solution including 200g/L of sulfuric acid and 15g/L of oxalic acid for 25 min, under a temperature of 10°C. An electrical parameters of the hard anodic oxidation include: forward square wave pulse, duty ratio of 70%, frequency of 800Hz, electric current density of 5A/dm^2; thereby obtaining the aluminum alloy housing of the present invention.

Embodiment 5

[0072] This embodiment is used to describe the aluminum alloy housing of the present invention and a preparation method for same.

[0073] A pressure-casting aluminum alloy rear housing substrate (purchased from BYD Co., Ltd.) for use in a P8-model mobile phone is used as an aluminum alloy housing substrate of the this embodiment.

[0074] At a temperature of 50°C, the aluminum alloy housing substrate was subjected to alkali etching for 10s in a sodium hydroxide aqueous solution with a concentration of 55 g/L, and was cleaned twice with deionized water. Then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water. Next, at a temperature of 95°C, the aluminum alloy housing substrate was subjected to polishing for 10s in a chemical polishing solution containing 650 ml/L of phosphoric acid and 350 ml/L of sulfuric acid, and was cleaned twice with deionized water. Then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water. Next, the aluminum alloy housing substrate was dried for 20 min at a temperature of 80°C in a drying oven, to obtain the cleaned and dried aluminum alloy housing substrate.

[0075] An anode film was formed on a surface of the cleaned and dried aluminum alloy housing substrate by means of anodic oxidation. Conditions of the anodic oxidation include: using sulfuric acid with a concentration of 190 g/L as a bath solution, an anode voltage being 15 V, a temperature being 19°C, and an oxidation time being 35 min.

[0076] The aluminum alloy housing substrate on which the anodic oxidation has been performed was subjected to electrophoretic treatment to form an electrophoretic decorative layer on surface of the aluminum alloy housing substrate. Conditions of the electrophoretic treatment include: a temperature of 30°C, a voltage of 160V, a electrophoresing time of 2 min, a pH of 7.8, using a electrophoresing solution containing a flat lacquer (WNO-1) of Shimizu Corporation (Japan) and a varnish (NNO-4) of Shimizu Corporation (Japan); the weight ratio of the flat lacquer to the varnish is 7:3, and a content of a solid composition in the electrophoresing solution is 13wt%; the varnish (NNO-4) includes 50wt% of acrylic resin, 6wt% of 2-butoxy ethanol, 20wt% of ethylene glycol monoisobutyl ether, 18wt% of diethyl diol butyraldehyde, and 6wt% of other composition; the flat lacquer (WNO-1) includes 50wt% of acrylic resin, 10wt% of 2-butoxy ethanol, and 40wt% of other composition.

[0077] The electrophoretic decorative layer on the surface of the aluminum alloy housing substrate was polished by using a mechanical polishing machine, to reduce the overall thickness of the electrophoretic decorative layer by approximately 2 μm, so that the surface of the electrophoretic decorative layer is glossy and can reflect light.

[0078] The surface of the aluminum alloy housing substrate on which the mechanical polishing has been performed was subjected to laser carving via a laser carving machine, so as to expose the aluminum alloy substrate and to obtain a texture pattern having a depth of 0.1mm and a convex-concave effect on the surface of the aluminum alloy housing substrate.

[0079] Then, at a temperature of 50°C, the aluminum alloy housing substrate after being laser carved was subjected to alkali etching for 10s in a sodium hydroxide aqueous solution with a concentration of 55 g/L, and was cleaned twice with deionized water, and then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water.

[0080] Then, the cleaned aluminum alloy housing substrate was subjected to hard anodic oxidation by using a hard anodic oxidation solution including 170g/L of sulfuric acid and 20g/L of oxalic acid for 30 min, under a temperature of 5°C. An electrical parameters of the hard anodic oxidation include: forward square wave pulse, duty ratio of 80%, frequency of 500Hz, electric current density of 3A/dm^2; thereby obtaining the aluminum alloy housing of the present invention.

Embodiment 6

[0081] This embodiment is used to describe the aluminum alloy housing of the present invention and a preparation method for same.

[0082] A pressure-casting aluminum alloy rear housing substrate (purchased from BYD Co., Ltd.) for use in a P8-model mobile phone is used as an aluminum alloy housing substrate of the this embodiment.

