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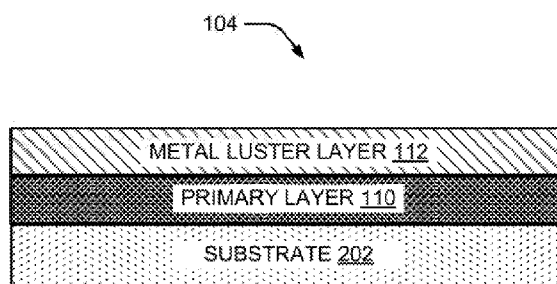


Figure 2

(57) Abstract: Examples of a cover for a device are described herein. The cover includes a substrate, which may be placed in proximity to an antenna. A primary layer may be applied on the substrate and over the primary layer a metal luster layer may be applied. The metal luster layer may comprise particles with surfaces partially coated with metal nanoparticles.



COVER FOR DEVICES

BACKGROUND

[0001] Electronic devices, such as computing devices are no longer restricted for office use but are widely used for personal purposes as well. With the increase in the popularity, and in addition to configuration and functions performed by a computing device, there has been an emphasis on enhancing aesthetics of the electronic devices. For instance, to enhance the aesthetics a lustrous finish, such as a metal finish, may be provided to an exterior surface of an electronic device.

BRIEF DESCRIPTION OF FIGURES

[0002] The following detailed description references the drawings, wherein:

[0003] Figure 1 illustrates a schematic of a device having a cover, in accordance with an example implementation of the present subject matter.

[0004] Figure 2 illustrates a schematic of the cover, in accordance with an example implementation of the present subject matter.

[0005] Figure 3 illustrates a schematic diagram illustrating preparation of a lustrous paint formulation, in accordance with an example implementation of the present subject matter.

[0006] Figures 4A-4E illustrate sectional views of the cover, in accordance with various example implementations of the present subject matter.

[0007] Figure 5 illustrates a method for preparing a lustrous paint formulation, in accordance with an example implementation of the present subject matter

[0008] Figure 6 illustrates a method for fabricating the cover, in accordance with another example implementation of the present subject matter.

DETAILED DESCRIPTION

[0009] With the advance in technology, electronic devices have become ubiquitous. In addition to being assessed based on the configuration, the electronic devices are often evaluated, based on aesthetics. The aesthetics may include, for instance, a lustrous finish provided to an exterior surface of electronic device. To provide lustrous finish, the exterior surface may be coated with a paint layer, which may include, for instance, metal particles to provide luster to the

exterior surface. In some cases, such metal particles may interfere with the working of an antenna of the electronic device. For example, the metal particles may allow flow of electric current, which in turn may interfere with electromagnetic waves received and transmitted by the antenna. This in turn may adversely affect the performance of the antenna, and hence, the electronic device.

[0010] A lustrous paint formulation and approaches to provide such a formulation and other articles thereof, are described. The example lustrous paint formulation while providing for luster, does not interfere with communication components, such as an antenna. The lustrous paint formulation, hereinafter referred to as paint formulation, may be composed of particles partially coated metal nanoparticles. In an example, the metal nanoparticles include a metal or an alloy. The partially metal coated particles prior to surface coating, referred to as base particles, may be composed of organic particles, inorganic particles, or composite particles. To coat the base particles with the metal nanoparticles, a deposition process, such as physical vapor deposition (PVD), may be used. While performing the PVD, the base particles may be coated with the metal nanoparticles such that the metal nanoparticles do not cover an entire surface of the base particle, i.e., the base particles may be partially coated with the metal nanoparticles. In an example, the resulting formulation includes particles having non-continuous metal nanoparticle coating.

[0011] Using the paint formulation, a lustrous paint may be prepared for coating or applying onto a device cover. To provide the luster, a layer of the lustrous paint may be deposited on the device cover. As the particles are partially coated with the metal nanoparticle, a discontinuous metal luster layer is formed, resulting in the metal luster layer to be no longer conductive. Accordingly, while the metal nanoparticles provide for luster, owing to partial coating of the nanoparticles on the particles, the flow of electric current through the metal luster layer is avoided. Thus, transmission and receipt of the electromagnetic waves may not be affected by the metal luster layer, thereby not affecting antenna performance.

[0012] The following detailed description refers to the accompanying drawings. Wherever possible, the same reference numbers are used in the

drawings and the following description to refer to the same or similar parts. While several examples are described in the description, modifications, adaptations, and other implementations are possible. Accordingly, the following detailed description does not limit the disclosed examples. Instead, the proper scope of the disclosed examples may be defined by the appended claims.

[0013] Figure 1 illustrates a schematic diagram of an electronic device 100, according to an example implementation of the present subject matter. The device 100 may be a personal computer (PC), a laptop, a tablet PC, a mobile phone, a smart camera, a set top box (STB) or any other electronic device having an antenna. Further, the device 100 may include, among other things, an antenna 102 and a device cover 104, hereinafter referred to as cover 104 housing the antenna 102. The antenna 102 may be an electrical component of the device 100 that provides for communication by sending and receiving electromagnetic signals. The antenna 102 may be operated to communicate with other devices.

[0014] Further, the cover 104 of the device 100 may be a part of a body of the device 100. In another example, the cover 104 may be separately provided on the device 100. The cover 104 may include a lustrous external surface to enhance the aesthetics of the device 100. In an example, the cover 104 may be provided with certain structural features for the aforementioned purpose. For example, the cover 104 may be provided with multiple layers thereon.

[0015] The layers may be provided on an outer surface 106 of the cover 104 while an inner surface 108 may face components, such as the antenna 102. The cover 104 may include a primary layer 110 applied over the outer surface 106 and a metal luster layer 112 applied over the primary layer 110. The primary layer 110 may be act as a bridge layer between the cover 104 and the metal luster layer 112 to provide better adhesion and to enhance aesthetics. The metal luster layer 112 may be provided as an exterior layer for enhancing aesthetics of the cover 104 and the device 100. The metal luster layer 112 is composed of partially coated particles. Such particles include base particles partially coated with metal nanoparticles to provide luster to the cover 104. As the particles are not completely coated with the metal (metal nanoparticles), the metal luster layer 112 composed of such particles may be incapable of conducting, thereby not

interfering with the working of the antenna 102. Thus, the metal luster layer 112 adds to the aesthetics and at the same time ensures the performance of the antenna 102.

