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(54) **ELECTRONIC ATOMIZATION DEVICE, ATOMIZATION ASSEMBLY, ATOMIZATION ELEMENT AND MANUFACTURING METHOD THEREFOR**

(57) Disclosed are an electronic atomization device, an atomization assembly (100), an atomization element (40) and a manufacturing method therefor. The atomization element (40) comprises a porous matrix (42) and a heating layer, wherein the porous substrate (42) is provided with an atomization surface (422); and the heating layer covers the atomization surface (422). The heating layer comprises a conductive layer (44) and a stable layer (46), wherein the conductive layer (44) covers the atomization surface (422); and the stable layer (46) covers the surface of the conductive layer (44) away from the porous matrix (42). The resistivity of a material for preparing the stable layer (46) is lower than that of the conductive layer (44), and the oxidation resistance of the stable layer (46) is higher than that of the conductive layer (44), so as to solve the problem of the resistance value of the conductive layer (44) rising too quickly.

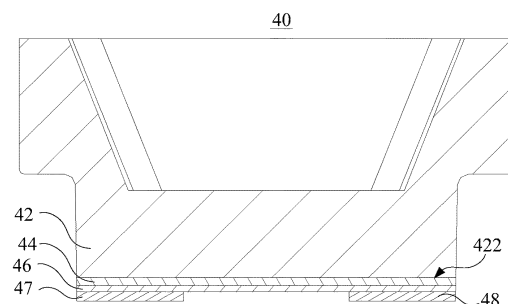


FIG. 4

Description

TECHNICAL FIELD

[0001] The present disclosure relates to the field of electronic atomization technologies, and in particular, to an electronic atomization device, an atomization assembly, an atomization element, and a method for making the atomization element.

BACKGROUND

[0002] As more attention is paid to the health of human bodies, people are aware of harm of tobacco to the bodies. Therefore, an electronic atomization device is made. The electronic atomization device has an appearance and taste similar to the cigarette, but generally does not include tar, suspended particles, and other harmful ingredients in the cigarette, which greatly reduces harm to a user's body. Therefore, the electronic atomization device is generally used as a substitute for the cigarette and used for giving up smoking.

[0003] The electronic atomization device generally includes an atomization assembly and a power supply assembly. A heating element of the atomization assembly of the electronic atomization device currently on the market includes a spring-shaped heating wire. In a producing process of the heating element, a linear heating wire is wound around a fixed shaft; and when the heating wire is powered on, an aerosol-generating material stored on the storage medium is adsorbed onto the fixed shaft and then are atomized by the heating of the heating wire. Another heating element includes a nested combination of a ceramic and a heating wire, but the atomization efficiency is less and aerosol-generating material is leakage to occur. The technology related to the heating element further includes producing a thin-film heating element on a porous ceramic substrate. However, the thin-film heating element has a poor stability of the resistance value and a short service life.

SUMMARY

[0004] The present disclosure provides an electronic atomization device, an atomization assembly, an atomization element, and a method for making the atomization element, to overcome the problem that a resistance value of a conductive layer increases excessively fast.

[0005] In order to overcome the aforementioned technical problem, a first technical solution provided in the present disclosure is an atomization element of an electronic atomization device, the atomization element includes: a porous substrate and a heating layer, the porous substrate includes an atomization surface, and the heating layer covers the atomization surface, the heating layer includes a conductive layer and a stabilizing layer, the conductive layer covers the atomization surface, and the stabilizing layer covers a surface of the conductive

layer far away from the porous substrate; and a resistivity of the stabilizing layer is higher than a resistivity of the conductive layer, and oxidation resistance of the stabilizing layer is lower than oxidation resistance of the conductive layer.

[0006] Furthermore, a material of the stabilizing layer is selected from the group consisting of an aluminum, a zinc, a tin, a magnesium and a titanium; and a material of the conductive layer is selected from the group consisting of a titanium, a zirconium, a niobium, a tantalum and a 316 stainless steel.

[0007] Furthermore, the material of the stabilizing layer is the aluminum; and the material of the conductive layer is a Ti-Zr alloy.

[0008] Furthermore, a thickness of the heating layer in the range of 1.5 μm to 5 μm , a thickness of the stabilizing layer in the range of 0.5 μm to 2 μm , and a thickness of the conductive layer in the range of 2 μm to 3 μm .

[0009] Furthermore, the atomization element further includes: a first electrode and a second electrode located on the stabilizing layer far away from the porous substrate, wherein a part of the stabilizing layer is covered by the first electrode and the second electrode.

[0010] Furthermore, materials of the first electrode and the second electrode are silver.

[0011] In order to overcome the aforementioned technical problem, a second technical solution provided in the present disclosure is an atomization assembly of an electronic atomization device, the atomization assembly includes: a liquid storage chamber, configured to store an aerosol-generating material and the atomization element is the atomization element according to any one of the aforementioned, the aerosol-generating material in the liquid storage chamber is able to be transferred to the atomization surface.

[0012] In order to overcome the aforementioned technical problem, a third technical solution provided in the present disclosure is an electronic atomization device, includes: a power supply assembly and the atomization assembly according to the aforementioned, the power supply assembly is electrically connected to the atomization assembly to supply power to the atomization element of the atomization assembly.

[0013] In order to overcome the aforementioned technical problem, a forth technical solution provided in the present disclosure is a method for making an atomization element of an electronic atomization device, includes: providing a porous substrate, the porous substrate includes an atomization surface; disposing a conductive layer on the atomization surface of the porous substrate; and disposing a stabilizing layer on a surface of the conductive layer far away from the porous substrate, a resistivity of the stabilizing layer is higher than a resistivity of the conductive layer, and oxidation resistance of the stabilizing layer is lower than oxidation resistance of the conductive layer.

[0014] Furthermore, the step of disposing a conductive layer on the atomization surface of the porous substrate

includes: disposing the conductive layer on the atomization surface of the porous substrate by adopting a direct-current sputtering deposition process or a magnetron sputtering deposition process; and/or the step of disposing a stabilizing layer on a surface of the conductive layer far away from the porous substrate includes: forming the stabilizing layer on one side of the conductive layer far away from the porous substrate by adopting the direct-current sputtering deposition process or the magnetron sputtering deposition process.

[0015] Furthermore, the method further includes: disposing a first electrode and a second electrode on one side of the stabilizing layer far away from the porous substrate and covering a part of the stabilizing layer in a screen-printing manner, and taking a process of low-temperature sintering on the first electrode and the second electrode.

