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(54) **USE OF ORGANIC POROUS MATERIAL IN AEROSOL GENERATING DEVICE AND ATOMIZER
USING ORGANIC POROUS MATERIAL**

(57) An application of an organic porous material (2) in an aerosol generating device, and an atomizer using the material. The organic porous material (2) is, at least in part, a melamine resin porous material. The melamine resin porous material has a decomposition temperature exceeding 400°C, can be used for a long time at a high temperature of 180-240°C without any change in properties, and thus can cover the operating temperature range of the atomizer. In addition, the material has a high

porosity and controllable pore size distribution, can achieve both good liquid guiding and locking performance, and thus is an ideal liquid guiding material for an atomizer. The organic porous material (2) is applied to an atomizer, and has the advantages of quick liquid absorption, high liquid storage capacity, smooth liquid guide, and outstanding liquid locking capability due to a nano-capillary microstructure formed after liquid infiltration.

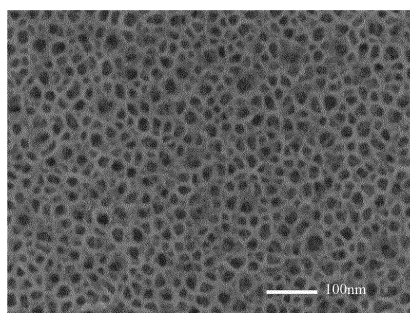


FIG. 1 (a)

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Description

CROSS REFERENCE TO RELATED APPLICATION(S)

[0001] This application claims priority to Chinese Patent Application entitled "Use of organic porous material in aerosol generating device and atomizer using organic porous material" with application number of 201910593233.X, submitted to China National Intellectual Property Administration on July 3rd, 2019, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to the field of aerosol generating devices, and in particular to a use of an organic porous material in an aerosol generating device and an atomizer using the organic porous material.

BACKGROUND

[0003] A device that changes an atomized liquid containing nicotine and the like into an aerosol by means of the heating and atomizing of an atomizing core is an electronic cigarette simulating a cigarette; the generated aerosol has similar smoke, flavor and feeling to the traditional cigarette. The aerosol containing nicotine generated by atomization does not contain harmful carcinogens such as tar that commonly exist in the smoke of traditional cigarettes and is considered as a cigarette substitute beneficial to the health of traditional smokers. Meanwhile, the electronic cigarette has advantages of good portability, generation of no open flame, generation of no second-hand smoke and environment friendliness, and is preferred by many smokers.

[0004] At present, two types of heating and atomizing technologies are widely employed in the aerosol generation device. 1) Cotton or fiber bundle is used as a liquid guide body, and a heating wire is wound on the cotton or fiber bundle to directly heat and atomize the e-liquid. 2) Honeycomb ceramic is used as a liquid guide body, and a heating wire or electric heating tape and the like is employed to heat so that the e-liquid is atomized.

[0005] The cotton or fiber bundle, as a liquid guide body, has features of simple structure, good effect and so on, and is highly appreciated by users when used in open-ended big-aerosol atomizing cores. The cotton is fluffy and has a high liquid absorption; however, the heat resistance is low, the ignition point is 150°C only, and the compression modulus is low, which easily leads to large permanent deformation. When the cotton is used in a closed small cigarette, it is difficult to solve the problems of liquid leaking and burning. Fiber bundles made of glass or special polymers and other materials or glass wools have good heat resistance; however, the density is low, the liquid absorption at saturation is low and the liquid locking capability is unsatisfactory.

[0006] The porous ceramic formed by sintering ingredients such as aggregate, adhesive and pore-forming additive has a large number of pore canals that communicate with one another and communicate with the surface, and has excellent performances such as stable chemical properties, low heat conductivity, high temperature resistance and corrosion resistance, which to some extent compensate for the performance defects of the liquid guide bodies made of cotton and fiber bundle. However, the porous ceramic type liquid guide bodies employed in the industry generally have problems of low porosity and large diameters of micropores; although the liquid absorption and guide performances can basically meet the design requirements, the liquid locking capability needs improving, that is, it is easy to leak liquid.

SUMMARY

[0007] In order to solve the problems in the prior art that the atomizing core is liquid leaking and the cotton liquid guide material is burned, the present disclosure provides the following solution creatively.

[0008] First, the embodiment of the present disclosure provides an application of an organic porous material in an aerosol generating device, wherein the organic porous material is, at least in part, a melamine resin porous material.

[0009] Further, the organic porous material has an apparent density of $(3\sim120)\times10^{-3}\text{g/cm}^3$, preferably $(4\sim12)\times10^{-3}\text{g/cm}^3$.

[0010] Further, the organic porous material has a 25% deformation compression strength of 5~30KPa.

[0011] Further, the organic porous material has a decomposition temperature exceeding 300°C, preferably a decomposition temperature exceeding 350°C, more preferably a decomposition temperature exceeding 400°C.

[0012] Further, the organic porous material has a porosity higher than 60%, preferably higher than 80%, more preferably higher than 95%.

[0013] Further, the organic porous material has a pore size distribution that over 90% volume is occupied by the pores with the pore size ranging between 10nano~100micron, more preferably between 10nano~100nano, and most preferably between 10nano~50nano.

[0014] Further, the aerosol generating device includes a heating element, and the organic porous material is used as a liquid guide body and is in contact with or adjacent to the heating element.

[0015] Further, the aerosol generating device includes a heating element, the organic porous material is used as a liquid guide body, and another porous material is contained between the organic porous material and the heating element.

