

(19)



(11)

EP 2 746 430 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
25.06.2014 Bulletin 2014/26

(51) Int Cl.:
C25D 11/12 (2006.01) **C25D 11/02** (2006.01)
G06K 19/077 (2006.01) **H01Q 7/00** (2006.01)

(21) Application number: **12198865.3**

(22) Date of filing: **21.12.2012**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME

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(54) **A method for anodization of a metal base**

(57) A method for anodizing a metal base is provided. The method comprises performing a first anodizing process of a first surface of the metal base whereby a first anodized oxide layer is provided and performing a second anodization process of a part of the first surface

whereby a second anodized oxide layer is provided. The second anodization process is performed forming a pattern of conductive traces of the second anodized oxide layer whereby a radiating element is provided.

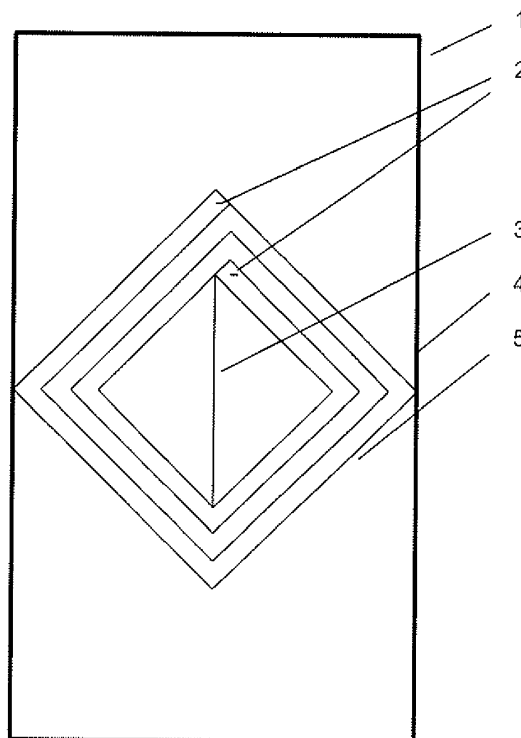


Fig. 1

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Description

TECHNICAL FIELD

[0001] Embodiments herein relate to methods for anodizing of a metal base, and especially to a method comprising a first anodizing process whereby a first anodized oxide layer is provided and a second anodization process a second anodized oxide layer is provided. Other embodiments herein relate to a substrate, an interconnect substrate and to electronic devices.

BACKGROUND

[0002] Anodizing, or controlled oxidation, is an electrochemical process typically used to build a thickness and a density of a naturally forming oxide layer on a surface of a metal. By increasing the thickness and density of the oxide layer anodizing generally provides for improved corrosion and wear resistance in the substrate. Additionally, it provides for substantially better adhesion of paints, and/or epoxies, and/or other protective/decorative coating materials onto the base. Optionally, it provides for electrical isolation. Aluminum and aluminum alloys are examples of types of metals on which a protective oxide layer naturally forms along the surface when the surface is exposed to the atmosphere. The oxide layer is generally adapted to moderately protect the metal from corrosion. In order to have increased protection over that provided by the naturally formed oxide layer, the base generally undergoes anodizing. Typically, for aluminum and aluminum alloys, anodizing is performed by submerging the base in a solution soluble to aluminum oxide, such as oxalic acid, phosphoric acid, sulphuric acid, chromic acid or any other appropriate material.

[0003] ALOX(TM) substrate technology is a unique multilayer substrate technology developed for microelectronics packaging applications. The process is simple and low cost, and contains a low number of process steps. The ALOX(TM) substrate technology serves as a wide technology platform, and can be implemented in various electronics packaging applications such as for RF, SiP, 3-D memory stacks, MEMS and high power modules and components.

[0004] A starting material in an ALOX(TM) process is a conductive aluminum sheet. A first step in the process is masking the top and bottom of the sheet using conventional lithography techniques (for example, photore-sist). Via structures, comprising solid aluminum, are formed using anodization of the sheet through the whole thickness of the sheet. The exposed areas are converted into aluminum oxide which is ceramic in nature and a highly insulating dielectric material. The protected unexposed areas remain as aluminum elements and form the connecting vias. In its simplest form, an ALOX(TM) interconnect substrate is formed by electrochemical anodic oxidation of selected portions of an initially conductive valve metal (for example, aluminum) substrate resulting

in areas (regions) of conductive (starting) material which are geometrically defined and isolated from one another by areas (regions) of anodized (non- conductive, such as aluminum oxide, or alumina) isolation structures. "Vertical" isolation structures extend into the substrate, including completely through the substrate. "Horizontal" isolation structures extend laterally across the substrate, generally just within a surface thereof. Anodizing from one or both sides of the substrate can be performed to arrive at complex interconnect structures.

