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(54) **SMOKING ARTICLES COMPRISING INNER WRAPPING STRIPS**

RAUCHARTIKEL MIT INNENUMHÜLLUNGSTREIFEN

ARTICLES À FUMER COMPRENANT DES BANDES ENVELOPPANTES INTERNES

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to tobacco products, such as smoking articles, and in particular, to cigarettes.

BACKGROUND OF THE INVENTION

[0002] Popular smoking articles, such as cigarettes, have a substantially cylindrical rod shaped structure and include a charge, roll or column of smokable material, such as shredded tobacco (e.g., in cut filler form), surrounded by a paper wrapper, thereby forming a so-called "smokable rod" or "tobacco rod." Normally, a cigarette has a cylindrical filter element aligned in an end-to-end relationship with the tobacco rod. Typically, a filter element comprises plasticized cellulose acetate tow circumscribed by a paper material known as "plug wrap," and is attached to one end of the tobacco rod using a circumscribing wrapping material known as "tipping paper." It also has become desirable to perforate the tipping material and plug wrap, in order to provide dilution of drawn mainstream smoke with ambient air. Descriptions of cigarettes and the various components thereof are set forth in Tobacco Production, Chemistry and Technology, Davis et al. (Eds.) (1999). A cigarette is employed by a smoker by lighting one end thereof and burning the tobacco rod. The smoker then receives mainstream smoke into his/her mouth by drawing on the opposite end (e.g., the filter end) of the cigarette.

[0003] Numerous references propose various types of cigarettes possessing various types of paper wrapping materials. See, for example, U.S. Patent Nos. 1,909,924 to Schweitzer; 4,489,650 to Weinert; 3,030,963 to Cohn; 4,146,040 to Cohn; 4,489,738 to Simon; 4,615,345 to Durocher; 4,607,647 to Dashley; 5,060,675 to Milford et al.; 4,924,888 to Perfetti et al.; 5,143,098 to Rogers et al.; 4,998,543 to Goodman; 5,220,930 to Gentry; and 5,271,419 to Arzonico et al. Some paper wrapping materials are so-called "banded papers" and possess segments defined by the composition, location and properties of the various materials within those wrapping materials. Numerous references contain disclosures suggesting various banded wrapping material configurations. See, for example, U.S. Patent Nos. 1,996,002 to Seaman; 2,013,508 to Seaman; 4,452,259 to Norman et al.; 5,417,228 to Baldwin et al.; 5,878,753 to Peterson et al.; 5,878,754 to Peterson et al.; and 6,198,537 to Bokelman et al.; and PCT WO 02/37991. Methods for manufacturing banded-type wrapping materials also have been proposed. See, for example, U.S. Patent Nos. 4,739,775 to Hampl, Jr.; 5,474,095 to Allen et al.; and PCT WO 02/44700 and PCT WO 02/055294. Some references further describe banded papers having segments of paper, fibrous cellulosic material or particulate material adhered to a paper web. See, for example, U.S. Patent Nos. 5,191,906 to Myracle, Jr.; 5,263,999 to Baldwin et al.; 5,417,228 to Baldwin et al.; 5,450,863 to Collins et al.; and 6,502,613 to Suzuki. See also U.S. Patent No. 6,609,999 to Crooks et al.

[0004] Reconstituted tobacco materials have been used as a wrapping material, particularly as an inner wrapping material (e.g., in regions that are overwrapped with at least one further layer of wrapping material), and representative reconstituted tobacco materials useful as wrapping materials for smokable rods are set forth in U.S. Patent Nos. 5,074,321 to Gentry et al.; 5,159,944 to Arzonico et al.; 5,261,425 to Raker; 5,462,073 to Bowen; and 5,699,812 to Bowen

[0005] Reconstituted tobacco sheets, particularly cast reconstituted tobacco sheets, have been proposed for use as a discontinuous inner wrapper for a cigarette as a means for modifying the burn rate of the cigarette. Such sheet materials, smoking articles made therefrom, and methods of forming such sheet materials are described in U.S. Patent Nos. 6,705,325 to Hicks et al.; 6,827,087 to Wanna et al.; and U.S. Patent Application Publication Nos. 2004/0177856 to Monsalud, Jr. et al. and 2005/0056294 to Wanna et al., or WO 2005/096850.

[0006] It would be desirable to provide a cigarette manufacturer with a manner or method to produce a cigarette that possesses controlled burn characteristics resulting from alterations to the wrapping material of the tobacco rod of that cigarette.

SUMMARY OF THE INVENTION

[0007] The present invention provides a cigarette or other smoking article comprising one or more inner wrapping strips positioned between a tobacco rod and the outer wrapping material circumscribing the tobacco rod. The inner wrapping strips extend longitudinally along the tobacco rod and contribute to greater control of the burn characteristics of the smoking article. The inner wrapping strips comprise a binder in the form of an alkali metal salt, such as a sodium salt (e.g., sodium alginate or sodium carboxymethyl cellulose). Further, the inner wrapping strips of the invention comprise a total alkali metal content of at least about 30,000 $\mu\text{g/g}$, based on the total weight of the inner wrapping strips. More preferably, the total alkali metal content is at least about 32,000 $\mu\text{g/g}$, and most preferably at least about 34,000 or at least about 36,000 $\mu\text{g/g}$. It is believed that increases in alkali metal content of the inner wrapping strips correlate to higher self-extinction rates.