[0016] Figure 2 illustrates a schematic diagram illustrating the cover 104, in accordance with an example implementation of the present subject matter. As mentioned previously, the cover 104, in addition to other things, provides for enhancing the aesthetics of the device 100. The cover 104 may be a detachable or non-detachable part of the body of the device 100. In an example, the cover 104 may cover an antenna slot of the device 100. In another example, the cover 104 may cover the whole of device 100.

[0017] In one example, the cover 104 includes a substrate 202, a primary layer 110, and a metal luster layer 112. The substrate 202 may be a skeleton structure of the cover 104 over which the coatings may be applied. During operation of the device 100, the substrate 202 may be in proximity to the antenna 102. A surface of the substrate 202 that faces the antenna 102 corresponds to the inner surface 108 and another surface of the substrate 202 that faces away from the antenna 102, i.e., the surface that is exposed to surroundings and comes in contact with the user corresponds to the outer surface 106. The substrate 202 may comprise a metal, a metal alloy, a polymer, a carbon fiber, a ceramic, and a composite material, to provide sturdiness and durability to the cover 104. In an example, the substrate 202 includes one of aluminum, magnesium, zinc, titanium, niobium, carbon steel, stainless, copper, iron, and silicon carbide.

[0018] The substrate 202 includes the primary layer 110 and the metal luster layer 112 applied over the primary layer 110. In an example, the primary layer 110 may be a layer disposed directly over a surface. The primary layer 110 may include color pigments, binders, fillers, such as carbon black, carbon nanotubes (CNT), graphene, graphite, titanium dioxide, aluminum oxide, barium sulfate, calcium carbonate, clay, mica, dyes, synthetic pigments, talc, metallic powders, organic powders, color pigments and inorganic powder. The primary layer 110 may be a monolayer or may include multiple layers, such as a base coat layer, a primer layer, and a powder coat layer, as will be explained in detail with respect to figures 4A-4E.

[0019] The primary layer 110 may enhance adhesion of the metal luster layer 112 to the substrate 202. The primary layer 110 may also enhance the aesthetics, for instance, color appearance by way of color pigments. As a result, the metal luster layer 112 may include minimum color pigments to provide better adhesion.

[0020] The metal luster layer 112 is applied using a lustrous paint formulation. To provide luster, the lustrous paint formulation and thus, the metal luster layer 112 include metal coated particles. According to an aspect of the present subject matter, base particles, i.e., particles to be coated, may be treated with metal nanoparticles using a PVD process. The base particles are treated such that a non-continuous coating of metal nanoparticles is formed on surface of the base particles. Thus, the resulting particles are partially coated with the metal nanoparticles. The preparation of lustrous paint formulation is explained in detail with respect to description of Figure 3. The metal lustrous layer 112 formed using the lustrous metal formulation provides a metal luster owing to presence metal coated particles; however, as the particles may not completely coated, the electromagnetic waves may no longer be blocked or reflected, thereby not hindering the working of the antenna 102 (shown in Figure 1).

[0021] Figure 3 a schematic 300 for preparing a lustrous paint formulation, in accordance with an example implementation of the present subject matter. In an example, a physical vapor deposition (PVD) process, such as sputtering deposition and a chemical vapor deposition, may be used. The sputtering deposition may include ion-beam sputtering, reactive sputtering, ion-assisted deposition (IAD), high-target-utilization sputtering, high-power impulse magnetron sputtering (HIPIMS), and gas flow sputtering. Although the preparation has been explained in detail with respect to sputtering deposition, it will be appreciated that other processes may also be used.

[0022] In an example, base particles 302-1, ...302-N, collectively referred to as base particles 302, may be added in a heat bath 304 of a reaction chamber 306. The base particles 302 may include one of organic particles, inorganic particles, or composite particles. The inorganic particles may include, for instance, ceramic powders, glass beads, glass plates glass fibers, clays, and hollow inorganic particles. The organic particles include, for instance, plastic

beads, polyacrylic, polycarbonate, polyurethane, hollow organic powders, thermoplastic polymers, or thermoset polymers. As mentioned earlier, the base particles 302 may be coated with metal nanoparticles 308-1, ..308-N, collectively referred to as metal nanoparticles 308. The metal nanoparticles 308 may include, for instance, titanium, chromium, nickel, zinc, zirconium, manganese, copper, aluminum, tin, molybdenum, tantalum, tungsten, hafnium, gold, palladium, vanadium, silver, platinum, graphite, stainless steel and alloy combinations thereof.

[0023] In operation, the reaction chamber 306 at one end may be grounded and at other end, a negative potential may be provided. Further, operating parameters, such as vacuum and temperature of the reaction chamber 306 may be controlled as per PVD process. In an example, the vacuum may be maintained at about 8×10^{-4} Torr to 1×10^{-4} Torr and temperature may be maintained at about 120°C -180°C. Further, the temperature of the heat bath 304 may be maintained at about 120°C -250°C. Upon setting operating parameters, a sputtering gas may be allowed to enter from an inlet 310 of the reaction chamber 306. The sputtering gas may be an inert gas, such as argon. The sputtering gas provides sputtering ions 312-1.. 312-N, such as Ar^+ . The sputtering ions 312-1.. 312-N, collectively referred to as sputtering ions 312 on reaching a sputtering target 314 eject sputtered target atoms 316-1, ...316-N, collectively referred to as sputtered target atoms 316. The sputtered target atoms 316 have wide energy distribution and on colliding with the metal nanoparticles 308 provide for deposition of the metal nanoparticles 308 over surfaces of the base particles 302. Further, an agitator 318 provided at an end of the reaction chamber 306 having the heat bath 304 provides for uniform deposition of the metal nanoparticles 308 on the base particles 302. The agitator 318 may continuously agitate the reaction mixture to ensure uniform deposition. Also, the agitation may also ensure that particles are partially coated. Further, to ensure partial coating of the PVD processing time may also be controlled. In an example, upon completion of surface treatment of base particles 302, the surface treated base particles may be placed in a holder, such as a plastic holder and the partially coated base particles may be detected through electromagnetic wave detection.