[0083] At a temperature of 50°C, the aluminum alloy housing substrate was subjected to alkali etching for 10s in a sodium hydroxide aqueous solution with a concentration of 55 g/L, and was cleaned twice with deionized water. Then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water. Next, at a temperature of 95°C, the aluminum alloy housing substrate was subjected to polishing for 10s in a chemical polishing solution containing 650 ml/L of phosphoric acid and 350 ml/L of sulfuric acid, and was cleaned twice with deionized water. Then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water. Next, the aluminum alloy housing substrate was dried for 20 min at a temperature of 80°C in a drying oven, to obtain the cleaned and dried aluminum alloy housing substrate.

[0084] An anode film was formed on a surface of the cleaned and dried aluminum alloy housing substrate by means of anodic oxidation. Conditions of the anodic oxidation include: using sulfuric acid with a concentration of 190 g/L as a bath solution, an anode voltage being 15 V, a temperature being 19°C, and an oxidation time being 35 min.

[0085] The aluminum alloy housing substrate on which the anodic oxidation has been performed was subjected to electrophoretic treatment to form an electrophoretic decorative layer on surface of the aluminum alloy housing substrate. Conditions of the electrophoretic treatment include: a temperature of 30°C, a voltage of 160V, a electrophoresing time of 2 min, a pH of 7.8, using a electrophoresing solution containing a flat lacquer (WNO-1) of Shimizu Corporation (Japan) and a varnish (NNO-4) of Shimizu Corporation (Japan); the weight ratio of the flat lacquer to the varnish is 7:3, and a content of a solid composition in the electrophoresing solution is 13wt%; the varnish (NNO-4) includes 50wt% of acrylic resin, 6wt% of 2-butoxy ethanol, 20wt% of ethylene glycol monoisobutyl ether, 18wt% of diethyl diol butyraldehyde, and 6wt% of other composition; the flat lacquer (WNO-1) includes 50wt% of acrylic resin, 10wt% of 2-butoxy ethanol, and 40wt% of other composition.

[0086] The electrophoretic decorative layer on the surface of the aluminum alloy housing substrate was polished by using a mechanical polishing machine, to reduce the overall thickness of the electrophoretic decorative layer by approximately 2 μm, so that the surface of the electrophoretic decorative layer is glossy and can reflect light.

[0087] The surface of the aluminum alloy housing substrate on which the mechanical polishing has been performed was subjected to laser carving via a laser carving machine, so as to expose the aluminum alloy substrate and to obtain a texture pattern having a depth of 0.1mm and a convex-concave effect on the surface of the aluminum alloy housing substrate.

[0088] Then, at a temperature of 50°C, the aluminum alloy housing substrate after being laser carved was subjected to alkali etching for 10s in a sodium hydroxide aqueous solution with a concentration of 55 g/L, and was cleaned twice with deionized water, and then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water.

[0089] Then, the cleaned aluminum alloy housing substrate was subjected to hard anodic oxidation by using a hard anodic oxidation solution including 270g/L of sulfuric acid and 20g/L of oxalic acid for 25 min, under a temperature of 12°C. An electrical parameters of the hard anodic oxidation include: forward square wave pulse, duty ratio of 60%, frequency of 1000Hz, electric current density of 7A/dm^2; thereby obtaining the aluminum alloy housing of the present invention.

Embodiment 7

[0090] This embodiment is used to describe the aluminum alloy housing of the present invention and a preparation method for same.

[0091] A pressure-casting aluminum alloy rear housing substrate (purchased from BYD Co., Ltd.) for use in a P8-model mobile phone is used as an aluminum alloy housing substrate of the this embodiment.

[0092] At a temperature of 50°C, the aluminum alloy housing substrate was subjected to alkali etching for 10s in a sodium hydroxide aqueous solution with a concentration of 55 g/L, and was cleaned twice with deionized water. Then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water. Next, at a temperature of 95°C, the aluminum alloy housing substrate was subjected to polishing for 10s in a chemical polishing solution containing 650 ml/L of phosphoric acid and 350 ml/L of sulfuric acid, and was cleaned twice with deionized water. Then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water. Next, the aluminum alloy housing substrate was dried for 20 min at a temperature of 80°C in a drying oven, to obtain the cleaned and dried aluminum alloy housing substrate.