[0008] The binder present in the inner wrapping materials may vary in concentration, but is typically present in an amount of about 2 to about 40 weight percent, based on the total weight of the inner wrapping strips. In certain preferred

embodiments, the alkali metal salt binder is present in the amount of about 30 to about 40 weight percent.

[0009] According to the invention, the inner wrapping strips further comprise a second alkali metal additive, such as a second additive increasing the sodium content or other alkali metal content. Exemplary alkali metal additives include sodium phosphate, sodium hydroxide, potassium hydroxide, sodium carbonate, sodium acetate, sodium oxalate, sodium malate, sodium chloride, and sodium levinulate.

[0010] The smoking articles of the invention preferably exhibit a minimum ignition temperature, such as an ignition temperature of at least about 625°C. In particularly preferred embodiments, the ignition temperature of the inner wrapping strips is at least about 650°C or at least about 675°C. It is believed that higher ignition temperatures correlate to improved ability to meet certain cigarette extinction criteria.

[0011] The smoking articles of the invention may comprise one or more wrapping strip, and preferably comprise a plurality of inner wrapping strips, each strip having a width of about 2 to about 10 mm, more preferably a width of about 2 to about 6 mm. In certain embodiments, the number of inner wrapping strips can be in the range of 1 to about 8, more preferably 2 to about 5.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] In order to assist the understanding of embodiments of the invention, reference will now be made to the appended drawings, which are not necessarily drawn to scale. The drawings are exemplary only, and should not be construed as limiting the invention.

Fig. 1 is an exploded perspective view of a smoking article having the form of a cigarette, showing the smokable material, the outer wrapping material components, and the filter element of the cigarette;

Fig. 2 is a perspective view of a smoking article having a the form of a cigarette, wherein the smoking article includes at least one inner wrapping strip according to the invention;

Fig. 3 is a cross-sectional view of the cigarette of Fig. 2 taken along line A-A, the cross-section illustrating the presence of two inner wrapping strips according to the invention; and

Fig. 4 is a perspective view of an outer wrapping material adapted for circumscribing a tobacco rod and a plurality of inner wrapping strips placed thereon prior to application of the wrapping material to a tobacco rod.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] The present inventions now will be described more fully hereinafter with reference to the accompanying drawing. The invention may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like numbers refer to like elements throughout. As used in this specification and the claims, the singular forms "a," "an," and "the" include plural referents unless the context clearly dictates otherwise.

[0014] Referring to Fig. 1, there is shown a smoking article 10 in the form of a cigarette and possessing certain representative components of a smoking article of the present invention. The cigarette 10 includes a generally cylindrical rod 12 of a charge or roll of smokable filler material contained in a circumscribing wrapping material 16. The rod 12 is conventionally referred to as a "tobacco rod." The ends of the tobacco rod 12 are open to expose the smokable filler material. The cigarette 10 is shown as having one optional band 22 (e.g., a printed coating including a film-forming agent, such as starch, ethylcellulose, or sodium alginate) applied to the wrapping material 16, and that band circumscribes the cigarette rod in a direction transverse to the longitudinal axis of the cigarette. That is, the band 22 provides a cross-directional region relative to the longitudinal axis of the cigarette. The band 22 can be printed on the inner surface of the wrapping material (i.e., facing the smokable filler material), or less preferably, on the outer surface of the wrapping material. Although the cigarette can possess a wrapping material having one optional band, the cigarette also can possess wrapping material having further optional spaced bands numbering two, three, or more.

[0015] At one end of the tobacco rod 12 is the lighting end 18, and at the other end is positioned a filter element 20. The filter element 20 is positioned adjacent to one end of the tobacco rod 12 such that the filter element and tobacco rod are axially aligned in an end-to-end relationship, preferably abutting one another. Filter element 20 may have a generally cylindrical shape, and the diameter thereof may be essentially equal to the diameter of the tobacco rod. The ends of the filter element 20 permit the passage of air and smoke therethrough.

[0016] During use, the smoker lights the lighting end 18 of the cigarette 10 using a match or cigarette lighter. As such, the tobacco rod 12 begins to burn. The mouth end of the cigarette 10 is placed in the lips of the smoker. Thermal decomposition products (e.g., components of tobacco smoke) generated by the burning smokable material are drawn through the cigarette 10, through the filter element 26, and into the mouth of the smoker.