[0016] Furthermore, a total thickness of the stabilizing layer and the conductive layer in the range of 1.5 μm to 5 μm , a thickness of the stabilizing layer in the range of 0.5 μm to 2 μm , and a thickness of the conductive layer in the range of 2 μm to 3 μm ; and/or a material of the stabilizing layer is selected from the group consisting of an aluminum, a zinc, a tin, a magnesium and a titanium; and a material of the conductive layer is selected from the group consisting of a titanium, a zirconium, a niobium, a tantalum and a 316 stainless steel.

[0017] Furthermore, the material of the stabilizing layer is the aluminum; and the material of the conductive layer is a Ti-Zr alloy.

[0018] Beneficial effects of the present disclosure are as follows. Different from the related art, in the present disclosure, a conductive layer and a stabilizing layer are formed on an atomization surface of a porous substrate, a resistivity of the stabilizing layer is higher than a resistivity of the conductive layer, and oxidation resistance of the stabilizing layer is lower than oxidation resistance of the conductive layer. In the present disclosure, a resistance value of the conductive layer is relatively stable during heating, and does not increase excessively fast, thereby overcoming the problem that the resistance value of the conductive layer increases excessively fast, and bringing an excellent and stable taste to the user.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] In order to more clearly illustrate the technical solutions of the embodiments of the present disclosure, the drawings for the description of the embodiment will be described in brief. Obviously, the drawings in the following description are only some of the embodiments of the present disclosure. For a person of ordinary skill in the art, other drawings may be obtained based on the following drawings without any creative work.

FIG. 1 is a three-dimensional schematic structural diagram of an electronic atomization device according to an embodiment of the present disclosure.

FIG. 2 is a schematic structural exploded diagram of an atomization assembly of the electronic atomization device shown in FIG. 1.

FIG. 3 is a schematic cross-sectional diagram of a partial enlargement structure of the atomization assembly shown in FIG. 2.

FIG. 4 is a schematic planar structural diagram of an atomization element according to an embodiment of the present disclosure.

FIG. 5 is a process flow diagram of a first embodiment of a method for making an atomization element according to the present disclosure.

FIG. 6 is a process flow diagram of a second embodiment of a method for making an atomization element according to the present disclosure.

DETAILED DESCRIPTION

[0020] Technical solutions of the embodiments of the present disclosure will be clearly and comprehensively described by referring to the accompanying drawings. Obviously, the embodiments described herein are only a part of, but not all of, the embodiments of the present disclosure. Based on the embodiments in the present disclosure, all other embodiments obtained by a person of ordinary skill in the art without any creative work shall fall within the scope of the present disclosure.

[0021] Existing common ceramic heating wires cannot heat evenly, and an aerosol-generating material is leakage occur during atomizing. A heating film of a nitride type has a poor stability and a short heating service life. A heating wire of a noble metal type has high costs, and particles are easy to reunite. In order to reduce an increase in the resistance value, the present disclosure provides a new type electronic atomization device, atomization assembly, atomization element, and a method for making the atomization element, which will be described below with reference to the accompanying drawings and embodiments.

[0022] Referring to FIG. 1, the electronic atomization device of the present disclosure includes an atomization assembly 100 and a power supply assembly 200. The power supply assembly 200 is electrically connected to the atomization assembly 100, and supply power to the atomization assembly 100.

[0023] In one embodiment, the power supply assembly 200 is detachably connected to the atomization assembly 100, so that any one of the atomization assembly 100 and the power supply assembly 200 can be replaced if they are damaged. In other embodiments, the power supply assembly 200 and the atomization assembly 100 may share a same housing, so that the electronic atomization device can be an integral structure and then the electronic atomization device is more convenient to carry. A specific connection manner of the power supply assembly 200 and the atomization assembly 100 is not limited in the embodiments of the present disclosure.

[0024] Referring to FIG. 2 and FIG. 3, the atomization

assembly 100 includes a liquid storage chamber 10, a cover 20, an airflow channel 30, and an atomization element 40. The atomization element 40 is disposed inside the cover 20, the cover 20 is configured to deliver the aerosol-generating material in the liquid storage chamber 10 into the atomization element 40, and the airflow channel 30 is in communication with an atomization surface of the atomization element 40 to output an atomized aerosol.

[0025] In one embodiment, the cover 20 may include a guiding portion 22, a matching portion 24, and a capacity portion 26 that are connected in that order. The guiding portion 22 is provided with a liquid inlet hole 222 and an air outlet hole 224, the liquid inlet hole 222 is in communication with the liquid storage chamber 10, and the air outlet hole 224 is in communication with the airflow channel 30. A cavity chamber 262 for accommodating the atomization element 40 is formed on the capacity portion 26, and the atomization element 40 is accommodated in the cavity chamber 262. The matching portion 24 is configured to communicate the guiding portion 22 with the capacity portion 26, to deliver the aerosol-generating material in the liquid inlet hole 222 to the atomization element 40.

[0026] The atomization element 40 is configured to atomize the delivered aerosol-generating material into aerosol by heating. The air outlet hole 224 is in communication with the atomization surface of the atomization element 40, the aerosol-generating material is heated on the atomization surface and atomized into the aerosol, and the aerosol is delivered through the airflow channel 30 from the air outlet hole 224.

[0027] In one embodiment, referring to FIG. 2 and FIG. 3, the cover 20 is an integrally-formed component. For example, the liquid inlet hole 222 and the air outlet hole 224 are separately provided on an end surface of the cover 20 close to the liquid storage chamber 10, and the cavity chamber 262 is formed on an end surface of the capacity portion 26 far away from the liquid storage chamber 10; and finally, a through hole communicated the liquid inlet hole 222 with the cavity chamber 262 is provided on the matching portion 24. Certainly, the guiding portion 22, the matching portion 24, and the capacity portion 26 may alternatively be made on the cover 20 in other machining sequences or manners. That will not be specifically limited herein.

[0028] Since the guiding portion 22, the matching portion 24, and the capacity portion 26 are integrally formed structure, the number of elements of the atomization assembly 100 can be reduced, so that a mounting of the atomization assembly 100 is more convenient and the sealing performance is better.

[0029] FIG. 4 is a schematic structural diagram of an embodiment of an atomization element of an electronic atomization device according to the present disclosure. The atomization element 40 includes a porous substrate 42 and a heating layer. The heating layer includes a conductive layer 44 and a stabilizing layer 46. The porous

substrate 42 includes the atomization surface 422, and the conductive layer 44 and the stabilizing layer 46 are formed on the atomization surface 422 in that order. The aerosol-generating material in the liquid storage chamber 10 is delivered to the porous substrate 42 through the cover 20 and is further delivered onto the atomization surface 422 by the porous substrate 42. Therefore, the aerosol-generating material on the atomization surface 422 may be heated when the conductive layer 44 and/or the stabilizing layer 46 is powered on to generate heat, thereby atomizing the aerosol-generating material into aerosol.