[0016] Second, the embodiment of the present disclosure provides an atomizer of an aerosol generating device, including:

a shell, inside which a liquid storage chamber configured for storing an atomized liquid is formed, wherein the liquid storage chamber includes an outlet, an aerosol channel extending along the longitudinal direction of the shell is formed inside the shell, the aerosol channel includes an inlet and an air outlet, and the air outlet is located on one end of the shell;

an atomizing core, which is accommodated in the shell, wherein the outlet of the liquid storage chamber is communicated with a liquid absorption surface of the atomizing core, an atomizing surface of the atomizing core is communicated with the aerosol channel, and the atomizing core is, at least in part, made of a melamine resin porous material;

a fixing element, which is configured for fixing the atomizing core and the shell;

a heating body, which is in contact with or adjacent to the atomizing surface; and

an electrode, which is configured for connecting to the heating body and enabling the heating body to receive an electric power.

[0017] Further, the atomizing core includes porous ceramic and a melamine resin porous material; one surface of the porous ceramic forms the atomizing surface, and one surface of the melamine resin porous material forms the liquid absorption surface; and the melamine resin porous material covers, at least in part, the porous ceramic, such that the atomizing liquid enters the atomizing core through the liquid absorption surface and is transmitted to the atomizing surface.

[0018] The organic porous material is, at least in part, a melamine resin porous material. The melamine resin porous material is, for example, a melamine sponge. The embodiment of the present disclosure preferably may use the melamine resin porous material as a liquid guide material of the aerosol generating device as a whole, or combine the melamine resin porous material with other porous materials to form a liquid guide body, for example, combining the melamine resin porous material with non-woven cloth, cotton and other materials having capillarity to form a liquid guide material, wherein the combining may be bonding, or stacking and so on.

[0019] The melamine sponge is a material having a three-dimensional porous structure, which has a porosity over 99%, an open-porosity over 95%, and meanwhile has good flame retardance, that is, it will not burn after contacting the open flame and it can self-extinguish when leaving the fire. The melamine resin decomposes slowly at a temperature higher than 420°C and the thermal decomposition products are not harmful to human bodies. The melamine sponge possesses excellent chemical stability, safety and environmental friendliness due to the stable chemical and crosslinking structure.

[0020] Compared with the cotton commonly used in the field, the organic porous material provided in the embodiment of the present disclosure has advantages of

high liquid absorption at saturation, good shape after saturation absorption of liquid and high-temperature resistance, which is conducive to transmitting the e-liquid to the heating body.

[0021] Compared with the ceramic porous material commonly used at present, the organic porous material provided in the embodiment of the present disclosure has a high porosity and can smoothly transmit the e-liquid. The discovered material has good e-liquid affinity, which endows the organic porous material provided in the embodiment of the present disclosure with a good e-liquid locking capability.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] One or more embodiments are illustrated through the image(s) in corresponding drawing(s). These illustrations do not form restrictions to the embodiments. Elements in the drawings with a same reference number are expressed as similar elements, and the images in the drawings do not form restrictions unless otherwise stated.

FIG. 1(a) is a microstructure SEM photo of a melamine resin porous material according to one embodiment of the present disclosure.

FIG. 1(b) is a diagram of a pore size distribution of a melamine resin porous material according to one embodiment of the present disclosure.

FIG. 2 is a sectional view of an aerosol generating device employing an organic porous material according to one embodiment of the present disclosure.

FIG. 3 is a sectional view of an aerosol generating device employing an organic porous material according to one embodiment of the present disclosure.

FIG. 4 is an actual photo of an atomizing core according to one embodiment of the present disclosure.

FIG. 5 is a structure diagram of an open-ended big-aerosol atomizing core employing an organic porous material according to one embodiment of the present disclosure.

FIG. 6 is contrast photos of liquid locking capability between an atomizing core (a) made of absorbent cotton and an atomizing core (b) made of a melamine resin porous material according to one embodiment of the present disclosure.

FIG. 7 is contrast photos of liquid storage and burning resistance between an atomizing core (a) made of absorbent cotton and an atomizing core (b) made of a melamine resin porous material according to one embodiment of the present disclosure.

Description of designators in drawings:

[0023] 1 represents a heating body, 2 represents an

organic material porous body, 3 represents a sealing element, 4 represents an e-liquid, 5 represents an air inlet, 6 represents an aerosol outlet, 7 represents a flowing direction of an e-liquid, 8 represents an aerosol escape pipe, 9 represents an atomizer shell, 10 represents a positive electrode of a power supply, 11 represents a negative electrode of a power supply, 12 represents a sealing cover, and 13 represents a ceramic porous body inbuilt with a heating wire.

DETAILED DESCRIPTION

[0024] The present disclosure is described below in further detail in conjunction with embodiments and accompanying drawings. The embodiments are merely to make the technical features, purposes and effects of the present disclosure better understood, rather than limiting the present disclosure.

[0025] Referring to FIG. 1, FIG. 1(a) is a microstructure SEM photo of a melamine resin porous material according to one embodiment of the present disclosure; and FIG. 1(b) is a diagram of a pore size distribution of a melamine resin porous material according to one embodiment of the present disclosure.

[0026] The melamine resin porous material is a flexible nano ultrafine fiber foam plastic, with narrow pore size; in addition, the melamine resin sponge has a high temperature resistance, which is suitable for working a long time in working conditions of 200~240°C, without volatilization and deformation under 400°C. The liquid guiding and locking capability of the melamine resin sponge for an e-liquid has no obvious relationship with the pore size of the melamine resin sponge, and good liquid guiding and locking effects can be achieved when the average pore size lowers to 20nano to 100micron.

[0027] Referring to FIG. 2, which is a sectional structure view of an embodiment of an aerosol generating device employing an organic porous material.

[0028] A spiral heating body 1 formed by coiling a heating wire or heating tape is wound on a cylindrical surface of the organic material porous body 2.