[0017] The filter element 20 comprises a filter material 26 circumscribed along its outer circumference or longitudinal periphery by a layer of outer plug wrap 28. The filter element 20 may comprise one or more filter segments and may

comprise adsorbent materials therein. The production of filter rods, filter segments and filter elements, and the manufacture of cigarettes from those filter rods, filter segments and filter elements can be carried out using the types of rod-forming units that have been employed to provide cigarette filters, multi-segment cigarette filters and filtered cigarettes. Multi-segment cigarette filter rods can be manufactured using a cigarette filter rod making device available under the brand name Mulfi from Hauni-Werke Korber & Co. KG of Hamburg, Germany. Other representative types of commercially available filter rod making equipment that can suitably modified for use include the KDF-2 unit available from Hauni-Werke Korber & Co. KG and the Decoufle unit available from Decoufle of France.

[0018] A ventilated or air diluted smoking article can be provided with an optional air dilution means, such as a series of perforations 30, each of which extend through the plug wrap 28. The optional perforations 30 can be made by various techniques known to those of ordinary skill in the art, such as laser perforation techniques. Alternatively, so-called off-line air dilution techniques can be used (e.g., through the use of porous paper plug wrap and pre-perforated tipping paper).

[0019] The dimensions of a representative cigarette 10 can vary. Preferred cigarettes are rod shaped, and can have diameters of about 7.5 mm (e.g., circumferences of about 20 mm to about 27 mm, often about 22.5 mm to about 25 mm); and can have total lengths of about 70 mm to about 120 mm, often about 80 mm to about 100 mm. The length of the filter element 20 can vary. Typical filter elements can have lengths of about 15 mm to about 40 mm, often about 20 mm to about 35 mm.

[0020] In the present invention, the cigarette 10 further includes one or more inner wrapping strips 34 between the tobacco rod and the outer wrapping paper 16, as shown in Fig. 2. The inner wrapping strips 34 preferably extend along the entire length of the tobacco rod. The inner wrapping strip or strips 34 in the cigarette 10 of the invention can extend continuously around the entire circumference of the tobacco rod. However, it is preferable for the inner wrapping strips 34 to be discontinuous. In one embodiment, the inner wrapping strips 34 comprise 1 to about 8 strips spaced along the periphery of the tobacco rod. The exact location of the individual wrapping strips 34 may vary, but is preferable to space one or more of the inner wrapping strips away from the seam 38 of the cigarette, as shown in Fig. 2.

[0021] A cross-sectional view of Fig. 2 is shown in Fig. 3, where two inner wrapping strips 34 are visible between the tobacco rod 12 and the outer wrapping 16. Fig. 4 illustrates one embodiment of the invention wherein four inner wrapping strips (designated 34a, 34b, 34c, and 34d) are utilized. As shown in Fig. 4, prior to placing the outer wrapper 16 around the tobacco rod 12, the inner wrapping strips can be placed at spaced intervals on a surface of the outer wrapper. The use of inner wrapping strips 34 can be incorporated into the cigarette manufacturing process using equipment and methods described, for example, in U.S. Pat. No. 6,705,325 to Hicks et al.

[0022] The inner wrapping strips 34 are preferably constructed of a reconstituted tobacco sheet material formed using any of various reconstituted tobacco processes known in the art, such as paper-making processes and cast sheet processes. Preferred embodiments of the inner wrapping strips comprise a binder material, a tobacco material, wood pulp, glycerin, and water. In particular, the preferred embodiments of the inner wrapping strips 34 comprise about 2 to about 40 percent binder, based on the total weight of the inner wrapping strips, about 25 to about 65 percent tobacco material (e.g., tobacco scraps or dust), about 10 to about 15 percent wood pulp, about 13 to about 17 percent glycerin, and the balance water. If a cast sheet method of production is used, the binder content will typically be about 10 to about 40 weight percent, more preferably about 30 to about 40 weight percent. If a paper-making process is utilized, the binder content could be as low as about 2 to about 5 weight percent.

[0023] Preferably, the reconstituted sheet material used as the inner wrapping material is constructed using a cast sheet process, such as the process described in U.S. Patent Application Publication No. 2004/0177856 Monsalud, Jr. et al. The process generally involves forming a mixture having the composition described above and optionally subjecting the mixture to a heat treatment process, such as by heating the mixture to a temperature of about 140°F (60°C) to about 200°F (93°C) for a period of time of about 30 min. to about 60 min. The heating step may further include an addition of about 1.5 to about 3.5 weight percent potassium hydroxide, based on the weight of the tobacco material, which can facilitate the release of pectin from the tobacco material. The release of pectin can be desirable because pectin helps to maintain adequate cohesiveness within the cast sheet material. Following the optional heating step and treatment with potassium hydroxide, the reconstituted sheet mixture is cast on a steel belt and dried to a desired moisture level, such as about 8 to about 16% moisture. Thereafter, the dried cohesive sheet material can be captured on a roll and cut into desired widths.

[0024] The width of the inner wrapping strips 34 used in the invention can vary. Typically, the width of each strip will be between about 2 and about 10 mm, more preferably between about 2 and about 6 mm. The overall thickness of the inner wrapping materials may vary, but the inner wrapping strips are typically thicker than the outer wrapper 16. Exemplary thicknesses range from about 80 to about 120 μm .