[0005] In a more complex form a multilayer low cost ceramic board is formed using this process. A complete "three metal layer" core contains an internal aluminum layer, top and bottom patterned copper layers with through vias and blind vias incorporated in the structure.

[0006] WO 2008/142699 discloses a method for deep anodization of at least a portion of a thick substrate comprising a thick valve metal base (minimum thickness 200 [μm]), wherein the anodization reaches a depth of at least 200 [μm] into the base from a surface of the base exposed to an anodization process. By using the disclosed method, for example, anodization may be used for via forming in a thick substrate of thickness at least 0.4 mm. Via forming in a thick substrate provides for substantially high breakdown voltage, and for high power dissipation in micromechanical, optical, thermal applications.

SUMMARY

[0007] An object of embodiments herein is to provide an improved method for anodization. According to some embodiments described herein, a method for anodizing of a metal base is provided. The method comprises performing a first anodizing process of a first surface of the metal base whereby a first anodized oxide layer is provided and performing a second anodization process of a part of the first surface whereby a second anodized oxide layer is provided. The second anodization process is performed forming a pattern of conductive traces of said second anodized oxide layer whereby a radiating element is provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Examples of embodiments herein are described in more detail with reference to attached drawings in which:

Figure 1 shows a metal base provided with an anodized pattern according to embodiments disclosed herein.

DETAILED DESCRIPTION

[0009] Embodiments herein will be exemplified in the following detailed non-limiting description.

[0010] Figure 1 shows a metal base 1 provided with

an anodized pattern according to embodiments disclosed herein. An exemplified method for anodizing of a metal base comprises performing a first anodizing process of a first surface of the metal base whereby a second anodized oxide layer 5 is provided, and performing a second anodization process of a part of the first surface whereby a second anodized oxide layer is provided. The second anodization process is performed forming a pattern of conductive traces of said second anodized oxide layer whereby a radiating element is provided. The radiating element may be such as an NFC coil antenna. In the drawing, pads 2 are seen and the antenna coil is located between these pads 2. The anodizing processes may for example comprise growing aluminum oxide. The metal base may be used in any electronic device comprising a radiating element, i.e. Bluetooth, WLAN, GPS or cellular radios, or an NFC coil antenna in the metal back of a mobile phone.

[0011] By anodizing a pattern throughout a base of aluminum, or any other suitable metal, back cover conductive traces are made in order to form a radiating element such as an NFC coil antenna. The aluminum back cover is anodized in a conventional manner, providing a first thin oxide layer. In addition, a second anodization process is performed throughout the back cover in a pattern providing conductive traces forming a radiating element such as an NFC antenna coil. The pattern may be designed in a way still allocating space for a camera hole or the like provided on an electronic device, and other options for different industrial design, etc.

[0012] A third anodization 3 on at least a part of said first surface may be performed. The third additional anodization throughout the back cover may also be performed in order to eliminate unwanted eddy currents. The first anodization ensures that the a radiating element such as NFC antenna is not visible since the outer surface of the aluminum back cover is anodized all over in a thin outer layer.

[0013] Methods disclosed herein may be used to produce a substrate. Embodiments disclosed herein relates to a substrate comprising a metal base. The metal base may comprise aluminum. A first surface of the metal base is provided with a first anodized oxide layer provided by the first anodization process. A part of the first surface comprises a second anodized oxide layer provided by a second anodization process. The second anodized oxide layer forms a pattern of conductive traces whereby a radiating element such as an NFC coil antenna is provided. The anodized layers may comprise aluminum oxide.

[0014] Further embodiments herein relates to an interconnect substrate comprising a metal base. A first surface of the metal base comprises a first anodized oxide layer provided by a first anodization process. A part of the first surface comprises a second anodized oxide layer provided by a second anodization process. The second anodized oxide layer forms a pattern of conductive traces whereby a radiating element such as an NFC coil antenna is provided.

[0015] Still further embodiments herein relates to an electronic device comprising a substrate comprising a metal base. At least a first surface of the metal base is provided with a first anodized oxide layer provided by a first anodization process. A part of the first surface comprises a second anodized oxide layer provided by a second anodization process. The second anodized oxide layer forms a pattern of conductive traces whereby a radiating element such as an NFC coil antenna is provided.

[0016] Further embodiments herein relates to an electronic device comprising an interconnect substrate comprising a metal base. At least a first surface of the metal base is provided with a first anodized oxide layer provided by a first anodization process. A part of the first surface comprises a second anodized oxide layer provided by a second anodization process. The second anodized oxide layer forms a pattern of conductive traces whereby a radiating element such as an NFC coil antenna is provided.