[0029] The organic material porous body 2 has an appearance presenting a dumbbell structure, which is thin in the middle and thick at two ends.

[0030] An aerosol escape pipe 8 has an appearance presenting a circular tube, of which a bottom defines horizontal circular symmetrical through holes, the organic material porous body 2 wound by the heating body 1 is installed in the circular symmetrical holes horizontally, and the dumbbell structure thick at two ends, after absorbing the e-liquid 4 in the liquid storage chamber, can also function as sealing to prevent the e-liquid leaking.

[0031] An atomizer shell 9 of the aerosol generating device has an open-ended structure at the bottom, such that an e-liquid can be filled; after the aerosol escape pipe 8, the heating body 1, the porous body 2 and the e-liquid 4 are assembled, a sealing element made of silicone rubber is employed to seal the bottom of the shell

9 of the aerosol generating device.

[0032] The e-liquid 4 enters the liquid storage part inside the porous body through the liquid absorption surface of the porous body 2, to reach the atomizing surface.

5 The flow direction of the e-liquid is indicated by 7.

[0033] When an action of suction occurs, a controller is triggered to supply power through electrodes 10 and 11, and the heating body transfers the heat to the e-liquid on the atomizing surface of the porous body.

10 **[0034]** The e-liquid on the atomizing surface receives the heat transferred by the heating body 1 and is converted into a gas, which then interacts with the air entering from the air inlet 5 to generate an aerosol that escapes from the aerosol outlet 6.

15 **[0035]** The present embodiment is an aerosol generating device of simple structure, which makes full advantages of the micro three-dimensional nanonet structure of an organic porous material, achieves fast liquid absorption, effectively improves the liquid storage capacity, and enhances the smooth transmission capability of the e-liquid inside the porous body. A nano-capillary microstructure is formed after liquid infiltration, which has an outstanding liquid locking capability, and can effectively solve the problem of easy leaking of liquid. The aerosol generated by the atomizing surface of the porous body escapes immediately through the escape pipe along the suction direction, without retention or problems of flavor degradation caused by repeated heating, which also greatly reduces the probability of occurrence of pyrolysis byproducts.

20 **[0036]** Referring to FIG. 3 and FIG. 4, which are a sectional structure view of another embodiment of an aerosol generation device employing the organic porous material and an actual photo of an atomizer core.

25 **[0037]** The organic material porous body 2 is covered on a surface of a ceramic porous body 13 inside which a heating wire 1 is sintered, to compensate for the insufficient liquid locking capability of the porous ceramic.

30 **[0038]** At present, porous ceramic type liquid guide bodies are employed in the industry. The ceramic porous bodies have excellent performances such as stable chemical properties, low thermal conductivity, high-temperature resistance and corrosion resistance, which to some extent compensate for the performance defects of liquid guide bodies made of cotton and fiber bundles.

35 **[0039]** However, due to the brittleness and fragility of the ceramic material, the ceramic porous bodies generally have problems such as low porosity and large diameters of micropores; the porosity ranges between 40%~80%, the pore size ranges between 10 μ m~300 μ m, the liquid absorbing and guiding performance basically can meet the design requirements, however, the liquid locking capability needs improving, that is, it is easy to leak liquid.

40 **[0040]** FIG. 4 is an actual photo of an embodiment of an organic porous material wrapped on a surface of a porous ceramic heating body in which a heating wire is sintered. From the figure it is obvious that the liquid lock-

ing capability of the organic porous material is better than the porous ceramic, there is droplet leaked onto the lead of the heating wire in the ceramic part, while the surface of the organic porous material part is wet but without liquid leaked.

[0041] Referring to FIG. 5, which is a structure diagram of an embodiment of an open-ended liquid-dripping big-aerosol atomizing core employing an organic porous material.

[0042] In the present embodiment, the organic porous material is directly used as a liquid storage carrier and a liquid guide body, and is applied to an open-ended liquid-dripping big-aerosol atomizing core, to directly replace the cotton type liquid storage carriers and liquid guide bodies that are employed in the industry.

[0043] The cotton has an ignition point of 150°C only, which is easy to be burned by the heating wire.

[0044] The melamine resin porous material taking a heat resistant polymer as a base material has a decomposition temperature exceeding 400°C. It can be used for a long time at 200-240°C, which just covers the operating temperature range of the electronic cigarette atomizer. The melamine resin decomposes slowly at a temperature higher than 420°C and the thermal decomposition products are not harmful to human bodies.

[0045] Compared with cotton, the organic porous material provided by the present disclosure has advantages of high liquid absorption at saturation, good shape after saturation absorption of liquid and high-temperature resistance, which is conducive to transmitting the e-liquid to the heating body.

[0046] Referring to FIG. 6, besides comparing the liquid locking performances of the ceramic porous material and the melamine resin porous material (referring to FIG. 4), the present disclosure also compares the liquid locking performances of the absorbent cotton and the melamine resin porous material, FIG. 6 is a contrast of appearances of an atomizing core (a) made of absorbent cotton and an atomizing core (b) made of a melamine resin porous material after saturation absorption of e-liquid. After kept still for 10 minutes, the e-liquid absorbed into the atomizing core (a) made of absorbent cotton mostly overflows, while the atomizing core (b) made of a melamine resin porous material still keeps the original appearance of saturation absorption, with little e-liquid overflow.