[0093] An anode film was formed on a surface of the cleaned and dried aluminum alloy housing substrate by means of anodic oxidation. Conditions of the anodic oxidation include: using sulfuric acid with a concentration of 190 g/L as a bath solution, an anode voltage being 15 V, a temperature being 19°C, and an oxidation time being 35 min.

[0094] The aluminum alloy housing substrate on which the anodic oxidation has been performed was subjected to electrophoretic treatment to form an electrophoretic decorative layer on surface of the aluminum alloy housing substrate. Conditions of the electrophoretic treatment include: a temperature of 30°C, a voltage of 160V, a electrophoresing time of 2 min, a pH of 7.8, using a electrophoresing solution containing a flat lacquer (WNO-1) of Shimizu Corporation (Japan) and a varnish (NNO-4) of Shimizu Corporation (Japan); the weight ratio of the flat lacquer to the varnish is 7:3, and a content of a solid composition in the electrophoresing solution is 13wt%; the varnish (NNO-4) includes 50wt% of acrylic resin, 6wt% of 2-butoxy ethanol, 20wt% of ethylene glycol monoisobutyl ether, 18wt% of diethyl diol butyraldehyde, and 6wt% of other composition; the flat lacquer (WNO-1) includes 50wt% of acrylic resin, 10wt% of 2-butoxy ethanol, and 40wt% of other composition.

[0095] The electrophoretic decorative layer on the surface of the aluminum alloy housing substrate was polished by using a mechanical polishing machine, to reduce the overall thickness of the electrophoretic decorative layer by approximately 2 μm, so that the surface of the electrophoretic decorative layer is glossy and can reflect light.

[0096] The surface of the aluminum alloy housing substrate on which the mechanical polishing has been performed was subjected to laser carving via a laser carving machine, so as to expose the aluminum alloy substrate and to obtain a texture pattern having a depth of 0.1mm and a convex-concave effect on the surface of the aluminum alloy housing substrate.

[0097] Then, at a temperature of 50°C, the aluminum alloy housing substrate after being laser carved was subjected to alkali etching for 10s in a sodium hydroxide aqueous solution with a concentration of 55 g/L, and was cleaned twice with deionized water, and then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water.

[0098] Then, the cleaned aluminum alloy housing substrate was subjected to micro-arc oxidation by using a micro-arc oxidation solution including 0.03mol/L of sodium silicate and 0.05mol/L of sodium hydroxide for 40 min, under a temperature of 25°C, and an oxidation forward voltage of 500V; thereby obtaining the aluminum alloy housing of the present invention.

Embodiment 8

[0099] This embodiment is used to describe the aluminum alloy housing of the present invention and a preparation method for same.

[0100] A pressure-casting aluminum alloy rear housing substrate (purchased from BYD Co., Ltd.) for use in a P8-model mobile phone is used as an aluminum alloy housing substrate of the this embodiment.

[0101] At a temperature of 50°C, the aluminum alloy housing substrate was subjected to alkali etching for 10s in a sodium hydroxide aqueous solution with a concentration of 55 g/L, and was cleaned twice with deionized water. Then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water. Next, at a temperature of 95°C, the aluminum alloy housing substrate was subjected to polishing for 10s in a chemical polishing solution containing 650 ml/L of phosphoric acid and 350 ml/L of sulfuric acid, and was cleaned twice with deionized water. Then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water. Next, the aluminum alloy housing substrate was dried for 20 min at a temperature of 80°C in a drying oven, to obtain the cleaned and dried aluminum alloy housing substrate.

[0102] An anode film was formed on a surface of the cleaned and dried aluminum alloy housing substrate by means of anodic oxidation. Conditions of the anodic oxidation include: using sulfuric acid with a concentration of 190 g/L as a bath solution, an anode voltage being 15 V, a temperature being 19°C, and an oxidation time being 35 min.

