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(54) **BAKING OBJECT, METHOD FOR FABRICATION OF BAKING OBJECT, AND METHOD FOR MICROWAVE HEATING OF BAKING OBJECT**

(57) Provided are a baking object (100), a method for fabrication of the baking object (100), and a method for microwave heating of the baking object (100); the baking object (100) comprises tobacco (131) and a microwave absorber (132); both the tobacco (131) and the microwave absorber (132) can absorb microwaves to generate heat; the microwave absorber (132) is made of a solid material which has a stable dielectric loss constant and which is non-volatile; the microwave absorber is used for stably absorbing microwaves to generate heat, and thus conductively heat the tobacco (131). By means of adding the microwave absorber to the tobacco, the microwave absorber can absorb microwaves stably to generate heat; in addition to the tobacco itself absorbing microwaves and heating, it is also heated by the microwave absorber by means of thermal conduction; the temperature of the tobacco is more stable and uniform and the temperature can continue to rise to the effective baking temperature, achieving the function of fast smoking puffs, and can also be pyrolyzed so as to give off a unique smoky fragrance, and produce a suitable taste.

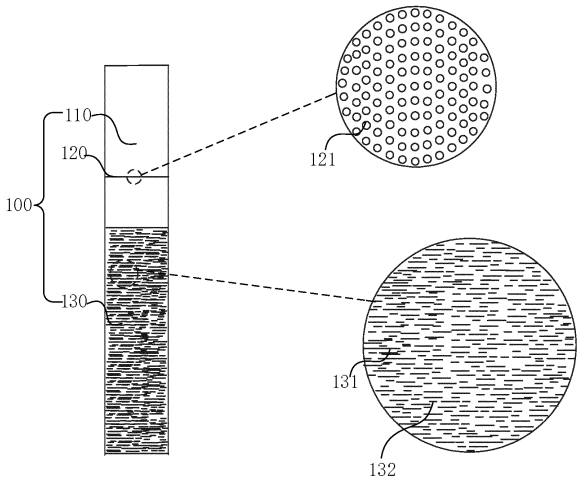

FIG. 1

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Description

TECHNICAL FIELD

[0001] This application relates to the field of microwave heating, and in particular, to a baked object, a method for preparing the baked object, and a microwave heating method for the baked obj ect.

BACKGROUND

[0002] A heat not burn technology refers to a method of baking a specific baked object (for example, a cigarette) through low-temperature heating without burning to generate vapor for a user to inhale.

[0003] Conventional low-temperature baking apparatuses mainly energize a heating element, the heating element generates heat through the Joule effect, and the heating element is in direct contact with the baked object (tobacco) to transfer the heat to the tobacco for baking. This method has problems such as a long preheating time and non-uniform cigarette baking, and the utilization efficiency of the tobacco is low.

[0004] Microwave heating is a process of utilizing continuous polarization of a heated material in a microwave electromagnetic field, and heating the material by using a dielectric loss (similar to internal friction) generated due to high-frequency reciprocating movement of dipoles inside the heated material. This method is characterized by a high heating speed and being capable of heating various parts of the baked object, so that the problems of a long preheating time and poor cigarette baking uniformity of the conventional electric heating method may be resolved. However, when heating a conventional cigarette, general microwave heating devices cannot effectively heat the baked object to a target temperature, so that it is difficult to effectively bake a tobacco to obtain a good taste.

SUMMARY

[0005] According to various embodiments of this application, a baked object is provided, including a tobacco and a microwave absorbing agent, where the tobacco and the microwave absorbing agent are both capable of absorbing microwaves to generate heat, the microwave absorbing agent is made of a non-volatile solid material with a stable dielectric loss constant, the dielectric loss constant of the microwave absorbing agent does not change as temperature changes, the dielectric loss constant of the microwave absorbing agent is higher than a dielectric loss constant of lignocellulose in the tobacco, and the microwave absorbing agent is capable of stably absorbing microwaves to generate heat, so as to heat the tobacco through thermal conduction.

[0006] In an embodiment, the microwave absorbing agent is one of ceramic powder, an inorganic non-metal element, a ferrite absorbing agent, metal powder, or any combination thereof.

[0007] In an embodiment, the ceramic powder includes one of silicon carbide, silicon nitride, aluminum nitride, or any combination thereof; the inorganic non-metal element includes one of coke, carbon powder, graphite powder, or any combination thereof; the ferrite absorbing agent includes Fe_3O_4; and the metal powder includes one of Ti powder, Fe powder, Ni powder, or any combination thereof.

[0008] In an embodiment, the microwave absorbing agent is uniformly distributed in the tobacco, and a particle size of the microwave absorbing agent ranges from 2 μm to 200 μm.

[0009] In an embodiment, a volume ratio of the microwave absorbing agent to the tobacco ranges from 1% to 30%.

[0010] In an embodiment, a thermal conductivity of the microwave absorbing agent is greater than a thermal conductivity of the tobacco.

[0011] In an embodiment, the baked object is a cigarette, and the cigarette includes a tobacco portion, a filter portion, and a microwave filter membrane, where the tobacco portion includes the tobacco and the microwave absorbing agent; and the microwave filter membrane is disposed in the filter portion or between the filter portion and the tobacco portion.

[0012] In an embodiment, the microwave filter membrane is a metal foil, the metal foil is provided with a first through hole, airflow is capable of circulating from the first through hole, the metal foil is configured to reflect microwaves to prevent microwave from leakage, and the first through hole is configured to intercept transmission of the microwaves.

[0013] This application further provides a method for preparing the foregoing baked object, including the following steps:

S110, crushing a tobacco raw material into a first component;

S120, adding an additive to the first component to obtain a second component through uniform mixing, and adding powder of the microwave absorbing agent into the second component and uniformly mixing to obtain a third component; or adding the microwave absorbing agent and the additive to the first component and uniformly mixing to obtain a fourth component through uniform mixing; and

S130: shaping the third component or the fourth component.