[0030] The porous substrate 42 is made of a material with a porous structure, and to be specific, the material may be a porous ceramic, a porous glass, a porous plastic, a porous metal etc. The material of the porous substrate 42 is not specifically limited in present disclosure. In one embodiment, the porous substrate 42 may be made of a material having relatively low temperature resistance, for example, the porous plastic. In another embodiment, the porous substrate 42 may be made of a conductive material with a conductive function, for example, the porous metal.

[0031] The porous ceramic has stable chemical properties, and does not chemically react with an aerosol-generating material. The porous ceramic has a high temperature resistance and does not deform due to an excessively high heating temperature. The porous ceramic is an insulator, and is not electrically connected to the conductive layer 44 formed on the porous ceramic to cause a short circuit; and the porous ceramic has advantages of easy manufacturing and low cost. Therefore, in the embodiment, the porous ceramic is selected to make the porous substrate 42.

[0032] In an embodiment, a porosity of the porous ceramic may in the range of 30% to 70%. The porosity refers to a ratio of a total volume of tiny pores in a porous medium to a total volume of the porous medium. The size of the porosity may be adjusted according to ingredients of the aerosol-generating material. For example, a relatively high porosity is selected when a viscosity of the aerosol-generating material is relatively large, so as to ensure delivery efficiency of the aerosol-generating material.

[0033] In another embodiment, the porosity of the porous ceramic may in the range of 50% to 60%. The porosity of the porous ceramic is controlled in the range of 50% to 60%, on the one hand, the delivery efficiency of the porous ceramic can be ensured, and dry burning caused by poor circulation of the aerosol-generating material is avoided, thereby the atomizing effect is improved. On the other hand, the case that the aerosol-generating material is delivered too fast by the porous ceramic, making it difficult to keep the aerosol-generating material and causing a greatly increased probability of aerosol-generating material leakage can be avoided.

[0034] Further, in one embodiment, the conductive layer 44 and the stabilizing layer 46 are both porous films.

The conductive layer 44 may be disposed on the atomization surface 422 of the porous substrate 42 by adopting a direct-current sputtering deposition process or a magnetron sputtering deposition process. The stabilizing layer 46 may be formed on one side of the conductive layer 44 far away from the porous substrate 42 by adopting the direct-current sputtering deposition process or the magnetron sputtering deposition process.

[0035] Further, the atomization element further includes a first electrode 47 and a second electrode 48 located on the stabilizing layer 46 far away from the porous substrate 42 and cover a part of the stabilizing layer 46 in present disclosure.

[0036] In one embodiment, a resistivity of the stabilizing layer 46 is higher than a resistivity of the conductive layer 44, and oxidation resistance of the stabilizing layer 46 is lower than oxidation resistance of the conductive layer 44. In a specific embodiment, a material of the stabilizing layer 46 is selected from the group consisting of an aluminum, a zinc, a tin, a magnesium and a titanium. A material of the conductive layer 44 is selected from the group consisting of a titanium, a zirconium, a niobium, a tantalum and a 316 stainless steel. Materials of the first electrode 47 and the second electrode 48 are silver. In an embodiment, the material of the stabilizing layer 46 is aluminum. The material of the conductive layer 44 is a Ti-Zr alloy.

[0037] The features of the titanium and zirconium are as follows.

(1) Titanium and zirconium are both metals having good biocompatibility, and especially, titanium is a biophile metal element having a higher safety.

(2) Titanium and zirconium have a larger resistivities among metal materials. In a normal temperature, a Ti-Zr alloy has a resistivity three times than an original resistivity after alloying according to a specific proportion, which is more suitable for being used as a heating film material.

(3) Titanium and zirconium have small thermal expansion coefficients, and the Ti-Zr alloy has a smaller thermal expansion coefficient after alloying, and has a better thermal matching with the porous ceramic. After titanium is alloyed with zirconium according to a specific proportion, the Ti-Zr alloy has a lower melting point, and the film-forming property of magnetron sputtering coating is better.

(4) After coating of a metal, it can be seen by electron microscope analysis that microscopic particles of the metal are spherical, and the particles are crowded together to form a microscopic morphology similar to cauliflower; while it can be seen by electron microscope analysis that microscopic particles of a film formed by the Ti-Zr alloy are sheet-shaped, and some grain boundaries between particles disappear, to provide a better continuity.

(5) Titanium and zirconium both have well plasticity and elongation rate, and the Ti-Zr alloy film has a

better resistance to thermal cycling and current surge.

(6) Titanium is usually used as a stress buffer layer of metals and ceramics, and an activation element of ceramic metallization, and titanium can be reacted with a ceramic surface to form a relatively strong chemical bond, which may improve the adhesion of the film.

[0038] Furthermore, since the titanium-zirconium in a Ti-Zr alloy film has poor stability in the air at high temperature, zirconium can easily absorb hydrogen gas, nitrogen gas, and oxygen gas, and the Ti-Zr alloy has better inspiratory after alloying, thus the stabilizing layer 46 is needed to cover the conductive layer 44 after the conductive layer 44 is made, and the material of the stabilizing layer 46 is aluminum.

[0039] In an embodiment, after the stabilizing layer 46 (an aluminum layer) is made, the first electrode 47 and the second electrode 48 are made in a screen-printing manner, and taking a process of low-temperature sintering on the first electrode 47 and the second electrode 48. The first electrode 47 and the second electrode 48 cover a part of the stabilizing layer 46. On the one hand, when the first electrode 47 and the second electrode 48 are formed in a low-temperature sintering manner, a relatively dense aluminum oxide layer is formed on a surface of the stabilizing layer 46, so that the conductive layer 44 can be isolated from air, thereby a resistance value of the conductive layer 44 can be prevented from being increased, to overcome the problem of the suction taste being changed and suction instability due to an increase in a resistance value of the heating layer. On the other hand, when the first electrode 47 and the second electrode 48 are made in the low-temperature sintering manner, as the first electrode 47 and the second electrode 48 are sintered, thereby a region of the stabilizing layer 46 covered by the first electrode 47 and the second electrode 48 can be prevented from being oxidized, and contact resistance can be avoided.