[0024] The above-mentioned process may result in a formulation, referred to as a lustrous paint formulation, having particles with non-continuous metal coating. Using the formulation, a lustrous paint may be prepared to be applied over device covers, such as the cover 104. Owing to non-continuous metal coating over the base particles 302, transmission of electromagnetic waves by a component, such as the antenna 102 is not blocked as compared to a case, where free electrons in a continuous metal layer may have formed a barrier to block the electromagnetic waves. Consequently, the antenna characteristics as well as a metallic luster be ensured.

[0025] Figures 4A-4E illustrate a cross sectional view of the cover 104, according to various example implementations of the present subject matter. For the sake of brevity, description of Figures 4A-4E is provided with reference to the primary layer 110 and the metal luster layer 112. It will be appreciated that multiple other layers, such as heat resistant layers and a chemical resistance layer may also be applied.

[0026] Referring to Figure 4A, a sectional view of the cover 104 of the device 100 is illustrated, in accordance with an example implementation of the present subject matter. On the outer surface 106 of the substrate 202, a base coat layer 402 is applied. The substrate 202 may include a metal, a plastic, a carbon fiber, a ceramic or composites. The base coat layer 402 functions as the primary layer 110 described above. The base coat layer 402 may have a thickness in a range of about 5 μm -20 μm . The base coat layer 402 includes, for instance, one or more of barium sulfate, talc, dyes, and color pigments. In an example, the material forming the base coat layer 402 may be spray coated on the substrate 202 to form the base coat layer 402. In one example, for applying the base coat layer 402 temperature may be maintained in the range of about 60°C -80°C and may be kept for 15-40 minutes.

[0027] As illustrated, the metal luster layer 112 may be applied over the base coat layer 402 using the lustrous paint formulation. The metal luster layer 112 provides metallic luster to substrate 202. Additionally, the metal luster layer 112 may provide for additional aesthetic properties, for example, the metal luster layer 112 may include a color coating or a coating to impart certain texture, such as

silky and matte, to the cover 104. In an example, the metal luster layer 112 may have a thickness in a range of about 10 μm -25 μm . In one example, for applying the metal luster layer 112 the temperature may be maintained in the range of about 60°C -80°C and may be kept for 20-40 minutes.

[0028] Figure 4B illustrates the sectional view of the cover 104, in accordance with another example implementation of the present subject matter. On the outer surface 106 of the substrate 202, a primer layer 404 is disposed. The primer layer 404 may have a thickness in a range of about 5 μm -15 μm . The primer layer 404 includes fillers, such as carbon black, titanium dioxide, clay, mica, talc, barium sulfate, calcium carbonate, synthetic pigments, metallic powders, aluminum oxide, CNT, graphene, graphite, and organic and inorganic powders.

[0029] Over the primer layer 404, the base coat layer 402 may be applied. Thus, the primer layer 404 may be interspersed between the substrate 202 and the base coat layer 402. The primer layer 404 and the base coat layer 402 may together function as the primary layer 110. Further, in case heat resistance properties are to be provided, heat insulating materials may also be added to the primer layer 404 and to the base coat layer 402. Finally, over the base coat layer 402, the metal luster layer 112 may be applied. The base coat layer 402 and the metal luster layer 112 may be provided as described with respect to Figure 4A.

[0030] Figure 4C illustrates the sectional view of the cover 104, in accordance with another example implementation of the present subject matter. The primer layer 404 is disposed over the outer surface 106 of the substrate 202. The primer layer 404 may function as the primary layer 110. Over the primer layer 404, the metal luster layer 112 may be provided. In said implementation, the metal luster layer 112 may also have properties of the base coat layer 402. An additional layer, a top layer 406 may be disposed as a final layer over the metal luster layer 112. In an example, the top layer may be a clear top layer. In another example, the top layer 406 may be metal based top layer and include less than 5 wt% aluminum flakes and/or less than 5 wt% of the particles with surface partially coated metal nanoparticles.

[0031] Further, Figure 4D illustrates the sectional view of the cover 104, in accordance with another example implementation of the present subject matter. A powder coat layer 408 may be disposed on the outer surface 106 of the substrate 202. The powder coat layer 408 includes fillers, such as carbon black, titanium dioxide, clay, mica, talc, barium sulfate, calcium carbonate, synthetic pigments, metallic powders, aluminum oxide, CNT, graphene, graphite, and organic and inorganic powders.

[0032] In an example, the powder adheres to the substrate 202 due to electrostatic charging of the powder. Further, the substrate 202 may include electrically ground material to enhance the charged particle attachment. The powder coat layer 408 normally has higher thickness in order to fill the porous substrate, such as die-casting magnesium alloy substrate more effectively in the whole pieces of Mg substrate (AZ91). The powder coat layer 408 may have a thickness in a range of about 20-60 μm . The powder coat layer 408 may also provide corrosion- resistance at top, side and bottom areas of a die casting Mg substrate. In one example, for applying the primer coat layer 408 the temperature may be maintained in the range of about 120°C -190°C and may kept for 10-40 minutes.

[0033] Over the powder coat layer 408, the primer layer 404 and the base coat layer 402 may be provided as discussed above. The powder coat layer 408, the primer layer 404, and the base coat layer 402 may together form the primary layer 110. Further, the metal luster layer 112 may be provided in the same manner as described with reference to Figure 4A.

[0034] Figure 4E illustrates the sectional view of the cover 104, in accordance with yet other example implementation of the present subject matter. The powder coat layer 408 is disposed over the substrate 202. The primer layer 404 may be disposed over the powder coat layer 408, and the metal luster layer 112 may be disposed over the powder coat layer 408. In said example, the metal luster layer 112 may also properties of the base coat layer 402. Further, the top layer 406 may be provided as the final coat as discussed with respect to Figure 4C.