[0047] Referring to FIG. 7, the present disclosure further studies the contrast of liquid storage and burning resistance between an atomizing core (a) made of absorbent cotton and an atomizing core (b) made of a melamine resin porous material; FIG. 7 is a contrast of liquid storage and burning resistance between an atomizing core (a) made of absorbent cotton and an atomizing core (b) made of a melamine resin porous material, which shows the appearances of the atomizing core (a) made of absorbent cotton and the atomizing core (b) made of a melamine resin porous material when heated for 8 seconds after saturation absorption of e-liquid, wherein the

heating condition is a heating wire of 1.2ohm and a voltage of 3.7volt. Remove the heating body after 8 seconds of heating, it can be seen part of the surface of the absorbent cotton is burned, while the melamine resin porous body has a complete appearance. Moreover, in the condition of equivalent volume, the amount of e-liquid absorbed by the absorbent cotton is obviously lower than the melamine resin porous material. Thus, the melamine resin porous material is conducive to smoothly supplying liquid and preventing dry burning.

[0048] It should be noted that although the description and accompanying drawings of the present disclosure illustrate some preferred embodiments of the present disclosure, the present disclosure may be implemented through many different forms, but not restricted to the embodiments described in the description. These embodiments shall not be construed as additional limitations on the contents of the present disclosure. These embodiments are described for the purpose of providing a more thorough and comprehensive understanding of the disclosed content of the present disclosure. Moreover, various embodiments not listed above formed by the above technical features combining with each other are all intended to be included in the scope of the present disclosure; furthermore, for the ordinary skill in the art, improvements or transformations may be made according to the above description, and these improvements and transformations shall belong to the protection scope of the claims appended below.

Claims

1. A use of an organic porous material in an aerosol generating device, wherein the organic porous material is, at least in part, a melamine resin porous material.
2. The use according to claim 1, wherein the organic porous material has an apparent density of $(3\sim120)\times10^{-3}\text{g/cm}^3$, preferably $(4\sim12)\times10^{-3}\text{g/cm}^3$.
3. The use according to claim 1, wherein the organic porous material has a 25% deformation compression strength of 5~30KPa.
4. The use according to claim 1, wherein the organic porous material has a decomposition temperature exceeding 300°C, preferably a decomposition temperature exceeding 350°C, more preferably a decomposition temperature exceeding 400°C.
5. The use according to claim 1, wherein the organic porous material has a porosity higher than 60%, preferably higher than 80%, more preferably higher than 95%.
6. The use according to claim 1, wherein the organic

porous material has a pore size distribution that over 90% volume is occupied by the pores with the pore size ranging between 10nano~100micron, preferably between 10nano~1micron, more preferably between 10nano~100nano, and most preferably between 10nano~50nano.

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7. The use according to any one of claims 1 to 6, wherein the aerosol generating device comprises a heating element, and the organic porous material is used as a liquid guide body and is in contact with or adjacent to the heating element.

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8. The use according to any one of claims 1 to 6, wherein the aerosol generating device comprises a heating element, the organic porous material is used as a liquid guide body, and another porous material is contained between the organic porous material and the heating element.

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9. An atomizer of an aerosol generating device, comprising:

a shell, inside which a liquid storage chamber configured for storing an atomized liquid is formed, wherein the liquid storage chamber comprises an outlet, an aerosol channel extending along the longitudinal direction of the shell is formed inside the shell, the aerosol channel comprises an inlet and an air outlet, and the air outlet is located on one end of the shell;

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an atomizing core, which is accommodated in the shell, wherein the outlet of the liquid storage chamber is communicated with a liquid absorption surface of the atomizing core, an atomizing surface of the atomizing core is communicated with the aerosol channel, and the atomizing core is, at least in part, made of a melamine resin porous material;

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a fixing element, which is configured for fixing the atomizing core and the shell;

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a heating body, which is in contact with or adjacent to the atomizing surface; and

an electrode, which is configured for connecting to the heating body and enabling the heating body to receive an electric power.

45

10. The atomizer according to claim 9, wherein the atomizing core comprises porous ceramic and a melamine resin porous material;

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one surface of the porous ceramic forms the atomizing surface, and one surface of the melamine resin porous material forms the liquid absorption surface; and

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the melamine resin porous material covers, at least in part, the porous ceramic, such that the atomizing liquid enters the atomizing core

through the liquid absorption surface and is transmitted to the atomizing surface.

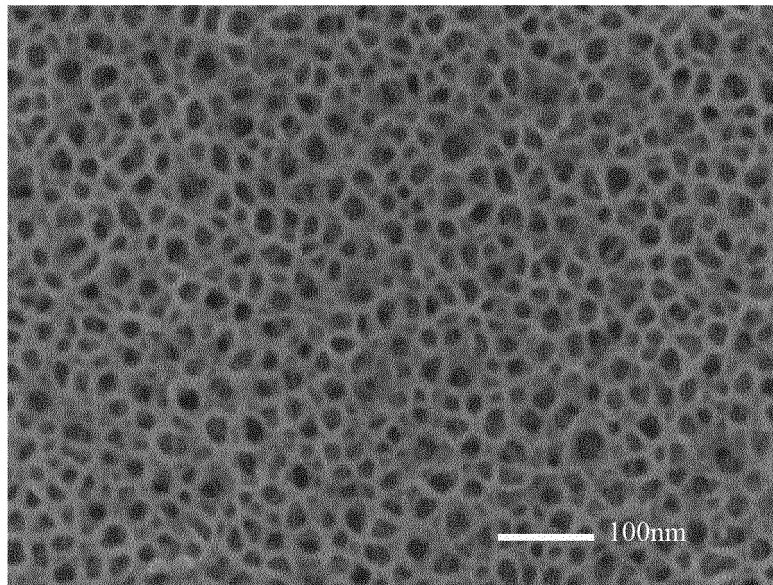


FIG. 1 (a)