[0040] Since a melting point of aluminum is 660°C and a melting point of aluminum oxide is 2054°C, the stabilizing layer 46 can maintain the stability and a particle reuniting is not easy to occur during atomizing. Compared with the case that particle reuniting is easy to occur in a noble metal protective layer such as Au/Ag during atomizing and causing failure of a heating element, selecting aluminum as the material of the stabilizing layer 46 can overcome this issue. On the other hand, aluminum oxide has same main ingredients as the ceramic, which has a low thermal expansion coefficient, and has smaller deformation during current surge.

[0041] The stabilizing layer 46 is made of aluminum, and the overall resistivity is larger than that of a noble metal. A resistivity of the noble metal in the range of 0.8 ohms to 1.2 ohms, and the resistivity of aluminum has a minimum value of about 1 ohm through parameter adjustment and substantially in the range of 1.5 ohms to 3

ohms. In addition, resistivities of the conductive layer 44 and the stabilizing layer 46 are relatively close by adopting the aforementioned method, which can prevent a current of one of the layers from being excessively large. Theoretically, a thermal expansion coefficient of the noble metal gold is 14.2, but a thermal expansion coefficient of aluminum oxide formed after aluminum is sintered is about half of gold, namely, 7.1. Therefore, a deformation rate of the conductive layer is lower during sucking, and the stability is improved.

[0042] In a specific embodiment, a thickness of the heating layer is in the range of 1.5 μm to 5 μm ; the heating layer includes the conductive layer 44 and the stabilizing layer 46. For example, the thickness of the conductive layer 44 is in the range of 2 μm to 3 μm , and the thickness of the stabilizing layer 46 is in the range of 0.5 μm to 2 μm .

[0043] In summary, in the embodiments of the present disclosure, the material of the conductive layer 44 is selected from the group consisting of the titanium, the zirconium, the niobium, the tantalum and the 316 stainless steel, and the material of the stabilizing layer 46 is selected from the group consisting of the aluminum, the zinc, the tin, the magnesium, and the titanium. Furthermore, the first electrode 47 and the second electrode 48 are made in the low-temperature sintering manner, so as to the service life of the heating element is prolonged, and the increase of the resistance value is reduced, and the contact resistance is avoided.

[0044] FIG. 5 is a schematic flow diagram of a first embodiment of a method for making an atomization element of an electronic atomization device according to the present disclosure. The method includes the following steps.

[0045] Step S51: providing a porous substrate; the porous substrate including an atomization surface.

[0046] The porous substrate is made of a material with a porous structure, and to be specific, the material may be a porous ceramic, a porous glass, a porous plastic, a porous metal etc. The material of the porous substrate is not specifically limited in present disclosure. In one embodiment, the porous substrate may be made of a material having relatively low temperature resistance, for example, the porous plastic. In another embodiment, the porous substrate may be made of a conductive material with a conductive function, for example, the porous metal. The porous substrate includes the atomization surface.

[0047] Step S52: disposing a conductive layer on the atomization surface of the porous substrate.

[0048] The conductive layer is formed on the atomization surface of the porous substrate by adopting a magnetron sputtering deposition process or a direct-current sputtering deposition process. For example, a material of the conductive layer is selected from the group consisting of the titanium, the zirconium, the niobium, the tantalum and the 316 stainless steel. Take the conductive layer which is disposed by adopting the direct-current sputtering deposition process for example, a specific method is as follows: A vacuum degree is kept in a range

of 8×10^{-4} Pa to 2×10^{-3} Pa; a power is kept in a range of 1500 W to 2500 W, and a time is kept in a range of 70 min to 110 min; and a pressure is kept in a range of 0.3 Pa to 0.8 Pa, a temperature is kept in a range of a room temperature to 300°C, and a particle diameter is kept approximately in a range of 200 nm to 400 nm.

[0049] Step S53: disposing a stabilizing layer on a surface of the conductive layer far away from the porous substrate.

[0050] The stabilizing layer is disposed on the surface of the conductive layer far away from the porous substrate by adopting the magnetron sputtering deposition process or the direct-current sputtering deposition process. For example, the material of the stabilizing layer is selected from the group consisting of the aluminum, the zinc, the tin, the magnesium, and the titanium. Take the stabilizing layer which is disposed by adopting the direct-current sputtering deposition process for example, a specific method is as follows: A time is in the range of 40 min to 60 min, a power is in the range of 500 W to 1500 W, a pressure is in the range of 1 Pa to 1.5 Pa, and a temperature is in the range of a room temperature to 300°C. A particle diameter ranges approximately from 100 nm to 200 nm.

[0051] In one embodiment, the conductive layer and the stabilizing layer are formed on the atomization surface in that order. An aerosol-generating material in the liquid storage chamber is delivered to the porous substrate through the cover and is further delivered onto the atomization surface by the porous substrate. Therefore, the aerosol-generating material on the atomization surface may be heated when the conductive layer and/or the stabilizing layer 46 is powered on to generate heat, thereby atomizing the aerosol-generating material into aerosol.

[0052] In an embodiment, a total thickness of the conductive layer and the stabilizing layer is 1.5 μm ; a thickness of the conductive layer is in the range of 2 μm to 3 μm , and a thickness of the stabilizing layer is in the range of 0.5 μm to 2 μm .

[0053] In an embodiment, a resistivity of the stabilizing layer is higher than a resistivity of the conductive layer, and oxidation resistance of the stabilizing layer is lower than oxidation resistance of the conductive layer. For example, the material of the stabilizing layer is aluminum, and the material of the conductive layer is a Ti-Zr alloy.

[0054] In the present disclosure, the material of the conductive layer is selected from the group consisting of the titanium, the zirconium, the niobium, the tantalum and the 316 stainless steel, and the material of the stabilizing layer is selected from the group consisting of the aluminum, the zinc, the tin, the magnesium, and the titanium. Therefore, the relatively dense aluminum oxide layer can be formed on the surface of the stabilizing layer, so that the conductive layer can be isolated from air, thereby the resistance value of the conductive layer can be reduced, to overcome the problem of the suction taste being changed and suction instability due to the increase in the

resistance value of the conductive layer.

[0055] FIG. 6 is a schematic flow diagram of a second embodiment of a method for making an atomization element of an electronic atomization device according to the present disclosure.

[0056] Step S61, step S62, and step S63 are respectively the same as step S51, step S52, and step S53 in the first embodiment shown in FIG. 5. A difference is, the embodiment further includes step S64: disposing a first electrode and a second electrode cover a part of the stabilizing layer on one side of the stabilizing layer far away from the porous substrate in a screen-printing manner, and taking a process of low-temperature sintering on the first electrode and the second electrode.