[0025] The inner wrapping strips 34 of the invention are characterized by the use of a binder in the form of an alkali metal salt, such as an alkali metal salt of alginate or a cellulose derivative (e.g., carboxymethyl cellulose). Examples of alkali metal salt binder materials include sodium alginate, potassium alginate, sodium carboxymethyl cellulose and mixtures thereof. The term "alkali metal" is used herein to refer to metallic elements of Group IA of the Periodic Table of the Elements, including lithium, sodium, potassium, rubidium, cesium, and francium.

[0026] The use of the alkali metal salt binder contributes to a desired total level of alkali metal in the inner wrapping strips 34. It is believed that elevated alkali metal content is desirable in the inner wrapping strips 34 in order to achieve desirable self-extinction rates according to certain test criteria in smoking articles incorporating the strips. As indicated by the examples described below, as alkali metal content of the inner wrapping strips 34 increase, self-extinction rates according to certain test criteria also increase. Embodiments of the inner wrapping strips 34 of the present invention exhibit a total alkali metal content of at least about 30,000 $\mu\text{g/g}$, more preferably at least about 32,000, most preferably at least about 34,000 or at least about 36,000 $\mu\text{g/g}$, based on the total weight of the inner wrapping strips. Expressed in terms of weight percentage based on total weight of the inner wrapping strips, preferred embodiments contain a total alkali metal content of at least about 3 percent, more preferably at least about 3.2 percent, most preferably at least about 3.4 or at least about 3.6 weight percent. In one preferred embodiment, the total alkali metal content is about 30,000 to about 50,000 $\mu\text{g/g}$ (about 3 to about 5 weight percent), more preferably about 32,000 to about 40,000 $\mu\text{g/g}$ (about 3.2 to about 4 weight percent).

[0027] The desired total alkali metal content of the inner wrapping strips 34 can be reached using the alkali metal salt binder alone, but in certain embodiments, the alkali metal salt binder is supplemented with one or more alkali metal additives that also contribute alkali metal content to the inner wrapping strips. Exemplary additives include sodium phosphate, sodium hydroxide, potassium hydroxide, sodium carbonate, sodium acetate, sodium oxalate, sodium malate, sodium chloride, and sodium levinulate. The exact amount of secondary alkali metal additives added to the inner wrapping strips will vary depending on the amount of alkali metal salt binder that is present and the desired total alkali metal content. In one embodiment, the secondary alkali metal additive is present at a concentration of about 1 to about 20 weight percent, more preferably about 1 to about 10 weight percent, based on the total weight of the strips 34.

[0028] The inner wrapping strips 34 of the invention preferably exhibit a high ignition temperature, which is believed to correlate favorably to high self-extinction rates as measured using certain test criteria described below. In the preferred embodiments, the inner wrapping strips 34 of the invention exhibit an ignition temperature of at least about 625°C, more preferably at least about 650°C, and most preferably at least about 675°C. The examples appended to this application show that inner wrapping materials 34 having higher ignition temperatures also exhibit higher self-extinction rates according to certain test criteria.

[0029] The overall density of the inner wrapping strips 34 may vary, but typically the basis weight of the inner wrapping strip is between about 70 to about 125 g/m^2 , and preferably about 80 to about 100 g/m^2 . The resulting porosity of the inner wrapping strips 34 is typically less than about 10 Coresta, more preferably less than about 8 Coresta, and most preferably less than about 5 Coresta. The porosity of the inner wrapping strips 34 is preferably very low, and most preferably, the inner wrapping strips exhibit essentially no gas transport properties (i.e., a diffusion capacity of essentially zero).

[0030] Inner wrapping materials, smoking articles made therewith, and methods of their manufacture described generally in the following references may find use in certain embodiments of the present invention: U.S. Patent Nos. 6,705,325 to Hicks et al.; 6,827,087 to Wanna et al.; and U.S. Patent Application Publication No. 2005/0056294 to Wanna et al.

[0031] Certain preferred inner wrapping strips 34 used in carrying out the present invention are useful for the manufacture of cigarettes designed to exhibit reduced ignition propensity. That is, cigarettes incorporating certain inner wrapping materials, when placed on a flammable substrate, tend to self extinguish before burning that substrate. Of particular interest are those cigarettes possessing tobacco rods manufactured using an appropriate number and configuration of inner wrapping strips 34, having sufficient sodium or other alkali metal content, so as to have the ability to meet certain cigarette extinction criteria. Certain cigarettes of the present invention possessing tobacco rods manufactured using inner wrapping strips 34 of the present invention, when tested using the methodology set forth in ASTM E 2187-02b, *Standard Method for Measuring the Ignition Strength of Cigarettes* (ASTM Int. 2002), using 10 layers of Whatman No. 2 filter paper, meet criteria requiring extinction of greater than about 50 percent, preferably greater than about 75 percent, more preferably greater than about 80 percent, most preferably greater than about 85 percent, and in some cases, greater than about 90 or about 95 percent or even about 100 percent, of cigarettes tested. This percentage is also referred to herein as the "self-extinction rate."