[0035] Figure 5 illustrates a method 500 for preparing a lustrous paint formulation, in accordance with an example implementation of the present subject matter. Further, Figure 6 illustrates a method 600 for fabricating a device cover, such as the cover 104 for the device 100, in accordance with another example implementation of the present subject matter. The order in which the methods are described is not intended to be construed as a limitation, and any number of the described method blocks can be combined in any appropriate order to execute the methods.

[0036] Referring to block 502, base particles may be treated with metal nanoparticles using a physical deposition process. The base particles 302 may include one of organic particles, inorganic particles, or composite particles. The metal nanoparticles 308 may include, for instance, titanium, chromium, nickel, zinc, zirconium, manganese, copper, aluminum, tin, molybdenum, tantalum, tungsten, hafnium, gold, palladium, vanadium, silver, platinum, graphite, stainless steel and alloy combinations thereof. In an example, the base particles 302 may be treated with the metal nanoparticles 308 using a sputtering deposition process described in Figure 3. Further, the reaction mixture may be continuously agitated and/or the process may be time controlled to allow the metal nanoparticles to partially coat a surface of the base particles.

[0037] At block 504, a lustrous paint formulation to coat a surface of a device cover may be prepared. For instance, upon the surface treatment, partially coated base particles may be selected using the electromagnetic detection to form the lustrous paint formulation. Thus, the lustrous paint formulation may be composed of particles partially coated with metal nanoparticles. The lustrous paint formulation, when applied on the surface provide metallic luster to enhance aesthetics.

[0038] Referring to Figure. 6, a method for fabricating an article, such as device cover is described, according to an example implementation of the present subject matter. Individual blocks may be deleted from the method 600 without departing from the spirit and scope of the subject matter described herein. at block 602, at least a surface of a device cover treated prior to applying various coatings. The type of surface treatment, which is to be performed is based on a material of

a substrate of the cover. For instance, in case the substrate comprises a metal, polishing, degreasing, activation, and neutralization may be performed in addition to surface cleaning. In another example, in case of metal substrate, die casting, CNC, or forging of metal substrate may be performed. In another example, an Mg alloy substrate may be treated using micro arc oxidation (MAO) process.

[0039] At block 604, subsequent surface treatment, a primary layer, such as the primary layer 110, is disposed on the treated surface. The primary layer may be provided for, for instance, enhancing adhesion to the substrate and enhancing aesthetic appeal, for example, color appearance. In an example, the primary layer may be multilayered comprising various combinations of a powder coat layer, a primer layer, and a base coat layer. In another example, the primary layer may be mono-layered, comprising a single layer, such as a base coat layer and a primer layer. The primary layer may be formed in a variety of ways as described below.

[0040] In one example, at block 604-1, a powder coat layer, such as the powder coat layer 408 is applied directly to the cover.

[0041] At block 604-2, a primer layer, such as the primer layer 404, is applied over the powder layer. In an example, the primer layer and the powder coat layer may together form the primary layer.

[0042] In yet another example, at block 604-3, a base coat layer, such as the base coat layer 402 is applied over the primer layer. In said example, the three layers, i.e., the base coat layer, the primer layer, and the powder coat layer, may together form the primary layer.

[0043] In another example, the base coat layer may be applied over the powder coat layer. In said example, the base coat layer and the powder coat layer may collectively form the primary layer.

[0044] In yet another example, the primary layer may be a monolayer. In said example, either a base coat layer, as illustrated at block 604-3, may applied over the cover or a primer layer, as illustrated at block 604-2, may be applied on the cover.

[0045] On forming the primary layer, at block 606, a metal luster layer, such as the metal luster layer 112, is applied on the primary layer. The metal luster

layer may be applied using a lustrous paint formulation composed of particles, such as the base particles 302, having surfaces partially coated with metal nanoparticles. The metal luster layer 112 provides for luster without interfering with working of a component, such as the antenna 102 owing to non-continuous coating of metal on the particles.

[0046] Although examples for the cover for the device, the device having the cover, and the methods for forming a lustrous formulation and fabricating the covers have been described in language specific to structural features and/or methods, it is to be understood that the appended claims are not limited to the specific features or methods described. Rather, the specific features and methods are disclosed as examples for the cover, the device, and the methods for preparing lustrous paint formulation and fabricating the covers.

What is claimed is:

1. A device cover comprising,
 - a substrate;
 - a primary layer applied over an outer surface of the substrate; and
 - a metal luster layer applied over the primary layer, the metal luster layer comprising particles with surfaces partially coated with metal nanoparticles.
2. The device cover as claimed in claim 1, wherein the particles comprise one of organic particles, inorganic particles, and composite particles.
3. The device cover as claimed in claim 1, wherein the particles are surface coated with the metal nanoparticles using a physical vapor deposition process.
4. The device cover as claimed in claim 1, wherein the primary layer comprises one of a base coat layer and a primer layer.
5. The device cover as claimed in claim 1, wherein the device cover comprises a top layer applied over the metal luster layer.
6. The device cover as claimed in claim 1, wherein the primary layer comprises a primer layer, wherein the primer layer is interspersed between the substrate and a base coat layer.
7. The device cover as claimed in claim 1, wherein the primary layer comprises:
 - a powder coat layer applied over the substrate; and
 - a primer layer applied over the powder coat layer.
8. A device comprising:
 - an antenna to facilitate communication; and
 - a device cover housing the antenna, the device cover comprising:
 - an inner surface facing the antenna;
 - an outer surface;
 - a primary layer applied over the outer surface; and
 - a metal luster layer applied over the primary layer, with the metal luster layer is composed of particles with surfaces partially coated with metal nanoparticles.