[0057] For example, materials of the first electrode and the second electrode are silver. The first electrode and the second electrode covering a part of the stabilizing layer are disposed on one side of the stabilizing layer far away from the porous substrate in the screen-printing manner. The first electrode and the second electrode cover a part of the stabilizing layer. Then taking a process of low-temperature sintering on the first electrode and the second electrode. when the first electrode and the second electrode are formed in a low-temperature sintering manner, a relatively dense aluminum oxide layer is formed on a surface of the stabilizing layer, so that the conductive layer can be isolated from air, thereby a resistance value of the conductive layer can be prevented from being increased, to overcome the problem of the suction taste being changed and suction instability due to an increase in a resistance value of the heating layer. On the other hand, when the first electrode and the second electrode are made in the low-temperature sintering manner, as the first electrode and the second electrode are sintered, thereby a region of the stabilizing layer covered by the first electrode and the second electrode can be prevented from being oxidized, and contact resistance can be avoided.

[0058] The above shows only embodiments of the present disclosure, but does not limit the scope of the present disclosure. Any equivalent structure or equivalent process transformation made based on the specification and the accompanying drawings of the present disclosure, applied directly or indirectly in other related arts, shall be included in the scope of the present disclosure.

Claims

1. An atomization element of an electronic atomization device, the atomization element comprising:

a porous substrate and a heating layer, wherein the porous substrate comprises an atomization surface, and the heating layer covers the atomization surface, wherein the heating layer comprises a conductive layer

and a stabilizing layer, the conductive layer covers the atomization surface, and the stabilizing layer covers a surface of the conductive layer far away from the porous substrate; and a resistivity of the stabilizing layer is higher than a resistivity of the conductive layer, and oxidation resistance of the stabilizing layer is lower than oxidation resistance of the conductive layer.

2. The atomization element of claim 1, wherein a material of the stabilizing layer is selected from the group consisting of an aluminum, a zinc, a tin, a magnesium and a titanium; and a material of the conductive layer is selected from the group consisting of a titanium, a zirconium, a niobium, a tantalum and a 316 stainless steel.
3. The atomization element of claim 2, wherein the material of the stabilizing layer is the aluminum; and the material of the conductive layer is a Ti-Zr alloy.
4. The atomization element of claim 1, wherein a thickness of the heating layer in the range of 1.5 μm to 5 μm , wherein a thickness of the stabilizing layer in the range of 0.5 μm to 2 μm , and a thickness of the conductive layer in the range of 2 μm to 3 μm .
5. The atomization element of any one of claims 1 to 4, further comprising a first electrode and a second electrode located on the stabilizing layer far away from the porous substrate, wherein a part of the stabilizing layer is covered by the first electrode and the second electrode.
6. The atomization element of claim 5, wherein materials of the first electrode and the second electrode are silver.
7. An atomization assembly of an electronic atomization device, the atomization assembly comprising:

a liquid storage chamber, configured to store an aerosol-generating material; and the atomization element according to any one of claims 1 to 6, wherein the aerosol-generating material in the liquid storage chamber is able to be transferred to the atomization surface.

8. An electronic atomization device, comprising:

a power supply assembly; and the atomization assembly according to claim 7, wherein the power supply assembly is electrically connected to the atomization assembly to supply power to the atomization element of the atomization assembly.

9. A method for making an atomization element of an electronic atomization device, comprising:

providing a porous substrate, wherein the porous substrate comprises an atomization surface; 5
 disposing a conductive layer on the atomization surface of the porous substrate; and
 disposing a stabilizing layer on a surface of the conductive layer far away from the porous substrate, wherein 10
 a resistivity of the stabilizing layer is higher than a resistivity of the conductive layer, and oxidation resistance of the stabilizing layer is lower than oxidation resistance of the conductive layer. 15

10. The method of claim 9, wherein the step of disposing a conductive layer on the atomization surface of the porous substrate comprises: 20

disposing the conductive layer on the atomization surface of the porous substrate by adopting a direct-current sputtering deposition process or a magnetron sputtering deposition process; 25
 and/or
 the step of disposing a stabilizing layer on a surface of the conductive layer far away from the porous substrate comprises:
 forming the stabilizing layer on one side of the conductive layer far away from the porous substrate by adopting the direct-current sputtering deposition process or the magnetron sputtering deposition process. 30
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11. The method of claim 9, further comprising:

disposing a first electrode and a second electrode on one side of the stabilizing layer far away from the porous substrate and covering a part of the stabilizing layer in a screen-printing manner, and taking a process of low-temperature sintering on the first electrode and the second electrode. 40

12. The method according to any one of claims 9 to 11, wherein a total thickness of the stabilizing layer and the conductive layer in the range of 1.5 μm to 5 μm , wherein a thickness of the stabilizing layer in the range of 0.5 μm to 2 μm , and a thickness of the conductive layer in the range of 2 μm to 3 μm ; and/or 45
 50

a material of the stabilizing layer is selected from the group consisting of an aluminum, a zinc, a tin, a magnesium and a titanium; and
 a material of the conductive layer is selected from the group consisting of a titanium, a zirconium, a niobium, a tantalum and a 316 stainless steel. 55

13. The method of claim 12, wherein the material of the stabilizing layer is the aluminum; and the material of the conductive layer is a Ti-Zr alloy.