[0032] Smokable materials and other associated materials useful for carrying out certain aspects of the present invention can vary. Smokable materials are materials that can be incorporated into the smokable segment or rod, and provide mass and bulk to some region within that smokable segment. Smokable materials undergo some type of destruction during conditions of normal use of the smoking article into which they are incorporated. Destruction of the smokable material, due at least in part to thermal decomposition of at least some component of that smokable material, results in the formation of an aerosol having the form normally characterized as "smoke." For example, smokable materials incorporating tobacco materials are intended to burn, or otherwise undergo thermal decomposition, to yield tobacco smoke. The selection of tobacco types and tobacco blends can determine the chemical composition of, and the sensory and organoleptic characteristics of, that aerosol produced when that tobacco material or blend of tobacco materials is burned. The tobacco materials described below can be used in the tobacco rod 12 portion of the smoking articles of the invention, or as the tobacco portion of the reconstituted sheet materials used to form the inner wrapping

strips 34.

[0033] It is most highly preferred that smokable materials of the smokable segment incorporate tobacco of some form. Preferred smokable materials are composed predominantly of tobacco of some form, based on the dry weights of those materials. That is, the majority of the dry weight of those materials, and the majority of the weight of a mixture incorporating those materials (including a blend of materials, or materials having additives applied thereto or otherwise incorporated therein) can be provided by tobacco of some form. For example, those materials can be processed tobaccos that incorporate minor amounts non-tobacco filler materials (e.g., calcium carbonate particles, carbonaceous materials, grains or wood pulp) and/or binding agents (e.g., guar gum, sodium alginate or ammonium alginate); and/or a blend of those materials can incorporate tobacco substitutes or extenders. Those materials, and blends incorporating those materials, frequently are composed of greater than about 70 percent tobacco, often are greater than about 80 percent tobacco, and generally are greater than about 90 percent tobacco, on a dry weight basis, based on the combined weights of the tobacco, non-tobacco filler material, and non-tobacco substitute or extender. Those materials also can be composed of virtually all tobacco material, and not incorporate any non-tobacco fillers, substitutes or extenders.

[0034] The smokable material can be treated with tobacco additives of the type that are traditionally used for the manufacture of cigarettes, such as casing and/or top dressing components. See, for example, U.S. Patent Nos. 3,419,015 to Wochnowski; 4,054,145 to Berndt et al.; 4,887,619 to Burcham, Jr. et al.; 5,022,416 to Watson; 5,103,842 to Strang et al.; and 5,711,320 to Martin. Typical casing materials include water, sugars and syrups (e.g., sucrose, glucose and high fructose corn syrup), humectants (e.g. glycerin or propylene glycol), and flavoring agents (e.g., cocoa and licorice). Those added components also include top dressing materials (e.g., flavoring materials, such as menthol). See, for example, U.S. Patent No. 4,449,541 to Mays et al. Additives also can be added to the smokable materials using the types of equipment described in U.S. Patent No. 4,995,405 to Lettau, or that are available as Menthol Application System MAS from Kohli Maschinenbau GmbH. The selection of particular casing and top dressing components is dependent upon factors such as the sensory characteristics that are desired, and the selection and use of those components will be readily apparent to those skilled in the art of cigarette design and manufacture. See, Gutcho, Tobacco Flavoring Substances and Methods, Noyes Data Corp. (1972) and Leffingwell et al., Tobacco Flavoring for Smoking Products (1972).

[0035] Smokable materials typically are used in forms, and in manners, that are traditional for the manufacture of smoking articles, such as cigarettes. Those materials can incorporate shredded or particulate pieces of tobacco (e.g., as lamina and/or stem), and/or those materials can be tobacco materials that are in processed forms. For example, those materials normally are used in cut filler form (e.g., shreds or strands of tobacco filler cut into widths of about 1/10 inch to about 1/60 inch, preferably about 1/20 inch to about 1/35 inch, and in lengths of about 1/8 inch to about 3 inches, usually about 1/4 inch to about 1 inch). Alternatively, though less preferred, those materials, such as processed tobacco materials, can be employed as longitudinally extending strands or as sheets formed into the desired configuration, or as compressed or extruded pieces formed into a desired shape.

[0036] Tobacco materials can include, or can be derived from, various types of tobaccos, such as flue-cured tobacco, burley tobacco, Oriental tobacco or Maryland tobacco, dark tobacco, dark-fired tobacco and *Rustica* tobaccos, as well as other rare or specialty tobaccos, or blends thereof. Descriptions of various types of tobaccos, growing practices, harvesting practices and curing practices are set for in Tobacco Production, Chemistry and Technology, Davis et al. (Eds.) (1999). See, also, U.S. Pat. Application Publication No. 2004/0084056 to Lawson et al. Most preferably, the tobacco materials are those that have been appropriately cured and aged.