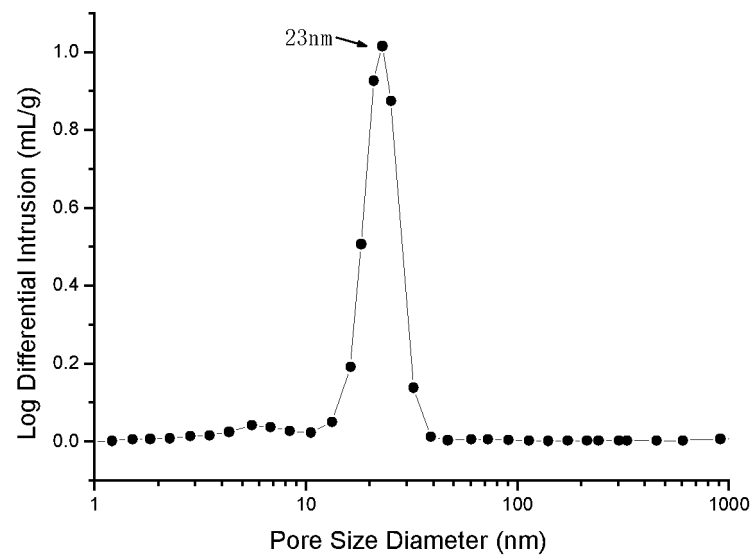


FIG. 1 (b)