[0014] In an embodiment, the additive in step S120 includes one of an acidity regulator, a bulking agent, a humectant, a stabilization agent/coagulating agent, a thickening agent, a natural flavoring agent, or any combination thereof.

[0015] In an embodiment, a manner for shaping the third component or the fourth component in step S130 includes at least one of coating, die-casting, or thermoforming.

[0016] This application further provides a microwave heating method for the foregoing baked object, including the following steps:

S210, generating, by a microwave generator, microwaves to heat the baked object; and

S220, absorbing, by the tobacco and the microwave absorbing agent, the microwaves to generate heat, and re-heating, by the microwave absorbing agent, the tobacco through thermal conduction.

[0017] In an embodiment, the microwave heating method for the baked object further includes a temperature control step S230, detecting, by a temperature detection unit, a temperature of the baked object, and transmitting a result of the detection to a circuit control unit, the circuit control unit controls a heating temperature of the baked object by controlling a working power of the microwave generator. In an embodiment, a manner in which the temperature detection unit detects the temperature of the baked object in step S230 includes at least one of thermocouple temperature measurement, optical pyrometer temperature measurement, or infrared optical fiber temperature measurement.

[0018] In an embodiment, a manner in which the temperature detection unit detects the temperature of the baked object in step S230 includes at least one of deriving a temperature of a cigarette according to a variation of a physical parameter of the cigarette or deriving a temperature of a cigarette according to a working power of the microwave generator.

[0019] Details of one or more embodiments of this application are provided in the accompanying drawings and descriptions below. Other features, objectives, and advantages of this application will become apparent from the specification, the accompanying drawings, and the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

FIG. 1 is a schematic structural diagram of a cigarette according to an embodiment of this application;

FIG. 2 is a schematic structural diagram of a microwave heating device according to an embodiment of this application;

FIG. 3 is a schematic diagram showing an electrical connection relationship among electronic components in a microwave heating device according to an embodiment of this application;

FIG. 4 is a flowchart of a method for preparing a baked object according to an embodiment of this application; and

FIG. 5 is a flowchart of a microwave heating method for a baked object according to an embodiment of this application.

[0021] Reference Numerals:

cigarette 100, filter portion 110, microwave filter membrane 120, first through hole 121, tobacco portion 130, tobacco 131, microwave absorbing agent 132; housing 210, airway hole 211, charging interface 212, power supply 220, circuit control unit 230, microwave generator 240, accommodation cavity 250, second through hole 251, main control switch 260, display screen 270, microwave power control button 280, microwave transmission channel 290; and temperature detection unit 400.

[0022] To better describe and illustrate embodiments and/or examples in this application disclosed herein, reference may be made to one or more accompanying drawings. Additional details or examples used to describe the accompanying drawings should not be considered as limiting the scope of any of the disclosed application, currently described embodiments and/or examples, and the best modes of this application currently understood.

DETAILED DESCRIPTION

[0023] To help understand this application, the following describes this application more comprehensively with reference to the related accompanying drawings. The accompanying drawings show exemplary implementations of this application. However, this application may be implemented in many different forms, and is not limited to the implementations described in this specification. On the contrary, the implementations are provided to make understanding of the disclosed content of this application more comprehensive.

[0024] It should be noted that, when a component is referred to as "being fixed to" another component, the component may be directly on the other component, or an intervening component may be present. When a component is considered to be "connected to" another component, the component may be directly connected to the other component, or an intervening component may also be present. The terms "inter", "outer", "left", "right" and similar expressions used in this

specification are only for purposes of illustration but not indicate a unique implementation.

[0025] When a conventional baked object such as a cigarette is heated by microwaves, it can be hardly effectively heated to a target temperature, so that it is difficult to obtain a good taste. It is found through research that a specific reason mainly lies in that, general microwave heating frequency is 2.45 GHz, and a heating power of a material of a unit volume under action of a microwave field is $P = 2\pi f \cdot \varepsilon_0 \varepsilon' \tan\delta \cdot /E/^2$, where f is microwave frequency, $\varepsilon' \tan\delta$ is a dielectric loss constant of the material, ε_0 is a vacuum dielectric constant, and E is an intensity of a microwave electric field, so that the microwave heating is closely related to the dielectric loss constant of the material and the intensity of the microwave electric field. Main components of a cigarette include lignocellulose, some water, and additives such as glycerol and flavoring agent. A tobacco baking process mainly includes volatilization of the water, the glycerol, nicotine, and a plant volatile substance and thermolysis of some cellulose and lignin. In a microwave heating early stage of the cigarette, dielectric loss constants of the water (the dielectric loss constant is 10 to 20) and the glycerol are relatively high, so that the temperature of the tobacco can rise quickly. However, along with volatilization of the water and the glycerol, and a dielectric loss constant of the lignocellulose is relatively small, a temperature-rising rate may decrease quickly and temperature rising of the tobacco even cannot be continued. Therefore, when a conventional baked object such as a cigarette is heated by microwaves, it cannot be effectively heated to a target temperature, which, according to a design of the cigarette, is generally 250°C to 400°C.

[0026] In an embodiment, the baked object is a cigarette 100. As shown in FIG. 1, the cigarette 100 includes a filter portion 110, a microwave filter membrane 120, and a tobacco portion 130. The tobacco portion 130 include a tobacco 131 and a microwave absorbing agent 132. The tobacco 131 is the same as a tobacco 131 in a common low-temperature baking cigarette. The tobacco 131 and the microwave absorbing agent 132 are both capable of absorbing microwaves to generate heat. The microwave absorbing agent 132 is made of a non-volatile solid material with a stable dielectric loss constant. The microwave absorbing agent 132 is capable of stably absorbing microwaves to generate heat to heat the tobacco 131 through thermal conduction. Under double heating of microwave radiation and thermal conduction, the temperature of the tobacco 131 can rise to an effective baking temperature.