[0103] The aluminum alloy housing substrate on which the anodic oxidation has been performed was subjected to electrophoretic treatment to form an electrophoretic decorative layer on surface of the aluminum alloy housing substrate. Conditions of the electrophoretic treatment include: a temperature of 30°C, a voltage of 160V, a electrophoresing time of 2 min, a pH of 7.8, using a electrophoresing solution containing a flat lacquer (WNO-1) of Shimizu Corporation (Japan) and a varnish (NNO-4) of Shimizu Corporation (Japan); the weight ratio of the flat lacquer to the varnish is 7:3, and a content of a solid composition in the electrophoresing solution is 13wt%; the varnish (NNO-4) includes 50wt% of acrylic resin, 6wt% of 2-butoxy ethanol, 20wt% of ethylene glycol monoisobutyl ether, 18wt% of diethyl diol butyraldehyde, and 6wt% of other composition; the flat lacquer (WNO-1) includes 50wt% of acrylic resin, 10wt% of 2-butoxy ethanol, and 40wt% of other composition.

[0104] The electrophoretic decorative layer on the surface of the aluminum alloy housing substrate was polished by using a mechanical polishing machine, to reduce the overall thickness of the electrophoretic decorative layer by approximately 2 μm, so that the surface of the electrophoretic decorative layer is glossy and can reflect light.

[0105] The surface of the aluminum alloy housing substrate on which the mechanical polishing has been performed was subjected to laser carving via a laser carving machine, so as to expose the aluminum alloy substrate and to obtain a texture pattern having a depth of 0.1mm and a convex-concave effect on the surface of the aluminum alloy housing substrate.

[0106] Then, at a temperature of 50°C, the aluminum alloy housing substrate after being laser carved was subjected to alkali etching for 10s in a sodium hydroxide aqueous solution with a concentration of 55 g/L, and was cleaned twice with deionized water, and then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water.

[0107] Then, the cleaned aluminum alloy housing substrate was subjected to micro-arc oxidation by using a micro-arc oxidation solution including 0.02mol/L of sodium silicate and 0.07mol/L of sodium hydroxide for 100 min, under a temperature of 30°C, and an oxidation forward voltage of 400V; thereby obtaining the aluminum alloy housing of the present invention.

Embodiment 7

[0108] This embodiment is used to describe the aluminum alloy housing of the present invention and a preparation method for same.

[0109] A pressure-casting aluminum alloy rear housing substrate (purchased from BYD Co., Ltd.) for use in a P8-model mobile phone is used as an aluminum alloy housing substrate of the this embodiment.

[0110] At a temperature of 50°C, the aluminum alloy housing substrate was subjected to alkali etching for 10s in a sodium hydroxide aqueous solution with a concentration of 55 g/L, and was cleaned twice with deionized water. Then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water. Next, at a temperature of 95°C, the aluminum alloy housing substrate was subjected to polishing for 10s in a chemical polishing solution containing 650 ml/L of phosphoric acid and 350 ml/L of sulfuric acid, and was cleaned twice with deionized water. Then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water. Next, the aluminum alloy housing substrate was dried for 20 min at a temperature of 80°C in a drying oven, to obtain the cleaned and dried aluminum alloy housing substrate.

[0111] An anode film was formed on a surface of the cleaned and dried aluminum alloy housing substrate by means of anodic oxidation. Conditions of the anodic oxidation include: using sulfuric acid with a concentration of 190 g/L as a bath solution, an anode voltage being 15 V, a temperature being 19°C, and an oxidation time being 35 min.

[0112] The aluminum alloy housing substrate on which the anodic oxidation has been performed was subjected to electrophoretic treatment to form an electrophoretic decorative layer on surface of the aluminum alloy housing substrate. Conditions of the electrophoretic treatment include: a temperature of 30°C, a voltage of 160V, a electrophoresing time of 2 min, a pH of 7.8, using a electrophoresing solution containing a flat lacquer (WNO-1) of Shimizu Corporation (Japan) and a varnish (NNO-4) of Shimizu Corporation (Japan); the weight ratio of the flat lacquer to the varnish is 7:3, and a content of a solid composition in the electrophoresing solution is 13wt%; the varnish (NNO-4) includes 50wt% of acrylic resin, 6wt% of 2-butoxy ethanol, 20wt% of ethylene glycol monoisobutyl ether, 18wt% of diethyl diol butyraldehyde, and 6wt% of other composition; the flat lacquer (WNO-1) includes 50wt% of acrylic resin, 10wt% of 2-butoxy ethanol, and 40wt% of other composition.

[0113] The electrophoretic decorative layer on the surface of the aluminum alloy housing substrate was polished by using a mechanical polishing machine, to reduce the overall thickness of the electrophoretic decorative layer by approximately 2 μm, so that the surface of the electrophoretic decorative layer is glossy and can reflect light.