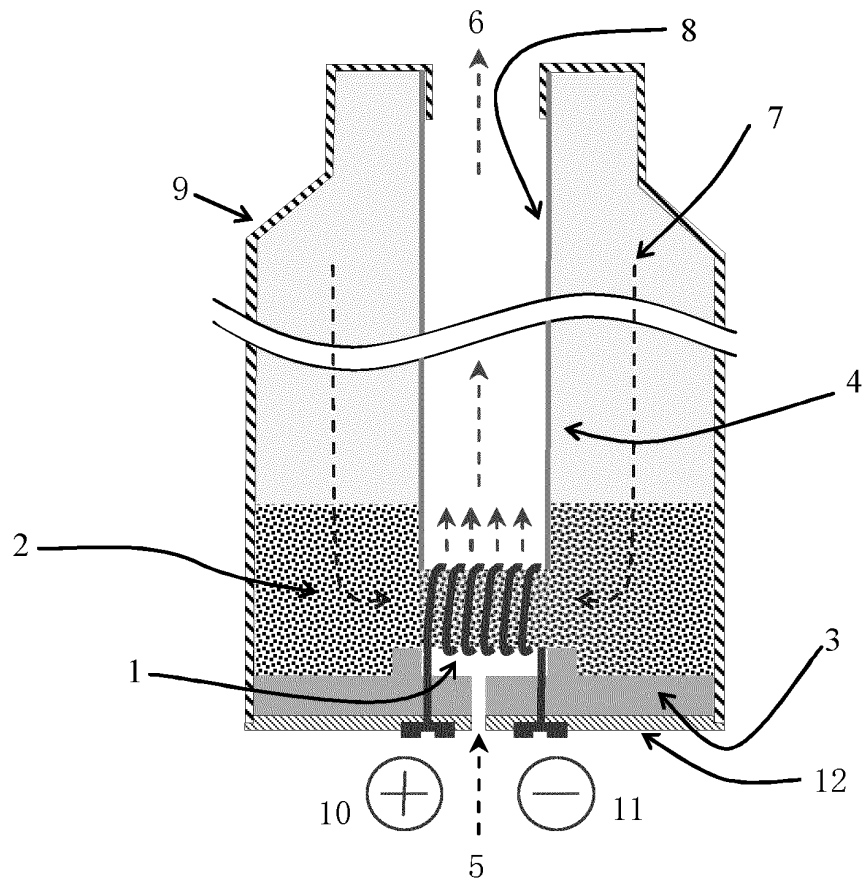


FIG. 2

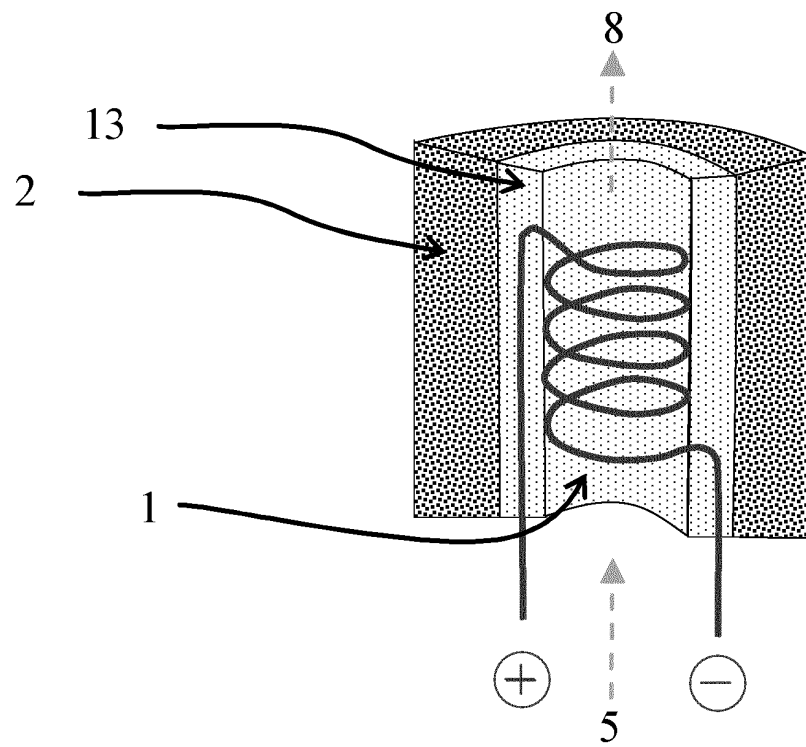


FIG. 3

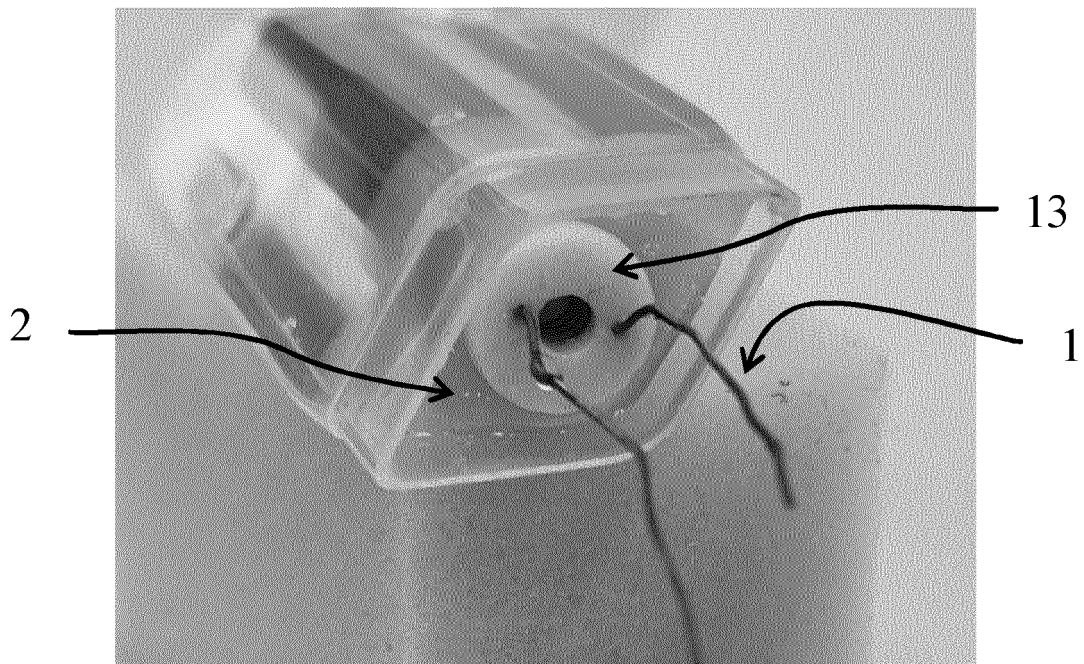