[0027] The microwave absorbing agent 132 has a relatively stable dielectric loss constant. It should be noted that, the relatively stable dielectric loss constant of the microwave absorbing agent described herein refers to that the microwave absorbing agent is generally in a solid state and may not be volatilized or undergo a chemical reaction, so that the dielectric loss constant thereof may not change as the temperature changes, and the microwave absorbing agent can stably absorb microwaves to generate heat. The microwave absorbing agent 132 may be granular or sheet-like ceramic powder (for example, silicon carbide, silicon nitride, or aluminum nitride), an inorganic non-metal element (for example, coke, carbon powder, or graphite powder), a ferrite-type absorbing agent (for example, Fe_3O_4), or even metal powder (for example, Ti, Fe, or Ni). The microwave absorbing agent 132 is added in a reproduction process of the tobacco, so that the microwave absorbing agent is uniformly distributed in the tobacco 131. The microwave absorbing agent 132 may be one of the foregoing ceramic powder, the inorganic non-metal element, the ferrite absorbing agent, the metal powder, or can be a combination thereof. The dielectric loss constant of the microwave absorbing agent is generally greater than a dielectric loss constant of lignocellulose in the tobacco. For example, a dielectric loss constant of the silicon carbide is generally 0.02 to 0.2, a dielectric loss constant of graphite ranges from 0.01 to 0.2, and a dielectric loss constant of lignocellulose is generally lower than $1*10^{-3}$.

[0028] Mixing of the microwave absorbing agent 132 and the tobacco 131 is not common mechanical mixing, but is to dope the microwave absorbing agent 132 in the reproduction process of the tobacco 131. In an embodiment, a method for preparing a tobacco 131 product mainly includes the following steps:

S110, crushing a tobacco raw material into a first component;

S120, adding a required additive to the first component obtained in step one and uniformly mixing to form a second component, the required additive mainly including an acidity regulator, a bulking agent, a humectant, a stabilization agent/coagulating agent, a thickening agent, or a natural flavoring agent; and adding powder of the microwave absorbing agent 132 into the second component and uniformly mixing to obtain a third component; or adding the microwave absorbing agent 132 and the additive to the first component and uniformly mixing to obtain a fourth component; and

S130, shaping the third component or the fourth component by coating, die-casting, or thermoforming. According to the foregoing method for preparing the tobacco 131 product, the microwave absorbing agent 132 can be mixed in the tobacco 131 quite uniformly, which facilitates heat to the tobacco 131 uniformly through thermal conduction subsequently.

[0029] As for a particle size of the microwave absorbing agent 132, the portability of being mixed into the tobacco 131 is mainly considered, if the particle size is too large, it is difficult to mix the microwave absorbing agent into the tobacco. Therefore, in an embodiment, the particle size of the microwave absorbing agent 132 ranges from 2 μm to 200 μm. In another embodiment, the particle size of the microwave absorbing agent 132 ranges from 2 μm to 50 μm, and a volume

ratio of the microwave absorbing agent 132 to the tobacco 131 ranges from 1% to 30%. In addition, generally, a thermal conductivity of the powder of the microwave absorbing agent 132 is greater than a thermal conductivity of the tobacco 131. Therefore, adding the microwave absorbing agent 132 into the tobacco 131 can further improve the thermal conductivity of the entire cigarette 100, thus further improving the temperature uniformity of the cigarette 100 after being heated.

[0030] After the cigarette 100 including the microwave absorbing agent 132 is placed into a microwave heating device, in addition to absorbing microwaves to generate heat, the tobacco 131 of the tobacco portion 130 may be further heated by the microwave absorbing agent 132 through thermal conduction. The rising of the temperature of the tobacco 131 is more stable and uniform under a double heating mechanism of microwave radiation and thermal conduction. In a volatilization process of materials such as water and glycerol in the tobacco 131, the microwave absorbing agent 132 can provide stable heating through thermal conduction, enable the temperature of the tobacco 131 to continue to rise to an effective baking temperature and produce unique smoked incense through thermolysis, thereby obtaining a good taste.

[0031] A main function of the microwave filter membrane 120 is to prevent microwaves from leaking out from the filter portion 110, and the microwave filter membrane 120 may be located in the middle of the filter portion 110 or may be located at a boundary of the filter portion 110 and the tobacco portion 130. In the embodiment shown in FIG. 1, the microwave filter membrane 120 is located in the filter portion 110. In an embodiment, as shown in FIG. 1, the microwave filter membrane 120 is a metal foil or a metal sheet. The metal foil or the metal sheet is provided with a plurality of first through holes 121, which can enable the airflow to flow normally at the first through hole 121 when the cigarette 100 is smoked. The metal material can reflect microwaves to prevent microwave from leakage, and the first through hole 121 can intercept transmission of microwaves to play a role of shielding.

[0032] In an embodiment, FIG. 2 shows a structure of the microwave heating device configured to heat the cigarette 100, the device mainly includes a housing 210, and a power supply 220, a circuit control unit 230, a microwave generator 240, and an accommodation cavity 250 located in the housing 210. The accommodation cavity 250 is configured to place the cigarette 100 including the microwave absorbing agent 132. The microwave generator 240 is configured to generate microwaves, so as to heat the cigarette 100 in the accommodation cavity 250. FIG. 3 shows an electrical connection relationship among the electronic components in the microwave heating device. As can be seen from FIG. 3, the circuit control unit 230 is electrically connected to the microwave generator 240 to control the microwave generator 240 to work. The power supply 220 is electrically connected to the circuit control unit 230 to supply power to the microwave heating device.