[0114] The surface of the aluminum alloy housing substrate on which the mechanical polishing has been performed was subjected to laser carving via a laser carving machine, so as to expose the aluminum alloy substrate and to obtain a texture pattern having a depth of 0.1mm and a convex-concave effect on the surface of the aluminum alloy housing substrate.

[0115] Then, at a temperature of 50°C, the aluminum alloy housing substrate after being laser carved was subjected to alkali etching for 10s in a sodium hydroxide aqueous solution with a concentration of 55 g/L, and was cleaned twice with deionized water, and then, at a temperature of 25°C, the aluminum alloy housing substrate was subjected to neutralization for 10s in nitric acid with a concentration of 250 ml/L, and was cleaned twice with deionized water.

[0116] Then, the cleaned aluminum alloy housing substrate was subjected to micro-arc oxidation by using a micro-arc oxidation solution including 0.05mol/L of sodium silicate and 0.03mol/L of sodium hydroxide for 60 min, under a temperature of 20°C, and an oxidation forward voltage of 600V; thereby obtaining the aluminum alloy housing of the present invention.

Performance tests

[0117] Performance tests are performed, according to the following methods, on the aluminum alloy housings with clear convex-concave patterns obtained in Embodiments 1-9. Test results are as shown in Table 1.

Glossiness test

[0118] A gloss meter (German BKY micro gloss meter A-4460) was used to test the glossiness of the surfaces of the aluminum alloy housings obtained in Embodiments 1-9. The results are as shown in Table 1.

Scratch resistance test

[0119] A UNI pen having 2H hardness was used to scratch at three different places of a sample with a force of 800 g applied at an angle of 45 degrees and a stroke of 10 mm. It is observed whether an evident scratch appears on the sample. If no, it indicates that the sample is qualified.

High temperature resistance test

[0120] The sample was put into a precise high temperature test chamber (HOLINK HRHL45), was heated for 240 hours at a temperature of 85°C, and stayed for 2 hours at room temperature. It is observed whether fall-off, deformation, crack, and color change occurs in the appearance of the sample. If no, it indicates that the sample is qualified.

Low temperature resistance test

[0121] The sample was put into a constant temperature and humidity test chamber (Taiwan KSON, THS-2001), stayed for 240 hours at a temperature of -40°C, and then stayed for 2 hours at room temperature. It is observed whether fall-off, deformation, crack, and color change occurs in the appearance of the sample. If no, it indicates that the sample is qualified.

Moisture resistance test

[0122] The sample was put into a constant temperature and humidity test chamber (Taiwan KSON, HTS-400) with a humidity of 90% and a temperature of 60°C, stayed for 96 hours, and then stayed for 2 hours at room temperature. It is observed whether fall-off, deformation, crack, and color change occurs in the appearance of the sample. If no, it indicates that the sample is qualified.

Temperature shock test

[0123] The sample was put into a thermal shock test chamber (HOLINK HTS-400), and first stayed for 1 hour in an environment with a temperature of -40°C; then, the temperature was switched to 85°C (a switching time was 15s), and the sample stayed for 1 hour at the temperature of 85°C. This process is repeated 12 times (24 hours). It is observed whether fall-off, deformation, crack, and color change occurs in the appearance of the sample. If no, it indicates that the sample is qualified.

Salt spray test

[0124] The sample was put into a test chamber (HOLINK H-SST-90 salt spray tester) with a temperature of 30°C and a humidity of 85% or higher. A solution with pH=6.8 (content of the solution: 50 g/L of NaCl) was used to spray continuously for 48 hours. Then, the sample was taken out, washed with normal-temperature water for 5 min, and dried with a drier. The sample stayed for 1 hour at room temperature. It is observed whether fall-off, deformation, crack, and color change occurs in the appearance of the sample. If no, it indicates that the sample is qualified.