9. The device as claimed in claim 8, wherein the particles are surface coated with the metal nanoparticles using a physical vapor deposition process.
10. The device as claimed in claim 8, wherein the primary layer comprises:
 - a powder coat layer applied over the outer surface;
 - a primer layer applied over the powder coat layer; and
 - a base coat layer applied over the primer layer.
11. The device as claimed in claim 8, wherein the device cover includes a top layer applied over the metal luster layer, wherein the top layer is one of:
 - a clear top layer; and
 - a metal based top layer comprising less than 5 weight percent (wt%) of one of aluminum flakes and the particles with the surface partially coated with metal nanoparticles.
12. A method comprising:
 - treating particles in a reaction chamber with metal nanoparticles using a physical vapor deposition process, the particles comprising one of organic particles, inorganic particles, and composite particles, and
 - preparing a lustrous paint formulation to coat a surface of a device cover, the paint formulation comprising particles with surfaces partially coated with the metal nanoparticles.
13. The method as claimed in claim 12, wherein the method further comprises applying a metal luster layer over the device cover, wherein the metal luster layer comprises the paint formulation.
14. The method as claimed in claim 13, wherein the method further comprising applying a primary layer interspersed between the device cover and the metal luster layer.
15. The method as claimed in claim 12, wherein the metal nanoparticles comprise one of a metal and an alloy.

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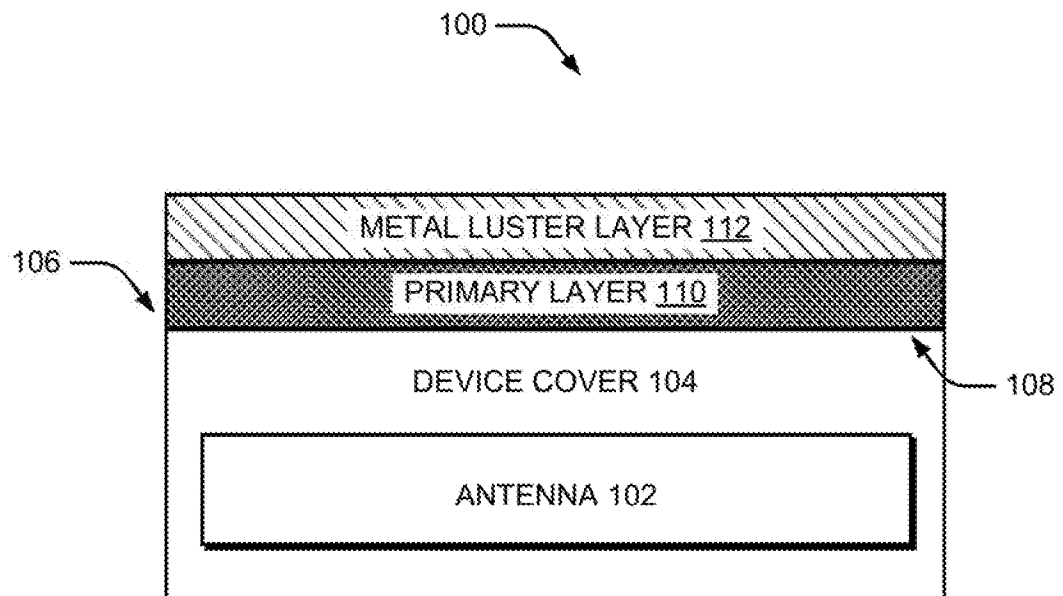


Figure 1

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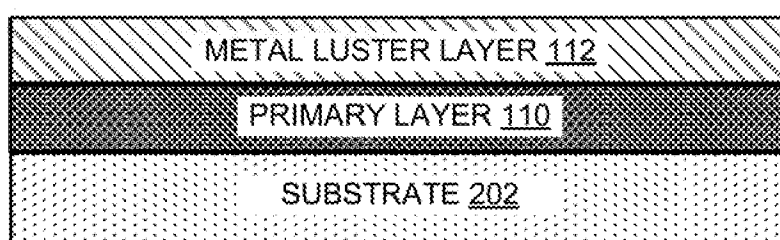
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Figure 2