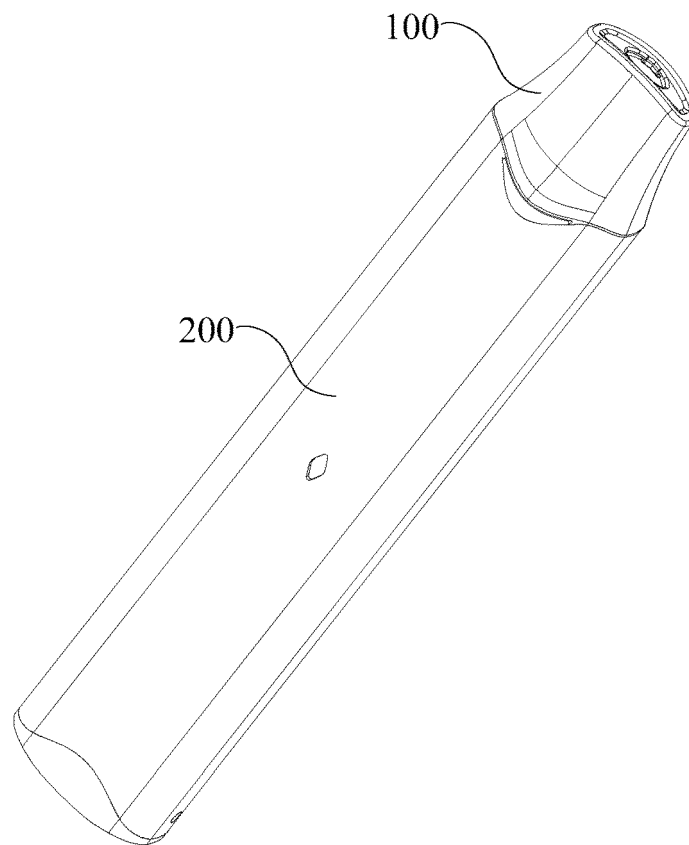


FIG. 1

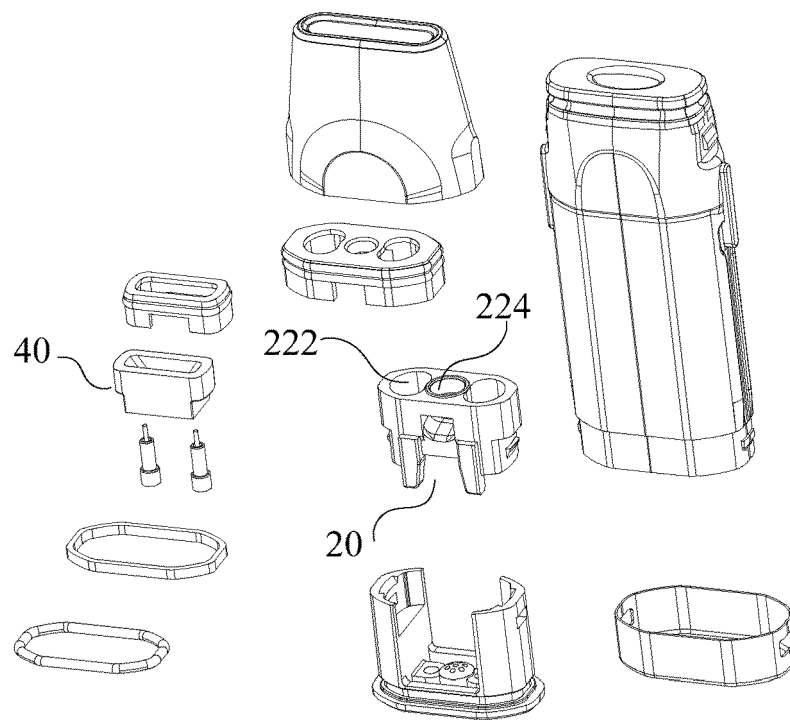


FIG. 2

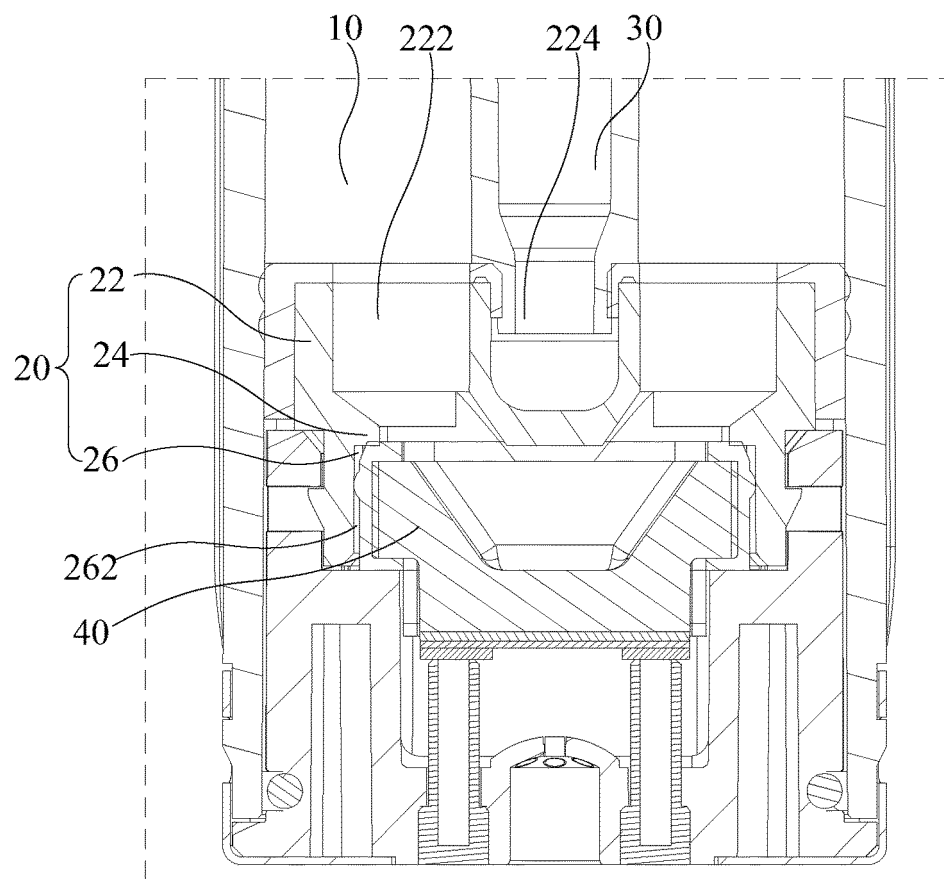


FIG. 3

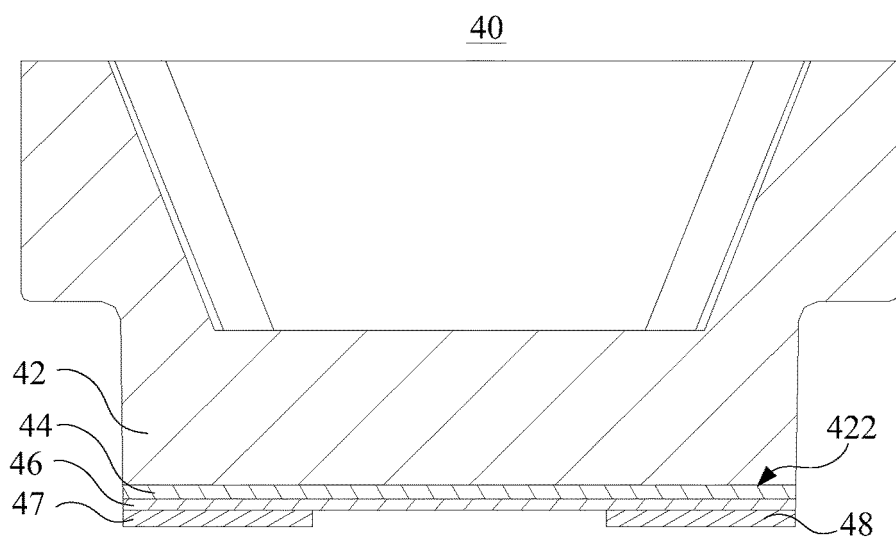


FIG. 4

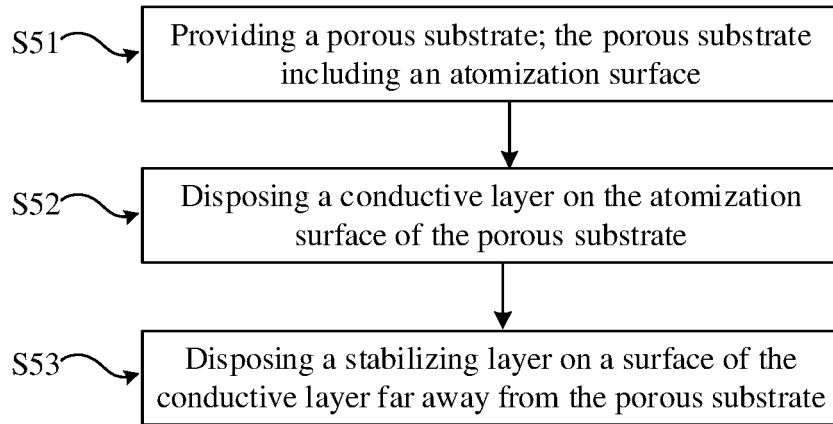


FIG.5

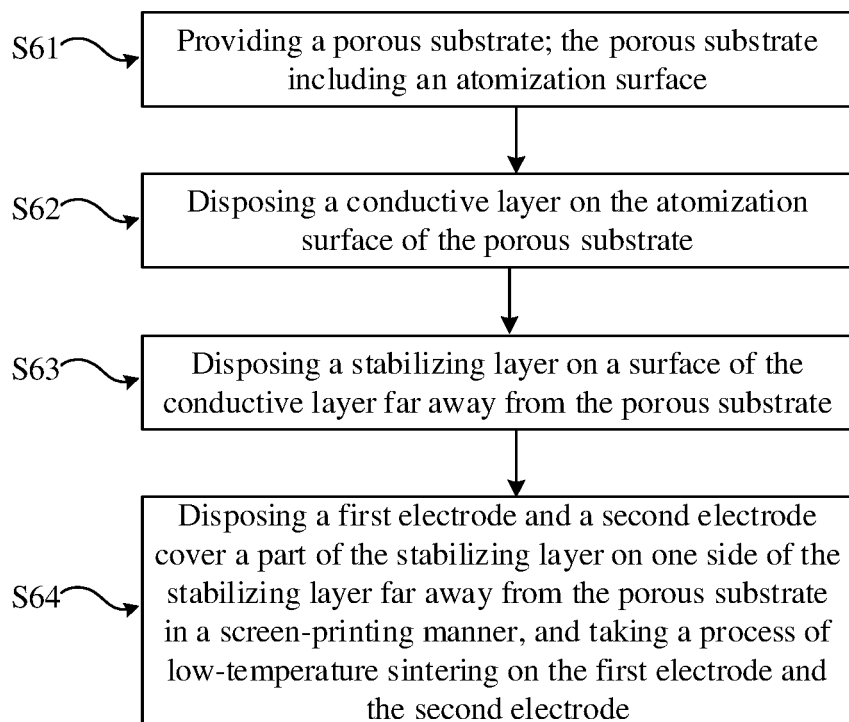


FIG.6

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A. CLASSIFICATION OF SUBJECT MATTER A24F 40/46(2020.01)i; A24F 40/00(2020.01)n; A24F 47/00(2020.01)n 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) A24F40; A24F47; C04B35 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) VEN; CNABS; 超星读秀学术: 氧化铝, 雾化, 虚拟, 仿真, 电子烟, 模拟, anti-oxidation, resist+ oxidation, plate?, porous+, capillary, "AL2O3", layer?, film, 电阻率																					
C. DOCUMENTS CONSIDERED TO BE RELEVANT																					
<table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>PX</td> <td>CN 111387555 A (SHENZHEN SMOORE TECHNOLOGY LIMITED) 10 July 2020 (2020-07-10) claims 1-13</td> <td>1-13</td> </tr> <tr> <td>X</td> <td>CN 109414078 A (SHENZHEN SMOORE TECHNOLOGY LIMITED) 01 March 2019 (2019-03-01) claims 1-21, description paragraphs 0043-0083, figures 1-6</td> <td>1-13</td> </tr> <tr> <td>X</td> <td>CN 106579564 A (XIANGTAN UNIVERSITY) 26 April 2017 (2017-04-26) claims 1-10</td> <td>1-13</td> </tr> <tr> <td>Y</td> <td>CN 209788491 U (XINHUA HENGRUI ELECTRONIC CERAMIC TECHNOLOGY CO., LTD.) 17 December 2019 (2019-12-17) claims 1-6, and figure 4</td> <td>1-13</td> </tr> <tr> <td>Y</td> <td>CN 109875123 A (SHENZHEN FIRST UNION TECHNOLOGY CO., LTD.) 14 June 2019 (2019-06-14) claims 1-13</td> <td>1-13</td> </tr> <tr> <td>A</td> <td>CN 110447959 A (SHENZHEN SMOORE TECHNOLOGY LIMITED) 15 November 2019 (2019-11-15) entire