Table 1 Performance Test Results of Aluminum Alloy Housings Obtained in Embodiments 1-9

	Glossiness of convex portion	Glossiness of concave portion	Scratch resistance test	High temperature test	Low temperature test	Moisture test	Temperature shock test	Salt spray test
Embodiment 1	96.2	14.5	Qualified	Qualified	Qualified	Qualified	Qualified	Qualified
Embodiment 2	96.4	15.2	Qualified	Qualified	Qualified	Qualified	Qualified	Qualified
Embodiment 3	97.2	19.2	Qualified	Qualified	Qualified	Qualified	Qualified	Qualified
Embodiment 4	95.6	24.8	Qualified	Qualified	Qualified	Qualified	Qualified	Qualified
Embodiment 5	105.0	16.2	Qualified	Qualified	Qualified	Qualified	Qualified	Qualified
Embodiment 6	94.5	5.4	Qualified	Qualified	Qualified	Qualified	Qualified	Qualified
Embodiment 7	93.5	19.7	Qualified	Qualified	Qualified	Qualified	Qualified	Qualified
Embodiment 8	90.0	0.5	Qualified	Qualified	Qualified	Qualified	Qualified	Qualified
Embodiment 9	96.5	5.0	Qualified	Qualified	Qualified	Qualified	Qualified	Qualified

[0125] It can be seen from the foregoing table that, the surface of the aluminum alloy housing of the present invention is not abraded easily, and the surface layer does not fall off easily, thereby improving the durability of the aluminum alloy housing. Moreover, with the convex-concave pattern, the aluminum alloy housing achieves a beautiful appearance effect, and has a clear bumpy solid texture. Therefore, the aluminum alloy housing provided by the present invention is beautiful and durable. In addition, after mechanical polishing, the surfaces of the aluminum alloy housings obtained in Embodiments 1-9 are also glossy.

[0126] In the description of the specification, the description made with reference to terms such as "one embodiment", "some embodiments", "example", "specific example", or "some examples" means that a specific characteristic, structure, material or feature described with reference to the embodiment or example is included in at least one embodiment or example of the present invention. In the specification, the illustrative expression of the foregoing terms is not necessarily intended for the same embodiment or example. Moreover, the described specific characteristic, structure, material or feature can be combined properly in any one or more embodiments or examples. In addition, without causing conflicts, a person skilled in the art can integrate and combine different embodiments or examples described in the specification or characteristics of different embodiments or examples.

[0127] Although the embodiments of the present invention have been shown and described above, it can be understood that the foregoing embodiments are merely examples and should not be construed as limitations on the present invention. A person of ordinary skill can make changes, modifications, replacements and transformations on the embodiments without departing from the scope of the present invention.

Claims

1. An aluminum alloy housing, wherein an external surface of the aluminum alloy housing has a convex portion and a concave portion, the convex portion has a convex oxide film and a convex electrophoretic decorative layer in turn, the concave portion has a concave oxide film or a concave electrophoretic decorative layer, surface of the convex electrophoretic decorative layer has a glossiness of 90-105, and surface of the concave oxide film has a glossiness of 5-25 or surface of the concave electrophoretic decorative layer has a glossiness of 0.5-5.

2. The aluminum alloy housing according to claim 1, wherein a height difference between the convex portion and the concave portion is 0.05-0.2 mm.

3. The aluminum alloy housing according to claim 1 or 2, wherein the convex oxide film and the concave oxide film have different colors.

4. A preparation method for an aluminum alloy housing, comprising steps of:

   step a: performing first anodic oxidation on the surface of an aluminum alloy housing substrate;
   step b: forming a convex electrophoretic decorative layer on surface of the aluminum alloy housing substrate on which the first anodic oxidation has been performed via first electrophoretic treatment;
   step c: performing mechanical polishing on the surface of the aluminum alloy housing substrate on which the first electrophoretic treatment has been performed;
   step d: performing laser carving on a surface of the aluminum alloy housing substrate on which the mechanical polishing has been performed, so as to obtain a texture pattern having a convex-concave effect on the surface of the aluminum alloy housing substrate;
   step e: performing second electrophoretic treatment or second anodic oxidation or hard anodic oxidation or micro-arc oxidation on portion of the texture pattern on the surface of the aluminum alloy housing substrate.

5. The preparation method according to claim 4, wherein the first anodic oxidation and/or the second anodic oxidation comprises performing pretreatment on the surface of the aluminum alloy housing substrate and then forming an anode film by means of anodic oxidation.