[0037] Typically, tobacco materials are used in a so-called "blended" form. For example, certain popular tobacco blends, commonly referred to as "American blends," comprise mixtures of flue-cured tobacco, burley tobacco and Oriental tobacco. Such blends, in many cases, contain tobacco materials that have processed forms, such as processed tobacco stems (e.g., cut-rolled stems, cut-rolled-expanded stems or cut-puffed stems), volume expanded tobacco (e.g., puffed tobacco, such as dry ice expanded tobacco (DIET), preferably in cut filler form). Tobacco materials also can have the form of reconstituted tobaccos (e.g., reconstituted tobaccos manufactured using paper-making type or cast sheet type processes). Tobacco reconstitution processes traditionally convert portions of tobacco that normally might be wasted into commercially useful forms. For example, tobacco stems, recyclable pieces of tobacco and tobacco dust can be used to manufacture processed reconstituted tobaccos of fairly uniform consistency. The precise amount of each type of tobacco within a tobacco blend used for the manufacture of a particular cigarette brand can vary, is a manner of design choice, depending upon factors such as the sensory characteristics desired. See, for example, Tobacco Encyclopedia, Voges (Ed.) p. 44-45 (1984), Browne, The Design of Cigarettes, 3rd Ed., p.43 (1990) and Tobacco Production, Chemistry and Technology, Davis et al. (Eds.) p. 346 (1999). Various representative tobacco types, processed types of tobaccos, types of tobacco blends, cigarette components and ingredients, and tobacco rod configurations, also are set forth in U.S. Patent Nos. 4,836,224 to Lawson et al.; 4,924,883 to Perfetti et al.; 4,924,888 to Perfetti et al.; 5,056,537 to Brown et al.; 5,159,942 to Brinkley et al.; 5,220,930 to Gentry; 5,360,023 to Blakley et al.; 5,714,844 to Young et al.; 6,730,832 to Dominguez et al.; and 6,701,936 to Shafer et al.; U.S. Patent Application Publication Nos. 2003/0075193 to Li et al.; 2003/0131859 to Li et al.; 2004/0084056 to Lawson et al.; 2004/0255965 to Perfetti et al.; 2005/0066984 to Crooks et

al.; and 2005/0066986 to Nestor et al.; PCT WO 02/37990 to Bereman; and Bombick et al., *Fund. Appl. Toxicol.*, 39, p. 11-17 (1997).

[0038] The outer wrapping material 16 of the tobacco rod 12 can have a wide range of compositions and properties. The selection of a particular wrapping material will be readily apparent to those skilled in the art of cigarette design and manufacture. Preferably, the outer wrapping material is a paper material, such as the type of paper material typically used in cigarette manufacture. The outer wrapping material can be composed of materials, or be suitably treated, in order that the wrapping material does not experience a visible staining as a result of contact with components of the smokable material (e.g., aerosol forming material). The porosity of the wrapping material can vary, and frequently is between about 5 CORESTA units and about 100 CORESTA units, often is between about 10 CORESTA units and about 90 CORESTA units, and frequently is between about 20 CORESTA units and about 80 CORESTA units. Exemplary types of wrapping materials, wrapping material components and treated wrapping materials are described in U.S. Patent Nos. 5,105,838 to White et al.; 5,271,419 to Arzonico et al.; 5,220,930 to Gentry; 6,874,508 to Shafer et al.; and 6,908,874 to Woodhead et al.; U.S. Pat. Application Publication Nos. 2004/0134631 to Crooks et al.; 2005/0005947 to Hampl, Jr. et al.; 2005/0005947 to Hampl, Jr. et al.; 2005/0016556 to Ashcraft et al.; and 2005/0076929 to Fitzgerald et al.; PCT WO 01/08514 to Fournier et al.; WO 03/043450 to Hajaligol et al.; and WO 2005/039326 to Rasouli et al.. Representative wrapping materials are commercially available as R. J. Reynolds Tobacco Company Grades 119, 170, 419, 453, 454, 456, 465, 466, 490, 525, 535, 557, 652, 664, 672, 676 and 680 from Schweitzer-Maudit International. Colored wrapping materials (e.g., brown colored papers) can be employed.

[0039] Both the outer wrapping material and the inner wrapping strips may comprise additives or fillers imbedded or dispersed therein. Exemplary fillers or additives are in the form of essentially water insoluble particles. The filler or additive materials may incorporate inorganic components. The fillers or additives may comprise catalysts or adsorbent materials capable of adsorbing or reacting with vapor phase components of mainstream smoke. Calcium salts are particularly preferred. One exemplary filler material has the form of calcium carbonate, and the calcium carbonate most preferably is used in particulate form. See, for example, U.S. Pat. No. 4,805,644 to Hampl; U.S. Pat. No. 5,161,551 to Sanders; and U.S. Pat. No. 5,263,500 to Baldwin et al.; and PCT WO 01/48,316. Other filler or additive materials include agglomerated calcium carbonate particles, calcium tartrate particles, magnesium oxide particles, iron oxide particles, magnesium hydroxide gels; magnesium carbonate-type materials, clays, diatomaceous earth materials, titanium dioxide particles, gamma alumina materials and calcium sulfate particles. The filler can be selected so as to impart certain beneficial characteristics to the wrapping material, such as modification of combustion properties or the ability to adjust the character and content of mainstream smoke (e.g., by adsorption of certain compounds).