document</td> <td>1-13</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	PX	CN 111387555 A (SHENZHEN SMOORE TECHNOLOGY LIMITED) 10 July 2020 (2020-07-10) claims 1-13	1-13	X	CN 109414078 A (SHENZHEN SMOORE TECHNOLOGY LIMITED) 01 March 2019 (2019-03-01) claims 1-21, description paragraphs 0043-0083, figures 1-6	1-13	X	CN 106579564 A (XIANGTAN UNIVERSITY) 26 April 2017 (2017-04-26) claims 1-10	1-13	Y	CN 209788491 U (XINHUA HENGRUI ELECTRONIC CERAMIC TECHNOLOGY CO., LTD.) 17 December 2019 (2019-12-17) claims 1-6, and figure 4	1-13	Y	CN 109875123 A (SHENZHEN FIRST UNION TECHNOLOGY CO., LTD.) 14 June 2019 (2019-06-14) claims 1-13	1-13	A	CN 110447959 A (SHENZHEN SMOORE TECHNOLOGY LIMITED) 15 November 2019 (2019-11-15) entire document	1-13
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X	CN 106579564 A (XIANGTAN UNIVERSITY) 26 April 2017 (2017-04-26) claims 1-10	1-13																			
Y	CN 209788491 U (XINHUA HENGRUI ELECTRONIC CERAMIC TECHNOLOGY CO., LTD.) 17 December 2019 (2019-12-17) claims 1-6, and figure 4	1-13																			
Y	CN 109875123 A (SHENZHEN FIRST UNION TECHNOLOGY CO., LTD.) 14 June 2019 (2019-06-14) claims 1-13	1-13																			
A	CN 110447959 A (SHENZHEN SMOORE TECHNOLOGY LIMITED) 15 November 2019 (2019-11-15) entire document	1-13																			
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Date of the actual completion of the international search 25 April 2021	Date of mailing of the international search report 07 May 2021																				
Name and mailing address of the ISA/CN China National Intellectual Property Administration (ISA/CN) No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088 China Facsimile No. (86-10)62019451	Authorized officer Telephone No.																				