[0033] In an embodiment, as shown in FIG. 2, the microwave heating device is further provided with a smoking set main control switch 260, a display screen 270, a microwave power control button 280, a temperature detection unit (not shown in FIG. 2), a charging interface 212, and an airway hole 211 on the housing 210, and the airway hole 211 is in communication with the accommodation cavity 250. The electrical connection relationship among the electronic components in the microwave heating device is shown in FIG. 3, the smoking set main control switch 260 is electrically connected to the power supply 220 or the circuit control unit 230 to turn on the microwave generator 240 to work; the display screen 270 is electrically connected to the circuit control unit 230 to display a working power of the microwave generator 240 and/or a temperature in the accommodation cavity 250; the microwave power control button 280 is electrically connected to the circuit control unit 230 to adjust and control working frequency of the microwave generator 240; the temperature detection unit 400 is electrically connected to the circuit control unit 230 to detect a temperature of the cigarette 100 in the accommodation cavity 250 and transmit a detected temperature to the circuit control unit 230; and the charging interface 212 is electrically connected to the power supply 220 to charge the power supply 220 in the microwave heating device.

[0034] In a specific embodiment, as shown in FIG. 2, the microwave generator 240 is a magnetron tube, which can generate microwaves with a frequency of 2.45 GHz. A microwave transmission channel 290 is further disposed between the microwave generator 240 and the accommodation cavity 250, and the microwave transmission channel 290 is configured to transmit the microwaves generated by the microwave generator 240 to the accommodation cavity 250. The accommodation cavity 250 is a cylindrical microwave resonator, the accommodation cavity 250 may be made of a metal material or a high-temperature-resistant organic material such as ceramic or Teflon, while an inner side of the accommodation cavity 250 needs to include a metal reflecting layer, which can enable microwaves to be vibrated and propagated inside the accommodation cavity 250. A bottom of the accommodation cavity 250 is provided with a plurality of second through holes 251 to facilitate entrance of airflow in an inhaling process and adjustment of inhaling resistance. The airway hole 211 on the housing 210 of the microwave heating device is in communication with the accommodation cavity 250 via the second through holes 251. After the cigarette 100 is inserted into the accommodation cavity 250 of the microwave heating device, the accommodation cavity 250 as well as the microwave filter membrane 120 in the cigarette 100 can form a microwave sealing cavity. Once the microwave generator 240 is turned on, microwaves are vibrated inside the accommodation cavity 250 to heat the tobacco portion 130 (including the tobacco 131 and the microwave absorbing agent 132) in the cigarette 100, so as to increase the temperature of the tobacco portion of the

cigarette 100 to a suitable temperature, thereby baking suitable vapor through thermolysis for a user to inhale.

[0035] In the embodiment shown in FIG. 2, the baked object is the cigarette 100, and the cigarette 100 is provided with the microwave filter membrane 120. It should be understood that, in other embodiments, if the baked object only includes the tobacco 131 and the microwave absorbing agent 132, and the baked object is not provided with the microwave filter membrane 120, the microwave filter membrane 120 needs to be disposed at an airflow outlet of the accommodation cavity 250 on the microwave heating device heating the baked object, so as to prevent microwaves inside the accommodation cavity 250 from leaking out.

[0036] In an embodiment, a microwave heating method for the cigarette 100 described above includes the following steps:

S210, generating, by the microwave generator 240, microwaves to heat the cigarette 100;
and
S220, absorbing, by the tobacco 131 and the microwave absorbing agent 132 in the cigarette 100, the microwaves to generate heat, and reheating, by the microwave absorbing agent 132, the tobacco 131 through thermal conduction. The temperature of the tobacco 131 will rise to an effective baking temperature under a dual heating mechanism of microwave radiation and thermal conduction. In some other embodiments, the microwave heating method for the cigarette 100 further includes a temperature control step S230, detecting, by the temperature detection unit 400, a temperature of the cigarette 100, and transmitting a result of the detection to the circuit control unit 230, so that the circuit control unit 230 controls a heating temperature of the cigarette 100 by controlling a working power of the microwave generator 240.

[0037] The temperature detection unit 400 can directly or indirectly detect the temperature of the cigarette 100. A direct temperature measurement manner includes thermocouple temperature measurement, optical pyrometer temperature measurement, and infrared optical fiber temperature measurement, where the infrared optical fiber temperature measurement is performed according to infrared electromagnetic waves radiated on a surface of the cigarette. An indirect temperature measurement manner mainly includes deriving according to experience, for example, deriving the temperature of the cigarette according to a variation of a physical parameter of the cigarette or deriving the temperature of the cigarette according to the working power of the microwave generator. A temperature control manner of the cigarette may be power feedback-type temperature control, namely, the heating temperature of the cigarette is controlled by the circuit control unit by controlling working frequency of the microwave generator. The microwave power control button 280 includes a certain number of adjustment grades. For example, in an embodiment, the microwave power control button includes six grades, which indicates that the cigarette includes six different balance temperatures, and generally, the balance temperatures range from 250°C to 250°C with 20°C as a stage.

[0038] According to the baked object in this application, the microwave absorbing agent 132 is added into the tobacco 131, the microwave absorbing agent 132 is made of a non-volatile solid material with a stable dielectric loss constant, and the microwave absorbing agent 132 is capable of stably absorbing microwaves to generate heat to heat the tobacco 131 through thermal conduction. After the baked object of this application is placed into a microwave heating device, in addition to absorbing microwaves to generate heat, the tobacco 131 of the tobacco portion 130 may be further heated by the microwave absorbing agent 132 through thermal conduction, and temperature rising of the tobacco 131 is more stable and uniform under a double heating mechanism of microwave radiation and thermal conduction. In a volatilization process of materials such as water and glycerol in the tobacco 131, the microwave absorbing agent 132 can provide stable heating through thermal conduction, to enable the temperature of the tobacco 131 to continue to rise to an effective baking temperature and produce unique smoked incense through thermolysis, thereby obtaining a good taste.