[0040] The configuration and content of the filter element 20 can vary. Representative filter elements can incorporate the types of filter element components, designs and formats set forth in Browne, *The Design of Cigarettes*, 3rd Ed. (1990); Tobacco Production, Chemistry and Technology, Davis et al. (Eds.) 1999; US Pat. Nos. 4,508,525 to Berger; 4,807,809 to Pryor et al.; 4,903,714 to Barnes et al.; 4,920,990 to Lawrence et al.; 5,012,829 to Thesing et al.; 5,025,814 to Raker; 5,074,320 to Jones, Jr. et al.; 5,076,295 to Saintsing et al.; 5,101,839 to Jakob et al.; 5,105,834 to Saintsing et al.; 5,105,838 to White et al.; 5,271,419 to Arzonico et al.; 5,137,034 to Perfetti et al.; 5,396,909 to Gentry et al.; 5,595,218 to Koller et al.; 5,718,250 to Banerjee et al.; 6,530,377 to Lesser et al.; 6,615,842 to Cerami et al.; 6,631,722 to MacAdam et al.; 6,792,953 to Lesser et al.; and 6,848,450 to Lilly, Jr. et al.; U.S. Patent Application Publication Nos. 2004/0261807 to Dube et al.; and 2005/0133052 to Fournier et al.; and U.S. Pat. Application Serial No. 10/901,662, filed July 29, 2004, to Gonterman et al. Representative filter materials can be manufactured from tow materials (e.g., cellulose acetate or polypropylene tow) or gathered web materials (e.g., gathered webs of paper, reconstituted tobacco, cellulose acetate, polypropylene or polyester).

[0041] The plug wrap 28 can vary. See, for example, U.S. Patent No. 4,174,719 to Martin. Typically, the plug wrap is a porous or non-porous paper material. Plug wrap materials are commercially available. Exemplary porous plug wrap papers are available from Schweitzer-Maudit International as Porowrap Plug Wrap 17-M1, 33-M1, 45-M1, 65-M9, 95-M9, 150-M4, 260-M4 and 260-M4T. Non-porous plug wraps exhibit porosities of less than about 10 CORESTA units, and preferably less than about 5 CORESTA units. Exemplary non-porous plug wrap papers are available as Ref. No. 646 Grade from Olsany Facility (OP Paprina) of the Czech Republic (Trierenberg Holding). Plug wrap paper can be coated, particularly on the surface that faces the filter material, with a layer of a film-forming material. Such a coating can be provided using a suitable polymeric film-forming agent (e.g., ethylcellulose, ethylcellulose mixed with calcium carbonate, or a so-called lip release coating composition of the type commonly employed for cigarette manufacture). Alternatively, a plastic film (e.g., a polypropylene film) can be used as a plug wrap material. For example, non-porous polypropylene materials that are available as ZNA-20 and ZNA-25 from Treofan Germany GmbH & Co. KG can be employed as plug wrap materials.

[0042] For cigarettes of the present invention that are air diluted or ventilated, the amount or degree of air dilution or ventilation can vary. Frequently, the amount of air dilution for an air diluted cigarette is greater than about 10 percent, generally is greater than about 20 percent, often is greater than about 30 percent, and sometimes is greater than about 40 percent. Typically, the upper level for air dilution for an air diluted cigarette is less than about 80 percent, and often

is less than about 70 percent. As used herein, the term "air dilution" is the ratio (expressed as a percentage) of the volume of air drawn through the air dilution means to the total volume and air and aerosol drawn through the cigarette and exiting the extreme mouth end portion of the cigarette. Higher air dilution levels can act to reduce the transfer efficiency of aerosol forming material into mainstream aerosol.

[0043] Preferred cigarettes of the present invention exhibit desirable resistance to draw. For example, an exemplary cigarette exhibits a pressure drop of between about 50 and about 200 mm water pressure drop at 17.5 cc/sec. air flow. Preferred cigarettes exhibit pressure drop values of between about 60 mm and about 180, more preferably between about 70 mm to about 150 mm, water pressure drop at 17.5 cc/sec. air flow. Typically, pressure drop values of cigarettes are measured using a Filtrona Cigarette Test Station (CTS Series) available from Filtrona Instruments and Automation Ltd. or a Quality Test Module (QTM) available from the Cerulean Division of Molins, PLC.

[0044] Cigarettes of the present invention, when smoked, yield an acceptable number of puffs. Such cigarettes normally provide more than about 6 puffs, and generally more than about 8 puffs, per cigarette, when machine smoked under FTC smoking conditions. Such cigarettes normally provide less than about 15 puffs, and generally less than about 12 puffs, per cigarette, when smoked under FTC smoking conditions. FTC smoking conditions consist of 35 ml puffs of 2 second duration separated by 58 seconds of smolder.