FIG. 4

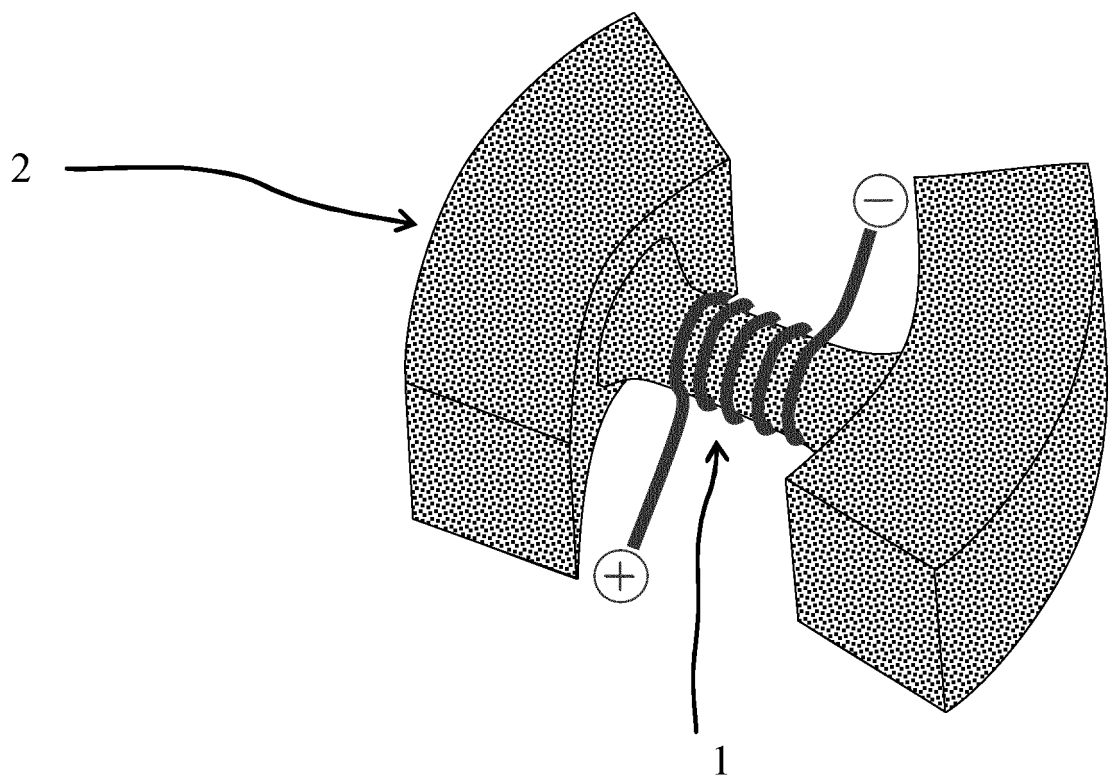
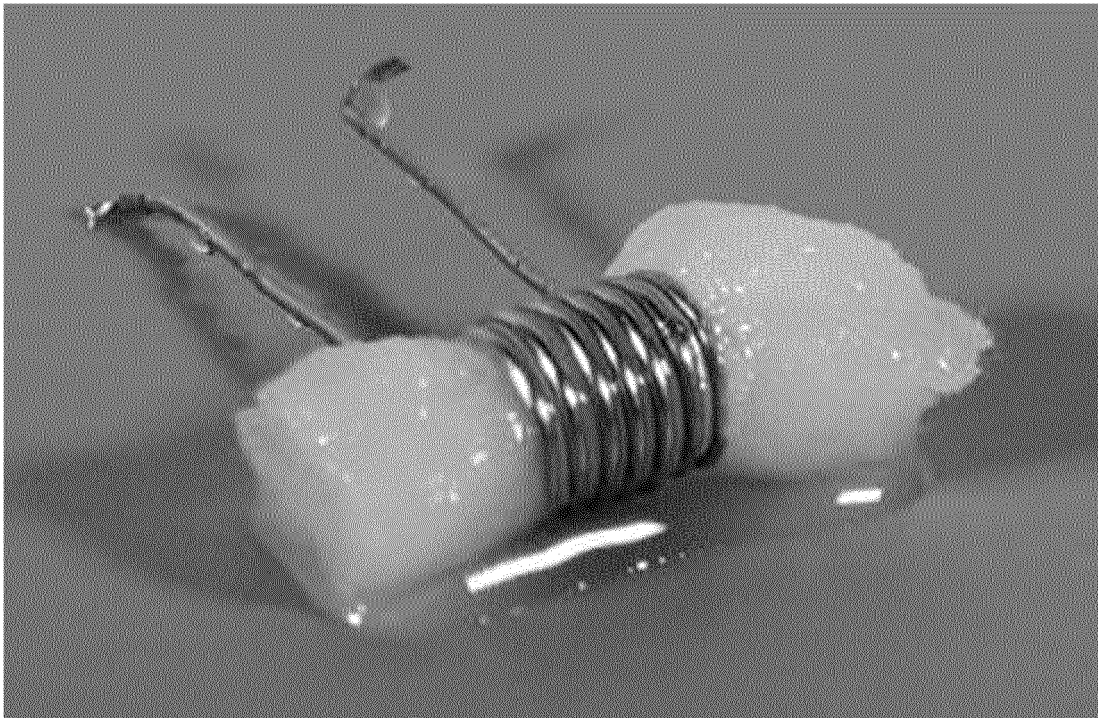
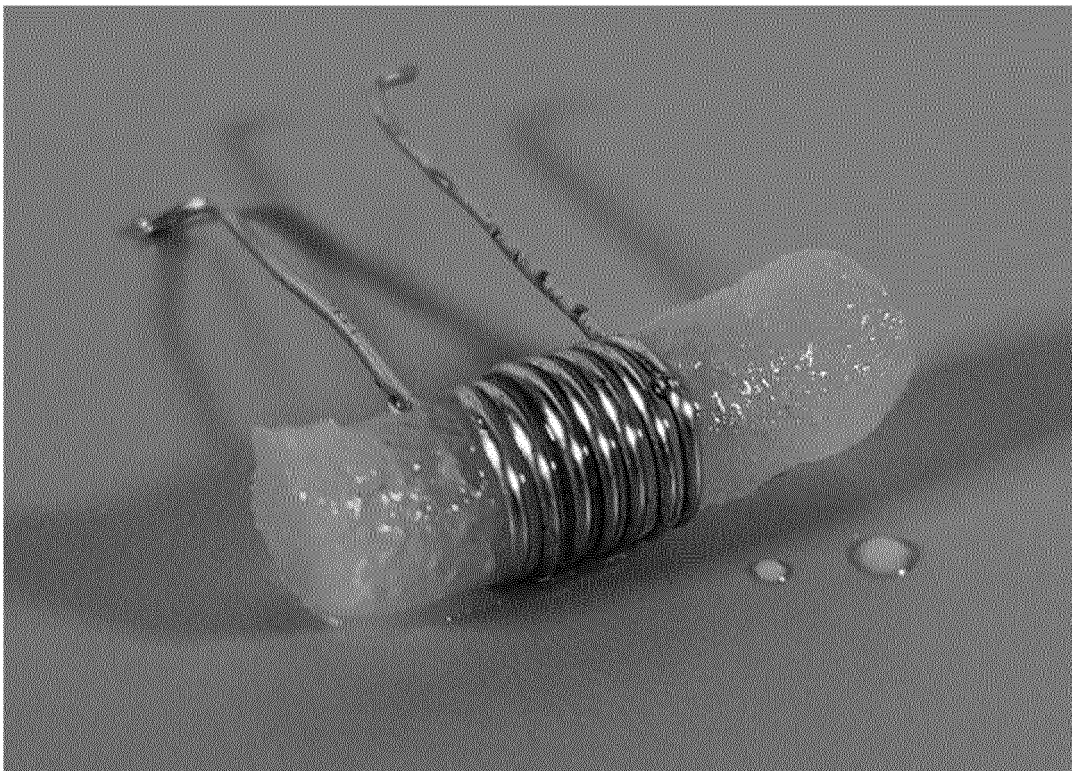