[0039] In an embodiment, silicon carbide ceramic powder, carbon powder, Fe_3O_4, and a composite additive of silicon carbide and carbon powder (a weight ratio is 1:1) are used as the microwave absorbing agent, temperature-rising rates of the cigarette under action of microwaves are measured in different particle sizes and mixture ratios. A working power of the microwave generator is 30 W, frequency of microwaves generated by the microwave generator is 2.45 GHz, an internal temperature of the cigarette is measured by thermocouple, and the temperature is controlled to be about 300°C using the power feedback-type temperature control manner. As shown in Table 1, D50 in Table 1 refers to a median of the particle sizes.

Table 1

Microwave absorbing agent	Particle size of the absorbing agent/D50	Ratio of the absorbing agent/%	t = 5 s	t = 10 s	t = 3 min (balanced state)
None (common cigarette)	/	/	68°C	83°C	95°C

(continued)

Microwave absorbing agent	Particle size of the absorbing agent/D50	Ratio of the absorbing agent/%	t = 5 s	t = 10 s	t = 3 min (balanced state)
SiC	5 μm	10%	104°C	165°C	296°C
SiC	15 μm	20%	158°C	246°C	295°C
SiC	15 μm	30%	235°C	298°C	295°C
SiC	25 μm	30%	240°C	296°C	298°C
Carbon powder	15 μm	20%	180°C	265°C	296°C
Carbon powder	25 μm	30%	275°C	295°C	298°C
Fe_3O_4 powder	15 μm	20%	82°C	128°C	296°C
Fe_3O_4 powder	25 μm	30%	125°C	163°C	295°C
Sic/C powder (1:1)	15 μm	20%	235°C	298°C	298°C

[0040] As can be seen from the data in Table 1, after the temperature of the common cigarette rises to about 80°C, it is difficult for the temperature to continue to rise. The addition of the microwave absorbing agent can increase the temperature-rising rate of the cigarette, such that the temperature of the cigarette can rise to a temperature designed by temperature control. As the content of the microwave absorbing agent increases, the temperature-rising rate of the cigarette is increased, while the particle size of the microwave absorbing agent has no significant effect on the temperature-rising rate.

[0041] The technical features in the foregoing embodiments may be randomly combined. For concise description, not all possible combinations of the technical features in the embodiments are described. However, provided that combinations of the technical features do not conflict with each other, the combinations of the technical features are considered as falling within the scope described in this specification.

[0042] The foregoing embodiments merely express several implementations of this application. The descriptions thereof are relatively specific and detailed, but should not be understood as limitations to the scope of this application. It should be noted that for a person of ordinary skill in the art, several transformations and improvements can be made without departing from the idea of this application. These transformations and improvements belong to the protection scope of this application. Therefore, the protection scope of the patent of this application shall be subject to the appended claims.

Claims

1. A baked object, comprising a tobacco and a microwave absorbing agent, wherein the tobacco and the microwave absorbing agent are both capable of absorbing microwaves to generate heat, the microwave absorbing agent is made of a non-volatile solid material with a stable dielectric loss constant, the dielectric loss constant of the microwave absorbing agent does not change as temperature changes, the dielectric loss constant of the microwave absorbing agent is higher than a dielectric loss constant of lignocellulose in the tobacco, and the microwave absorbing agent is capable of stably absorbing microwaves to generate heat, so as to heat the tobacco through thermal conduction.

2. The baked object according to claim 1, wherein the microwave absorbing agent is one of ceramic powder, an inorganic non-metal element, a ferrite absorbing agent, metal powder, or any combination thereof.

3. The baked object according to claim 2, wherein the ceramic powder comprises one of silicon carbide, silicon nitride, aluminum nitride, or any combination thereof;

   the inorganic non-metal element comprises one of coke, carbon powder, graphite powder, or any combination thereof; the ferrite absorbing agent comprises Fe_3O_4;
   the metal powder comprises one of Ti powder, Fe powder, Ni powder, or any combination thereof.

4. The baked object according to claim 1, wherein the microwave absorbing agent is uniformly distributed in the tobacco, and a particle size of the microwave absorbing agent ranges from 2 μm to 200 μm.

5. The baked object according to claim 1, wherein a volume ratio of the microwave absorbing agent to the tobacco ranges from 1% to 30%.

6. The baked object according to claim 1, wherein a thermal conductivity of the microwave absorbing agent is greater than a thermal conductivity of the tobacco.

7. The baked object according to any one of claims 1 to 6, wherein the baked object is a cigarette, and the cigarette comprises a tobacco portion, a filter portion, and a microwave filter membrane, the tobacco portion comprises the tobacco and the microwave absorbing agent, and the microwave filter membrane is disposed in the filter portion or between the filter portion and the tobacco portion.

8. The baked object according to claim 7, wherein the microwave filter membrane is a metal foil, the metal foil is provided with a first through hole, airflow is capable of circulating from the first through hole, the metal foil is configured to reflect microwaves to prevent microwave from leakage, and the first through hole is configured to intercept transmission of the microwaves.

9. A method for preparing the baked object according to any one of claims 1 to 6, comprising the following steps:

S110, crushing a raw material of the tobacco into a first component;
S120, adding an additive to the first component, uniformly mixing to obtain a second component, and adding powder of the microwave absorbing agent into the second component and uniformly mixing to obtain a third component; or adding the microwave absorbing agent and the additive to the first component and uniformly mixing to obtain a fourth component; and
S130, shaping the third component or the fourth component.

10. The method for preparing the baked object according to claim 9, wherein the additive in step S120 comprises one of an acidity regulator, a bulking agent, a humectant, a stabilization agent/coagulating agent, a thickening agent, a natural flavoring agent, or any combination thereof.

11. The method for preparing the baked object according to claim 9, wherein a manner for shaping the third component or the fourth component in step S130 comprises at least one of coating, die-casting, or thermoforming.