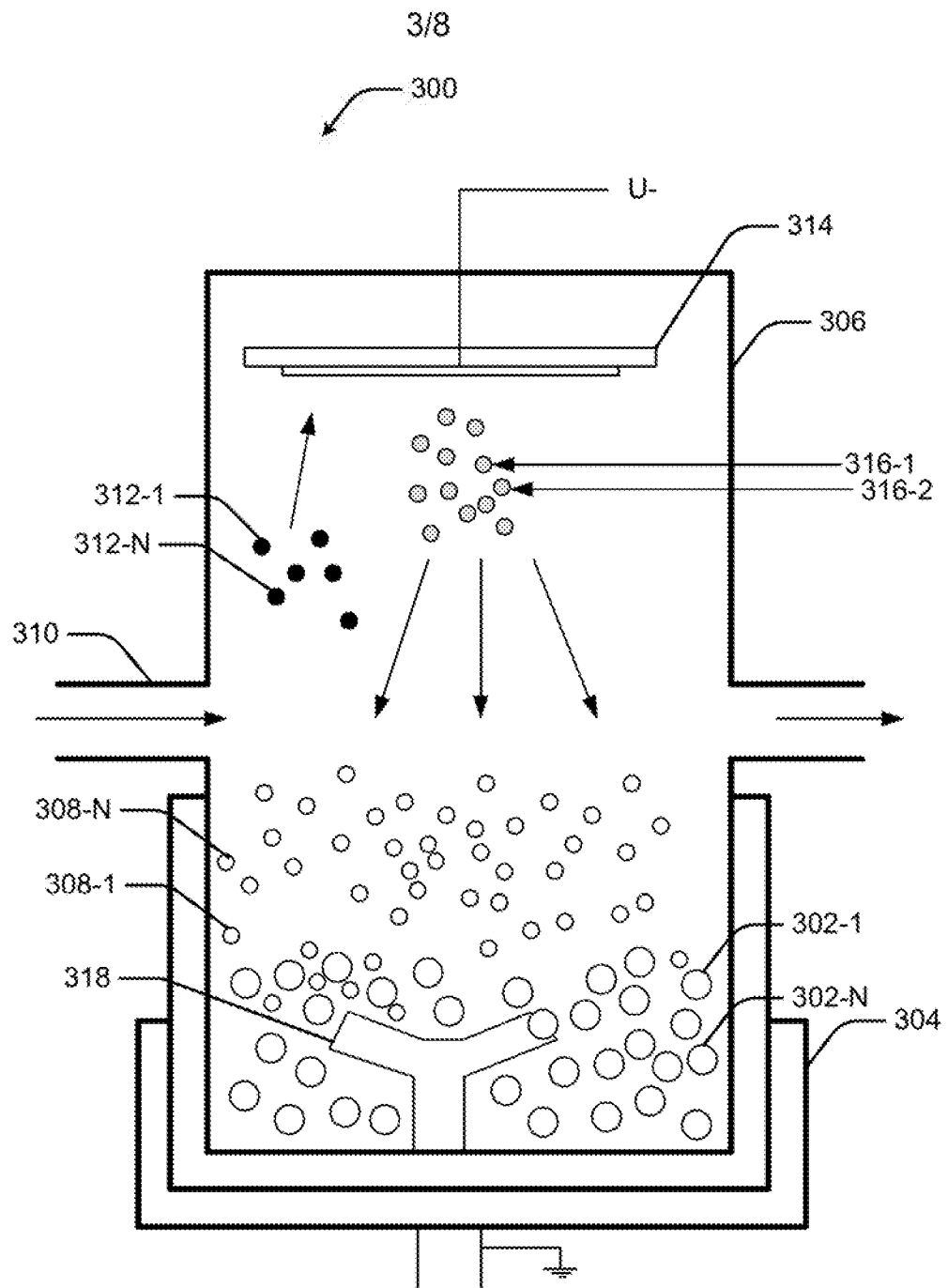


Figure 3

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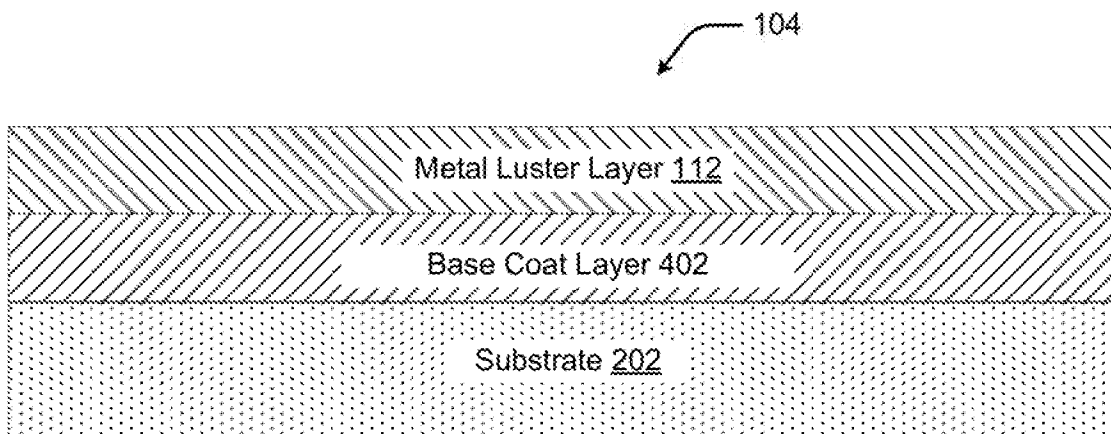


Figure 4A

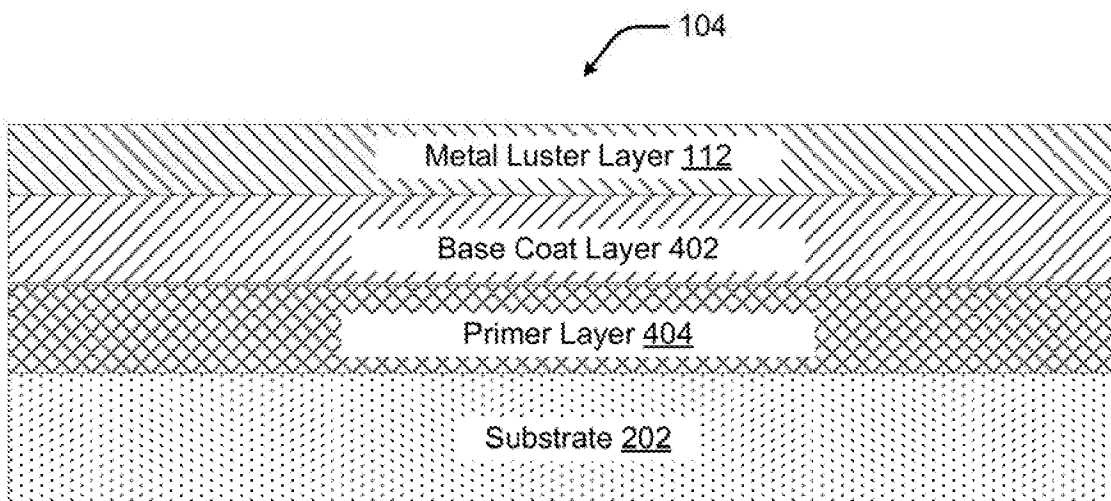


Figure 4B

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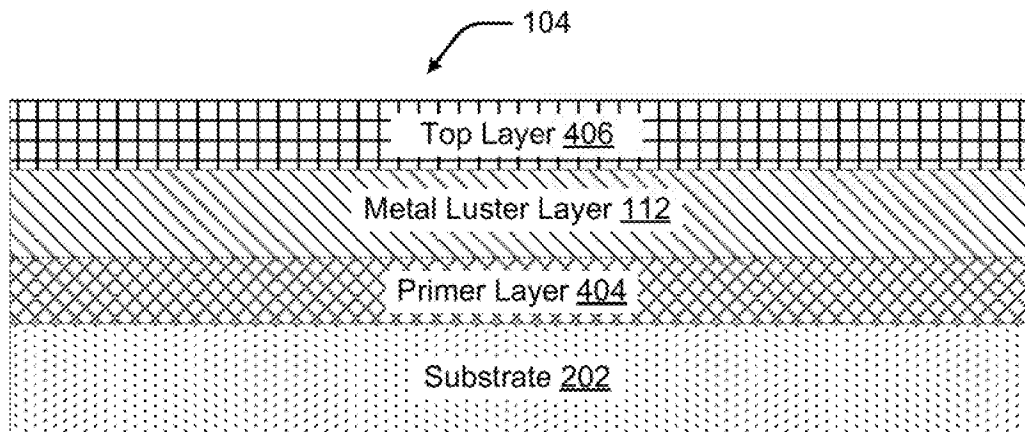