[0017] When using the word "comprise" or "comprising" it shall be interpreted as non-limiting, in the meaning of consist at least of. When using the word action/actions it shall be interpreted broadly and not to imply that the actions have to be carried out in the order mentioned. Instead, the actions may be carried out in any suitable order other than the order mentioned. Further, some action/actions may be optional. The embodiments herein are not limited to the above described examples. Various alternatives, modifications and equivalents may be used. Therefore, this disclosure should not be limited to the specific form set forth herein. This disclosure is limited only by the appended claims and other embodiments than the mentioned above are equally possible within the scope of the claims.

Claims

1. A method for anodizing of a metal base comprising:

- performing a first anodizing process of a first surface of said metal base whereby a first anodized oxide layer is provided;
- performing a second anodization process of a part of said first surface whereby a second anodized oxide layer is provided;
- wherein said second anodization process is performed forming a pattern of conductive traces of said second anodized oxide layer whereby a radiating element is provided.

2. The method of claim 1 further comprising:

- performing a third anodization on at least a part of said first surface.

3. The method of claim 1 or 2, wherein said metal base comprises aluminum.

4. The method of any of the preceding claims, wherein the anodizing processes comprises growing aluminum oxide.

5. A substrate comprising a metal base, wherein at least a first surface of said metal base is provided with a first anodized oxide layer provided by a first anodization process; and wherein a part of said first surface comprises a second anodized oxide layer provided by a second anodization process, wherein said second anodized oxide layer forms a pattern of conductive traces whereby a radiating element is provided.

6. The substrate of claim 5 wherein the metal base comprises aluminum.

7. The substrate of claim 5 or 6 wherein the anodized layers comprise aluminum oxide.

8. The substrate of any of claims 5, 6 or 7 wherein the radiating element is a NFC coil antenna.

9. An interconnect substrate comprising a metal base, wherein at least a first surface of said metal base comprises a first anodized oxide layer provided by a first anodization process; and wherein a part of said first surface comprises a second anodized oxide layer provided by a second anodization process, wherein said second anodized oxide layer forms a pattern of conductive traces whereby a radiating element is provided.

10. An electronic device comprising: a substrate comprising a metal base, wherein at least a first surface of said metal base is provided with a first anodized oxide layer provided by a first anodization process; and wherein a part of said first surface comprises a second anodized oxide layer provided by a second anodization process, wherein said second anodized oxide layer forms a pattern of conductive traces whereby a radiating element is provided.

11. An electronic device comprising: an interconnect substrate comprising a metal base, wherein at least a first surface of said metal base is provided with a first anodized oxide layer provided by a first anodization process; and wherein a part of said first surface comprises a second anodized oxide layer provided by a second anodization process, wherein said second anodized oxide layer forms a pattern of conductive traces whereby a radiating element is provided.

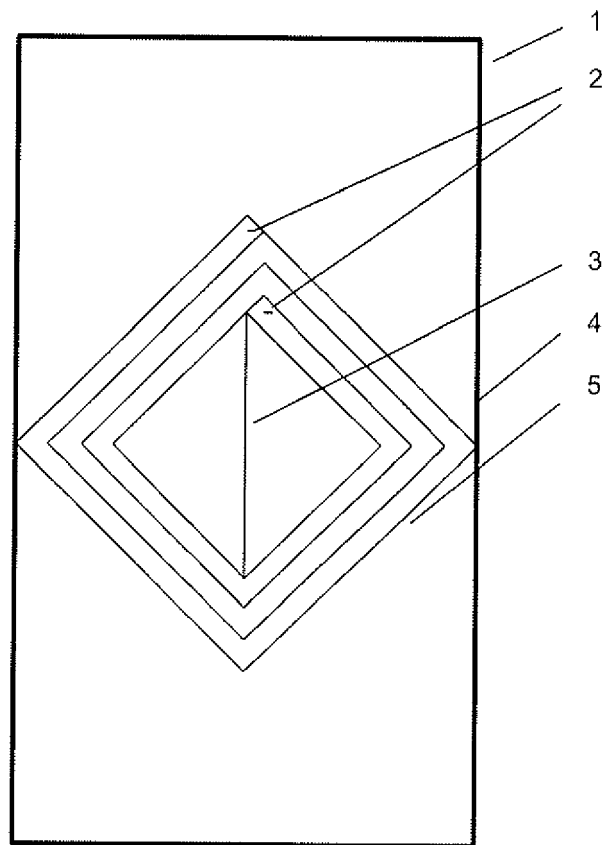


Fig. 1



EUROPEAN SEARCH REPORT

Application Number
EP 12 19 8865

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 28 May 2013	Examiner Haering, Christian
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 12 19 8865

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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