12. A microwave heating method for the baked object according to any one of claims 1 to 6, comprising the following steps:

S210, generating, by a microwave generator, microwaves to heat the baked object; and
S220, absorbing, by the tobacco and the microwave absorbing agent, the microwaves to generate heat, and reheating, by the microwave absorbing agent, the tobacco through thermal conduction.

13. The microwave heating method for the baked object according to claim 12, further comprising a temperature control step S230, detecting, by a temperature detection unit, a temperature of the baked object, and transmitting a result of the detection to a circuit control unit, the circuit control unit controls a heating temperature of the baked object by controlling a working power of the microwave generator.

14. The microwave heating method for the baked object according to claim 13, wherein a manner in which the temperature detection unit detects the temperature of the baked object in step S230 comprises at least one of thermocouple temperature measurement, optical pyrometer temperature measurement, or infrared optical fiber temperature measurement.

15. The microwave heating method for the baked object according to claim 13, wherein a manner in which the temperature detection unit detects the temperature of the baked object in step S230 comprises at least one of deriving a temperature of a cigarette according to a variation of a physical parameter of the cigarette or deriving a temperature of a cigarette according to a working power of the microwave generator.

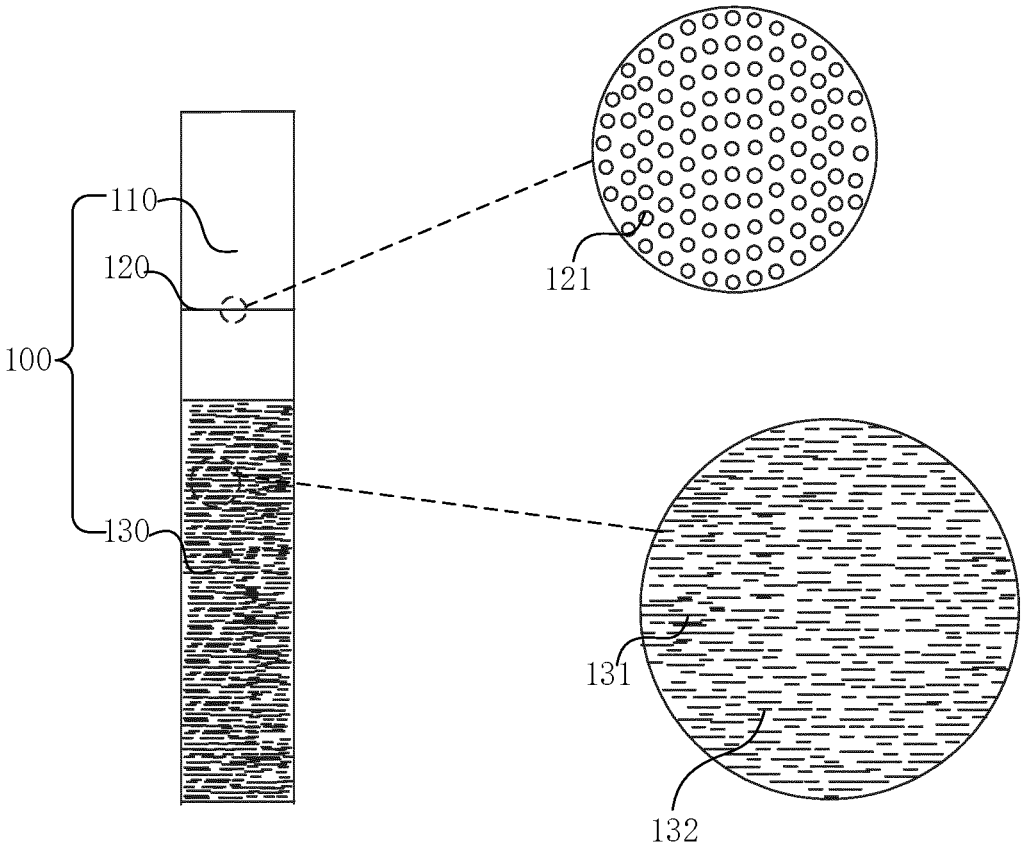

FIG. 1

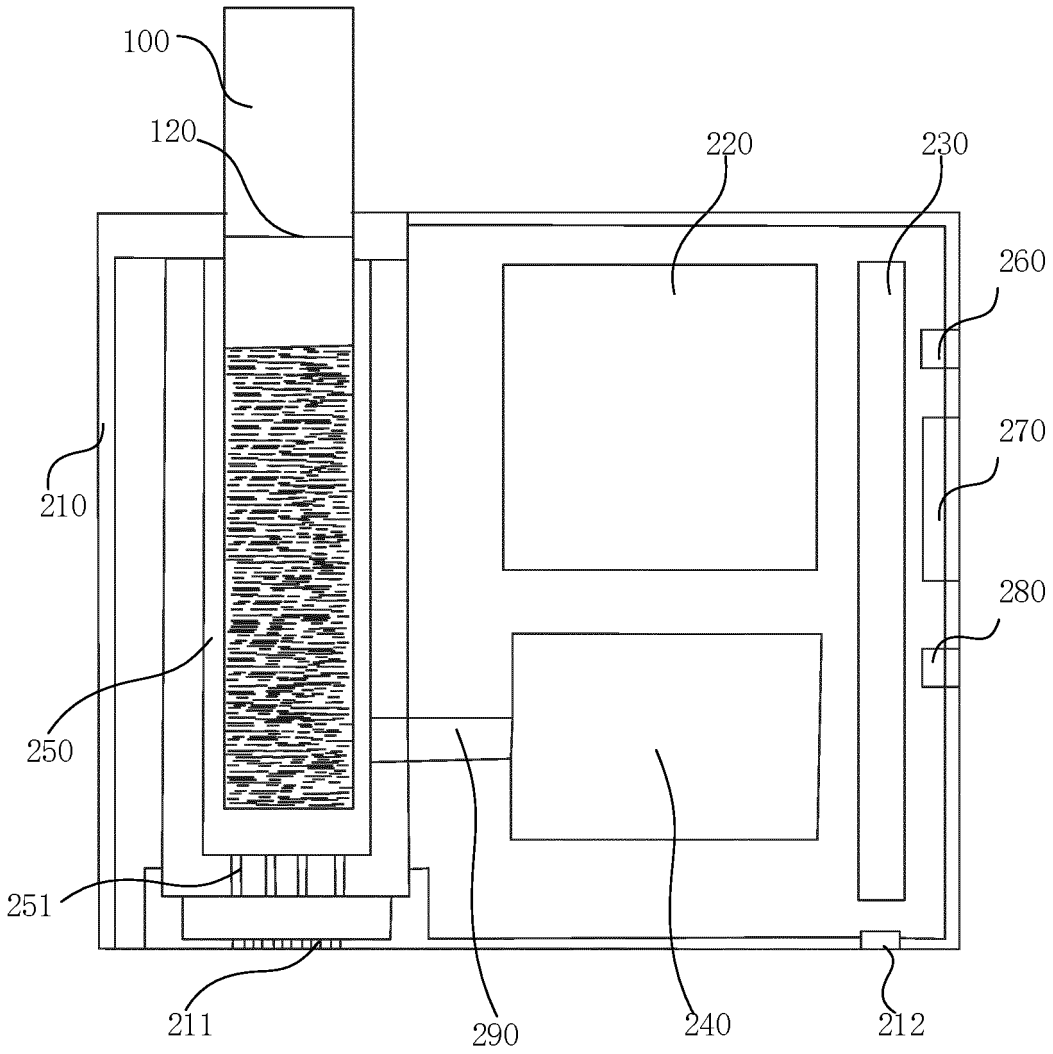

FIG. 2

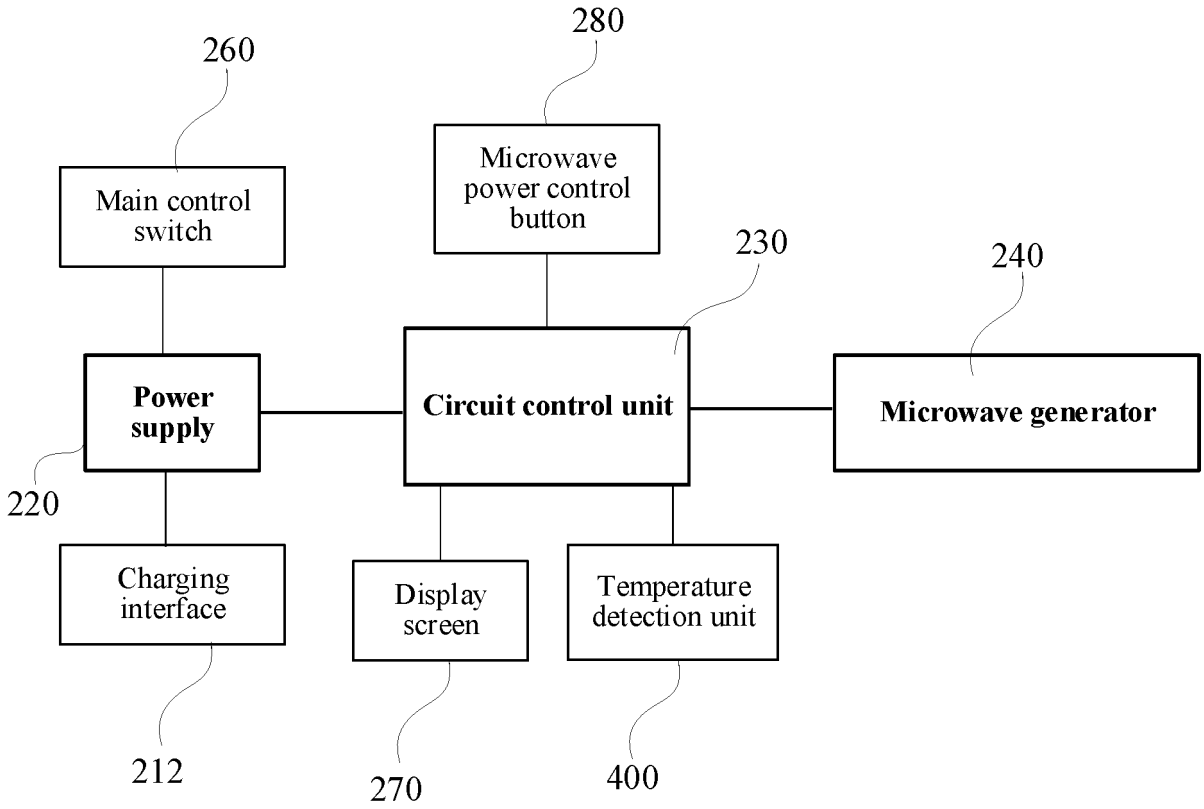
260
280
Main control switch
Microwave power control button
230
240
Power supply
Circuit control unit
Microwave generator
220
Charging interface
Display screen
Temperature detection unit
212
270
400