Figure 4C

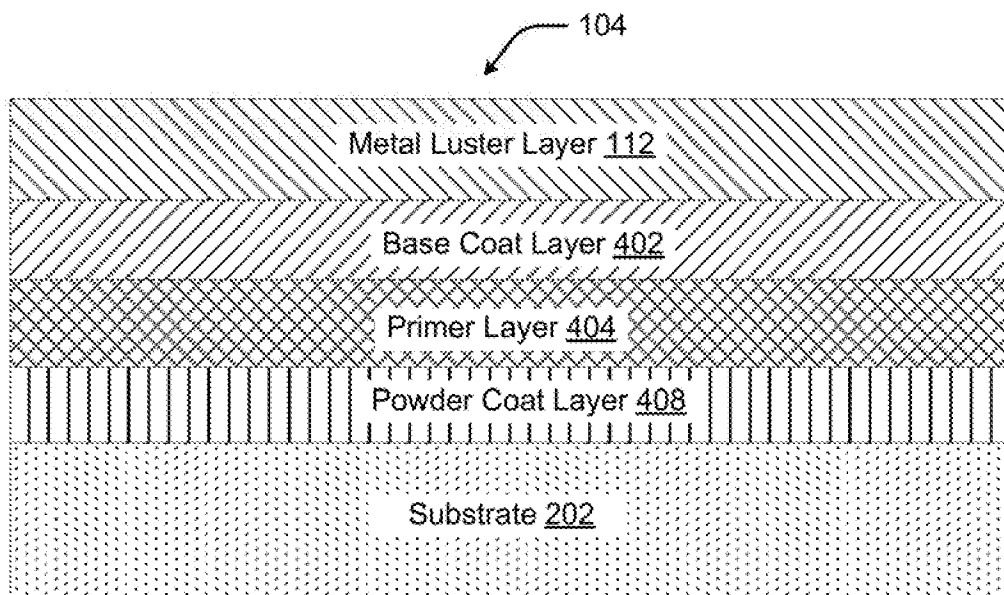


Figure 4D

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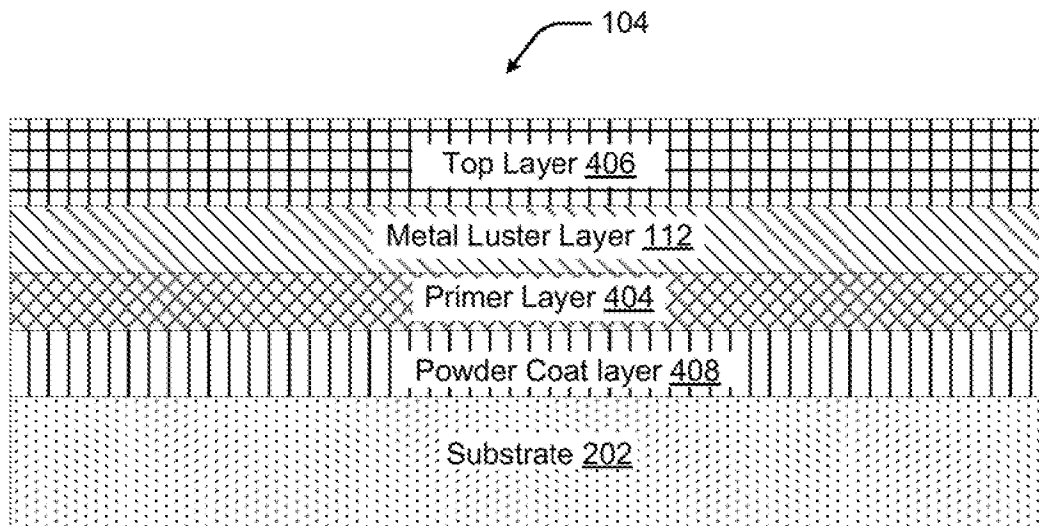


Figure 4E

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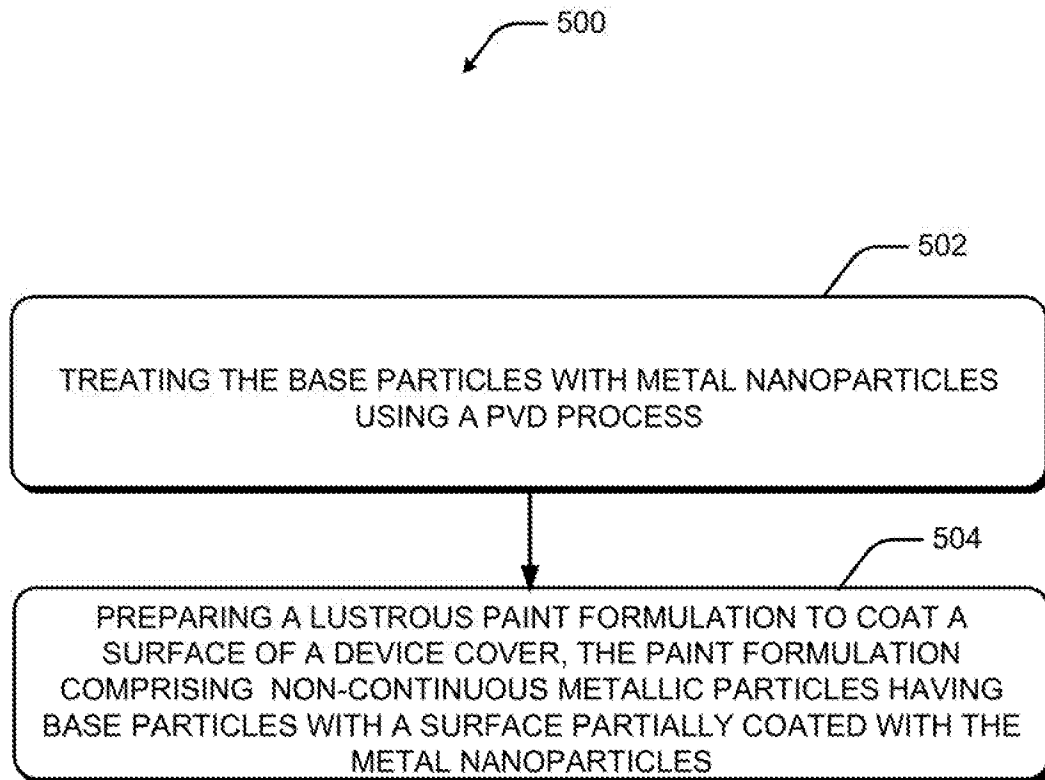