FIG. 5

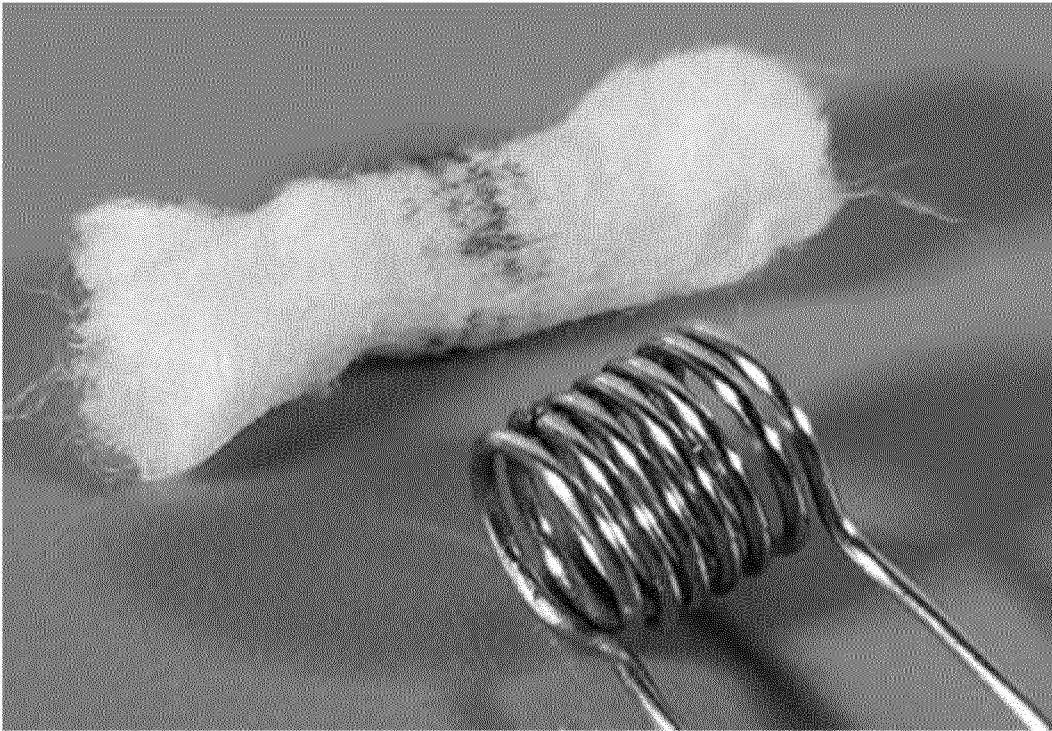


(a)

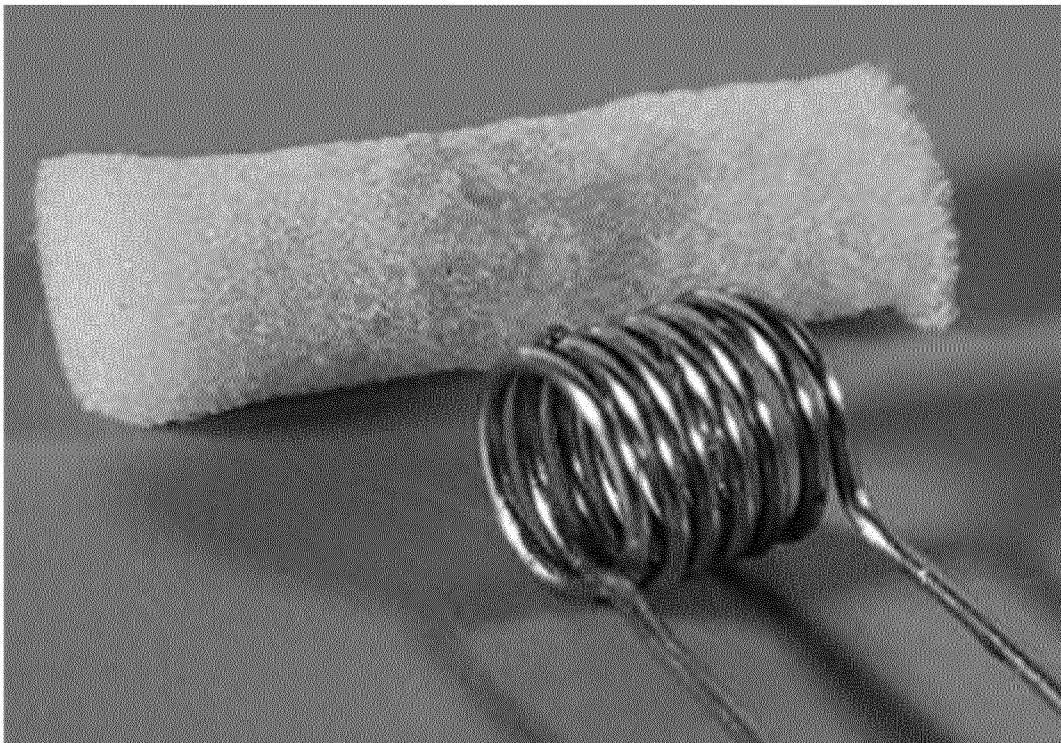


(b)

FIG. 6



(a)



(b)

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/100226

A. CLASSIFICATION OF SUBJECT MATTER

A24F 47/00(2020.01)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)

A24F 47/-

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)

EPODOC, WPI, CNKI, CNPAT, USTXT, CNABS, CNTXT: 加热, 雾化, 气溶胶, 多孔, 密胺, 密胺树脂, 甲醛, 树脂, 三聚氰胺 3d甲醛树脂, 温度, 电子烟, vaporizer, electronic 3d cigarette, vapor, resin, melamine, porous

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 109069497 A (NICOGEN LTD.) 21 December 2018 (2018-12-21) description, paragraphs [0051]-[0097] and [0245]-[0250], and figures 3 and 4	1-6
A	CN 102300478 A (US SMOKELESS TOBACCO CO.) 28 December 2011 (2011-12-28) entire document	1-10
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A	CN 109661182 A (JAPAN TOBACCO INC.) 19 April 2019 (2019-04-19) entire document	1-10
A	CN 109414062 A (JAPAN TOBACCO INC.) 01 March 2019 (2019-03-01) entire document	1-10

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

* Special categories of cited documents:

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Date of the actual completion of the international search

25 August 2020

Date of mailing of the international search report

10 October 2020

Name and mailing address of the ISA/CN

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China

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Facsimile No. (86-10)62019451

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2020/100226

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