FIG. 3

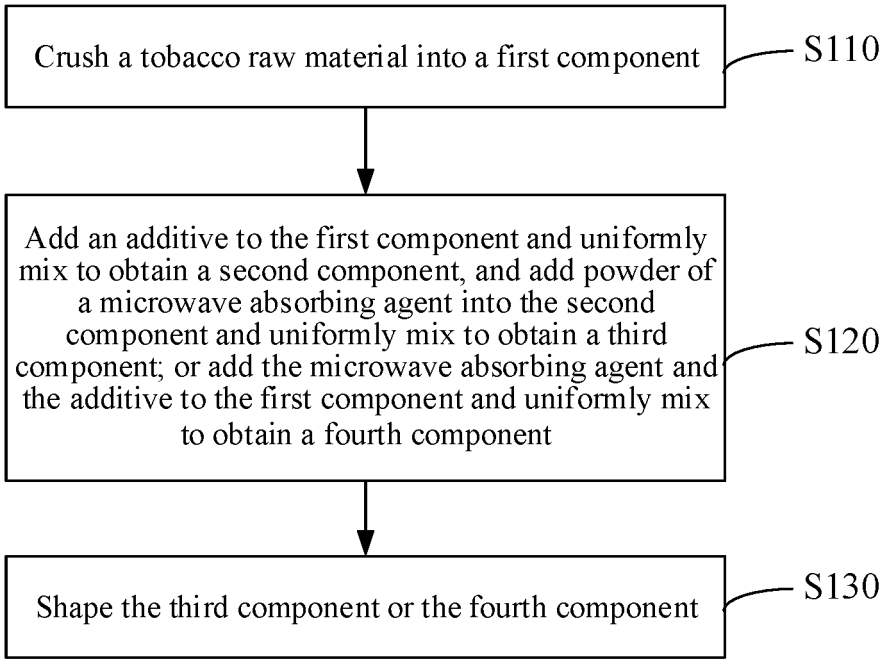
Crush a tobacco raw material into a first component
S110
Add an additive to the first component and uniformly mix to obtain a second component, and add powder of a microwave absorbing agent into the second component and uniformly mix to obtain a third component; or add the microwave absorbing agent and the additive to the first component and uniformly mix to obtain a fourth component
S120
Shape the third component or the fourth component
S130

FIG. 4

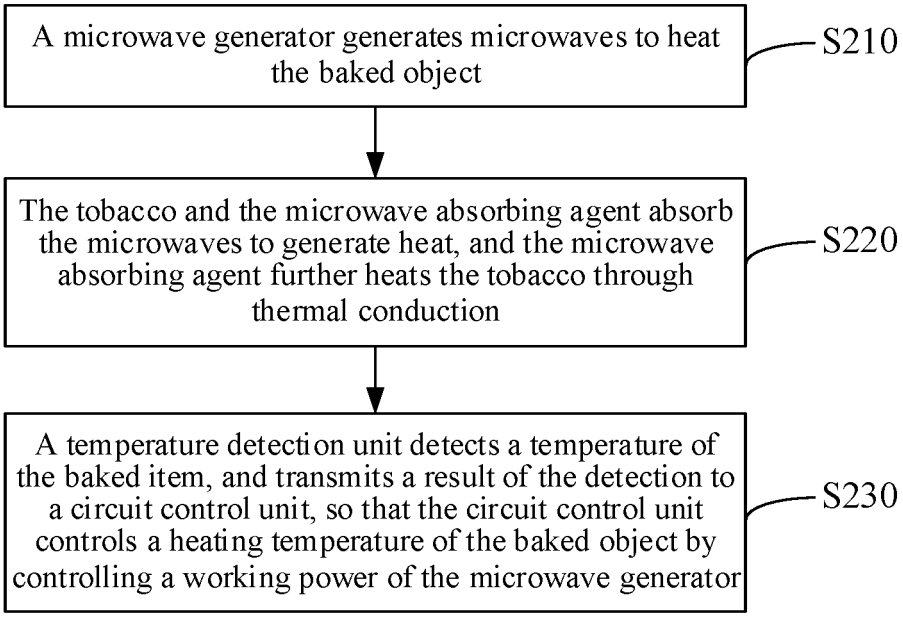
A microwave generator generates microwaves to heat the baked object
S210
The tobacco and the microwave absorbing agent absorb the microwaves to generate heat, and the microwave absorbing agent further heats the tobacco through thermal conduction
S220
A temperature detection unit detects a temperature of the baked item, and transmits a result of the detection to a circuit control unit, so that the circuit control unit controls a heating temperature of the baked object by controlling a working power of the microwave generator
S230

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2020/114540

A. CLASSIFICATION OF SUBJECT MATTER

A24B 3/10(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A24B+

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; CNTXT; SIPOABS: cigarette, absorb+, microwave, tobacco, smoking, 微波吸收, 剂, 介质, 烘烤, 材料, 烟, 卷烟, 烟芯, 烟草

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 1659985 A (JIANGJUN TOBACCO GROUP CO., LTD.) 31 August 2005 (2005-08-31) description, embodiments	1-15
A	CN 102178347 A (YUNNAN RESEARCH INSTITUTE OF TOBACCO SCIENCE) 14 September 2011 (2011-09-14) entire document	1-15
A	CN 102189580 A (LUO, Yi) 21 September 2011 (2011-09-21) entire document	1-15
A	CN 1796483 A (YU, Yizhe et al.) 05 July 2006 (2006-07-05) entire document	1-15
A	CN 108077990 A (HONGYUN HONGHE TOBACCO GROUP CO., LTD.) 29 May 2018 (2018-05-29) entire document	1-15
A	US 2002174874 A1 (REGENT COURT TECHNOLOGIES) 28 November 2002 (2002-11-28) entire document	1-15

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

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"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
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"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	Date of mailing of the international search report
20 October 2020	**04 November 2020**
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**	Authorized officer
Facsimile No. **(86-10)62019451**	Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2020/114540

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 1659985 A	31 August 2005	None	
CN 102178347 A	14 September 2011	None	
CN 102189580 A	21 September 2011	CN 102189580 B	08 May 2013
CN 1796483 A	05 July 2006	None	
CN 108077990 A	29 May 2018	None	
US 2002174874 A1	28 November 2002	US 6425401 B1	30 July 2002
		US 6202649 B1	20 March 2001
		US 2005109357 A1	26 May 2005

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