Figure 5

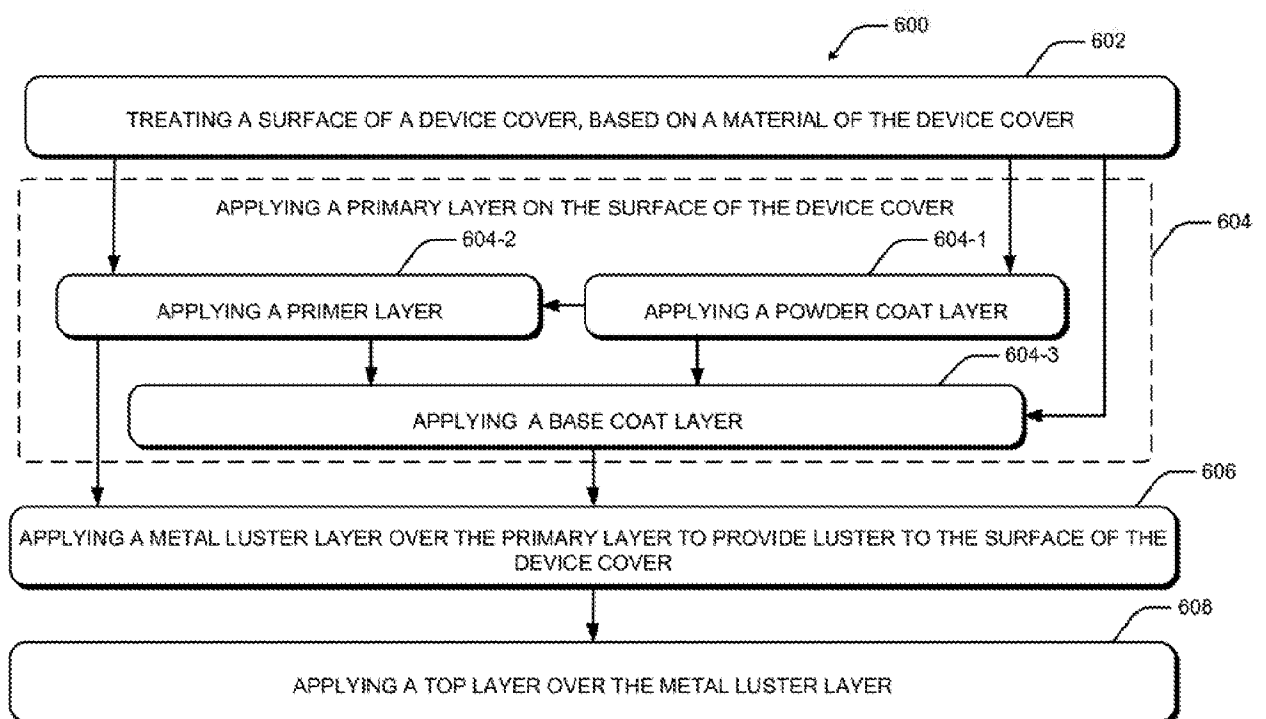


Figure 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2017/026938

A. CLASSIFICATION OF SUBJECT MATTER		
<i>B44C 1/00 (2006.01)</i> <i>C23C 14/02 (2006.01)</i> <i>B44C 1/04 (2006.01)</i> <i>B82Y 30/00 (2011.01)</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)		
B44C 1/00-1/22, 3/00, C23C 14/00-14/58, B82Y 30/00		
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)		
EAPATIS, Esp@ce, Esp@cenet, PAJ, RUPTO, USPTO, Patentscope, PatSearch (RUPTO internal)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2016/0347115 A1 (SHENZHEN FUTAIHONG PRECISION INDUSTRY CO., LTD. et al.) 01.12.2016	1-15
X	RAMESH S. et al. Review of physical vapour deposition (PVD) techniques. International conference on "Sustainable Manufacturing" Coimbatore Institute of Technology, ICSM 2013, India, pp. 427-433	1-15
A	US 2010/0098890 A1 (SHENZHEN FUTAIHONG PRECISION INDUSTRY CO., LTD. et al.) 22.04.2010	1-15
A	US 2010/0098920 A1 (SHENZHEN FUTAIHONG PRECISION INDUSTRY CO., LTD. et al.) 22.04.2010	1-15
A	US 2011/014405 A1 (SHENZHEN FUTAIHONG PRECISION INDUSTRY CO., LTD. et al.) 20.01.2011	1-15
☒ 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 document 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 11 September 2017 (11.09.2017)		Date of mailing of the international search report 21 September 2017 (21.09.2017)
Name and mailing address of the ISA/RU: Federal Institute of Industrial Property, Berezhkovskaya nab., 30-1, Moscow, G-59, GSP-3, Russia, 125993 Facsimile No: (8-495) 531-63-18, (8-499) 243-33-37		Authorized officer Z. Nabieva Telephone No. (495)531-64-81

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2017/026938

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2012/094046 A1 (WANG SHI-FENG et al.) 19.04.2012	1-15
A	US 2014/266924 A1 (SAMSUNG ELECTRONICS CO LTD) 18.09.2014	1-15
A	US 2010/330289 A1 (HSIAO CHANG-NENG et al.) 30.12.2010	1-15
A	US 2016/0271974 A1 (RALPH GIAMMARCO et al.) 22.09.2016	1-15