6. The preparation method according to claim 4 or 5, wherein the pretreatment comprises: performing alkali etching for 3-20s at a temperature of 50-70°C by using 50-60 g/L of sodium hydroxide, neutralizing for 10-20s a temperature of 15-25°C by using 200-300 ml/L of nitric acid, and performing chemical polishing for 5-20s at a temperature of 90-95°C by using a chemical polishing solution containing 650-750 ml/L of phosphoric acid and 350-250 ml/L of sulfuric acid.

7. The preparation method according to any of claims 4 to 6, wherein the anodic oxidation comprises oxidizing the

surface of the aluminum alloy housing substrate for 15-50 min under an anode voltage of 13-17 V and at a temperature of 10-21°C by using 190-200 g/L of sulfuric acid.

8. The preparation method according to any of claims 4 to 7, wherein the first electrophoretic treatment and/or the second electrophoretic treatment comprises electrophoresing for 1-3min under a voltage of 140-200 V and at a temperature of 28-32°C by using an electrophoresing solution having a pH of 7-9.

9. The preparation method according to any of claims 4 to 8, wherein the hard anodic oxidation comprises oxidizing for 25-50min under a temperature of 5-12°C by using a hard anodic oxidation solution.

10. The preparation method according to any of claims 4 to 9, wherein the hard anodic oxidation solution includes 170-270g/L of sulfuric acid and 8-20g/L of oxalic acid.

11. The preparation method according to any of claims 4 to 9, wherein the micro-arc oxidation includes oxidizing for 40-100min under a temperature of 20-30°C by using a micro-arc oxidation solution.

12. The preparation method according to any of claims 4 to 9, wherein the micro-arc oxidation solution includes 0.02-0.05mol/L of sodium silicate and 0.03-0.07mol/L of sodium hydroxide.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2016/111568

A. CLASSIFICATION OF SUBJECT MATTER

H05K 5/04 (2006.01) i; C25D 13/20 (2006.01) i
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H05K, C25D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
CNABS, CNTXT, SIPOABS, VEN: electrophoresis, aluminum, metal, alloy, oxidation, anod+, film, membrane, phoresis, concave, polish, carving, etching

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 101293460 A (BYD COMPANY LIMTED), 29 October 2008 (29.10.2008), description, pages 7 and 8	1-12
Y	CN 103352244 A (KUNSHAN THETA MICRO CO., LTD.), 16 October 2013 (16.10.2013), description, paragraphs [0021]-[0031]	1-12
A	CN 102724840 A (FUZHUN PRECISION INDUSTRY (SHENZHEN) CO., LTD. et al.), 10 October 2012 (10.10.2012), the whole document	1-12
A	CN 104735941 A (BYD COMPANY LIMTED), 24 June 2015 (24.06.2015), the whole document	1-12
A	WO 2015122901 A1 (HEWLETT-PACKARD DEV CO LP), 20 August 2015 (20.08.2015), the whole document	1-12
A	WO 2013139198 A1 (SHENZHEN BYD AUTO R & D CO., LTD. et al.), 26 September 2013 (26.09.2013), the whole document	1-12
A	CN 102400198 A (BBK ELECTRONICS CORP. LTD.), 04 April 2012 (04.04.2012), the whole document	1-12

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

“E” earlier application or patent but published on or after the international filing date

“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search 01 March 2017 (01.03.2017)	Date of mailing of the international search report **20 March 2017 (20.03.2017)**
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer **LI, Yuhong** Telephone No.: (86-10) **62084836**

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2016/111568

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 101293460 A	29 October 2008	CN 101293460 B	17 August 2011
CN 103352244 A	16 October 2013	CN 103352244 B	10 August 2016
CN 102724840 A	10 October 2012	CN 102724840 B	04 March 2015
		US 8603317 B2	10 December 2013
		US 2012251839 A1	04 October 2012
		US 2014011046 A1	09 January 2014
CN 104735941 A	24 June 2015	None	
WO 2015122901 A1	20 August 2015	CN 105765112 A	13 July 2016
		US 2016345451 A1	24 November 2016
WO 2013139198 A1	26 September 2013	EP 2828420 A4	09 December 2015
		US 2015044436 A1	12 February 2015
		EP 2828420 A1	28 January 2015
		CN 103320830 B	17 August 2016
		CN 103320830 A	25 September 2013
CN 102400198 A	04 April 2012	None	

Form PCT/ISA/210 (patent family annex) (July 2009)