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INTERNATIONAL SEARCH REPORT

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PCT/CN2021/075810

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 105394816 A (SHENZHEN MCQUAY CO., LTD.) 16 March 2016 (2016-03-16) entire document	1-13
A	CN 205337599 U (SHENZHEN SMOORE TECHNOLOGY LIMITED) 29 June 2016 (2016-06-29) entire document	1-13
A	WO 2019220372 A1 (RAI STRATEGIC HOLDINGS INC.) 21 November 2019 (2019-11-21) entire document	1-13
A	GB 2561959 A (NERUDIA LTD.) 31 October 2018 (2018-10-31) entire document	1-13
A	CN 109761640 A (XINHUA HENGRUI ELECTRONIC CERAMIC TECHNOLOGY CO., LTD.) 17 May 2019 (2019-05-17) entire document	1-13
A	李守泽 等 (LI, Shouze et al.). "15.导体的电阻率 (15. Resistivity of Conductors)" 《物理学问题集萃》 (Non-official translation: <i>Collection of Physics Questions</i>), 31 December 1992 (1992-12-31), p. 448	1-13

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2021/075810

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 111387555 A	10 July 2020	None	
CN 109414078 A	01 March 2019	WO 2020051749 A1	19 March 2020
CN 106579564 A	26 April 2017	CN 106579564 B	31 March 2020
CN 209788491 U	17 December 2019	None	
CN 109875123 A	14 June 2019	None	
CN 110447959 A	15 November 2019	WO 2021013208 A1	28 January 2021
CN 105394816 A	16 March 2016	US 2018125118 A1	10 May 2018
		EP 3158882 B1	06 February 2019
		EP 3366149 A4	24 October 2018
		WO 2017067278 A1	27 April 2017
		US 2018289058 A1	11 October 2018
		US 2020288779 A1	17 September 2020
		CN 105394816 B	21 December 2018
		EP 3466283 B1	05 February 2020
		US 2017112193 A1	27 April 2017
		EP 3366149 B1	08 January 2020
		US 10750790 B2	25 August 2020
		EP 3158882 A2	26 April 2017
		EP 3158882 A3	29 November 2017
		US 10492539 B2	03 December 2019
		CN 106998822 A	01 August 2017
		US 9888722 B2	13 February 2018
		US 2020054077 A1	20 February 2020
		EP 3366149 A1	29 August 2018
		CN 205337599 U	29 June 2016
		EP 3466283 A1	10 April 2019
CN 205337599 U	29 June 2016	US 2018125118 A1	10 May 2018
		EP 3158882 B1	06 February 2019
		EP 3366149 A4	24 October 2018
		WO 2017067278 A1	27 April 2017
		US 2018289058 A1	11 October 2018
		US 2020288779 A1	17 September 2020
		CN 105394816 A	16 March 2016
		CN 105394816 B	21 December 2018
		EP 3466283 B1	05 February 2020
		US 2017112193 A1	27 April 2017
		EP 3366149 B1	08 January 2020
		US 10750790 B2	25 August 2020
		EP 3158882 A2	26 April 2017
		EP 3158882 A3	29 November 2017
		US 10492539 B2	03 December 2019
		CN 106998822 A	01 August 2017
		US 9888722 B2	13 February 2018
		US 2020054077 A1	20 February 2020
		EP 3366149 A1	29 August 2018
		EP 3466283 A1	10 April 2019
WO 2019220372 A1	21 November 2019	AU 2019270627 A1	24 December 2020
		US 10932490 B2	02 March 2021
		US 2019350256 A1	21 November 2019

Form PCT/ISA/210 (patent family annex) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2021/075810

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
		CA 3100160 A1	21 November 2019
		KR 20210008864 A	25 January 2021
		BR 112020023138 A2	09 February 2021
GB 2561959 A	31 October 2018	GB 2561957 B	17 February 2021
		GB 201802842 D0	11 April 2018
		GB 2561957 A	31 October 2018
		GB 201802843 D0	11 April 2018
		GB 2561955 B	17 February 2021
		GB 201802844 D0	11 April 2018
		CN 110769884 A	07 February 2020
		GB 201802845 D0	11 April 2018
		GB 2561955 A	31 October 2018
		CN 110740773 A	31 January 2020
		GB 2561958 B	10 February 2021
		GB 2561953 A	31 October 2018
		EP 3615114 A1	04 March 2020
		GB 201706593 D0	07 June 2017
		GB 2561958 A	31 October 2018
		US 2020187561 A1	18 June 2020
		WO 2018197511 A1	01 November 2018
		EP 3615115 A1	04 March 2020
		GB 2561867 A	31 October 2018
		CN 110769885 A	07 February 2020
		GB 2561956 B	12 August 2020
		GB 2561956 A	31 October 2018
		EP 3615116 A1	04 March 2020
		CN 110769883 A	07 February 2020
		EP 3615117 A1	04 March 2020
		GB 201802836 D0	11 April 2018
		GB 2561954 B	03 February 2021
		WO 2018197513 A1	01 November 2018
		GB 201802837 D0	11 April 2018
		GB 201802840 D0	11 April 2018
		WO 2018197514 A1	01 November 2018
		GB 2561954 A	31 October 2018
		WO 2018197515 A1	01 November 2018
CN 109761640 A	17 May 2019	None	

Form PCT/ISA/210 (patent family annex) (January 2015)