[0045] Cigarettes of the present invention, when smoked, yield mainstream aerosol. The amount of mainstream aerosol that is yielded per cigarette can vary. When smoked under FTC smoking conditions, an exemplary cigarette yields an amount of FTC "tar" that normally is at least about 1 mg, often is at least about 3 mg, and frequently is at least about 5 mg. When smoked under FTC smoking conditions, an exemplary cigarette yields an amount of FTC "tar" that normally does not exceed about 20 mg, often does not exceed about 15 mg, and frequently does not exceed about 12 mg.

EXPERIMENTAL

[0046] The following example is provided to illustrate embodiments of the present invention, and should not be considered to limit the scope thereof. Unless otherwise noted, all parts and percentages are by weight. In Example 3, coal temperatures of various cigarettes are measured. Coal temperature of smoking articles are discussed in the art, such as in U.S. Patent Application Publication No. 2005/0066986 to Nestor et al.; The Chemistry of Tobacco and Tobacco Smoke, Schmeltz (ed.) (1972); Baker, Prog. Ener. Combust. Sci., 7: 135-153 (1981); Proceedings of the International Conference on the Physical and Chemical Processes Occurring in a Burning Cigarette (Apr. 26-29, 1987); Tobacco Production, Chemistry and Technology, Davis et al. (Eds.) p. 398-439 (1999); and Lyman et al., Beitr. Tabakforsch. Int., 20: 381-388 (2003).

Example 1

[0047] Reconstituted tobacco cast sheet materials with target sodium alginate content ranging from 15% to 35% are made. Cigarettes are made with each sheet material with two split inner wrap strips of 4 mm width. The strips are located longitudinally along the tobacco rod opposite one another and oriented 90 degrees from the side seam. All other cigarette construction details are held constant.

[0048] The sheet materials are tested for sodium content and for ignition temperature (as measured by differential scanning calorimetry). Self-extinction (SE) rates are measured for finished cigarettes by the ASTM E 2187-02b test procedure (20 cigarettes per test). The results from these tests are set forth in Table 1 below, and show a fairly strong correlation between the split inner wrap sodium content and the cigarette self-extinction rate. That is, as the sodium content increases, self-extinction rates increase. The results in Table 1 also show a strong correlation between the sodium content and the ignition temperature of the sheet materials. This suggests that sheets with high ignition temperatures yield high cigarette self-extinction rates.

Table 1

Cigarette ID	Target Binder Content (%)	Measured Sodium Content ($\mu\text{g/g}$)	Sheet Ignition Temperature ($^{\circ}\text{C}$)	SE Rate per ASTM Test (%)
1*	none	306	422	45
2	15	13650	558	30
3	15	15340	575	20
4	15	17190	570	50
5	15	19590	599	33

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(continued)

Cigarette ID	Target Binder Content (%)	Measured Sodium Content ($\mu\text{g/g}$)	Sheet Ignition Temperature ($^{\circ}\text{C}$)	SE Rate per ASTM Test (%)
6	15	20880	603	18
7	20	21520	605	15
8	25	20170	489	90
9	25	20550	617	40
10	25	24340	601	80
11	25	25390	627	75
12	25	26400	639	90
13	25	26460	624	48
14	25	27190	652	80
15	25	27810	619	60
16	25	34550	631	90
17	30	26070	636	55
18	30	33240	686	85
19	30	38370	641	53
20	35	24580	626	75
21	35	34200	649	95
22	35	37580	676	100
* Control cigarette				

Example 2

[0049] This experiment determines if the "alginate anion" content causes some (or all) of the self-extinction rate variation found in Example 1. In this experiment, sheet materials are made with 15% sodium alginate, with additions of 1.5%, 2.5% and 3.5% sodium phosphate. The resulting materials are tested for sodium content and cigarettes are made as described above. The results from these tests are set forth in Table 2 below, and show a small increase in self-extinction rate with the amount of added sodium phosphate. This suggests that the sodium content of the sheet material is moderating the cigarette self-extinction rate. Analysis of the sodium content and self-extinction data in Tables 1 and 2 suggests that the split inner wrap sodium content should exceed about 30,000 $\mu\text{g/g}$ to yield acceptable cigarette self-extinction rates and, thus, reliably conform to current regulations for low ignition propensity cigarettes. The requisite sodium content can be obtained by the use of sodium alginate, another sodium salt, or a combination thereof.

Table 2

Cigarette ID	Target Binder Content (%)	Added Sodium Phosphate (%)	Measured Sodium Content ($\mu\text{g/g}$)	SE Rate per ASTM Test (%)
1	15	0.0	14210	--
2	15	1.5	22280	53
3	15	2.5	25990	48
4	15	3.5	30780	68

Example 3

[0050] An experiment is conducted to investigate the relationships between cigarette coal temperatures and the split

inner wrap ignition temperature. For this work, six cigarette examples are chosen for testing, including five from the list shown in Table 1. Three of these have low self-extinction rates (18% - 30%), and low split inner wrap ignition temperatures (558°C - 603°C). The other three have high self-extinction rates (85% - 100%), and high split inner wrap ignition temperatures (649°C - 686°C). A control cigarette without split inner wrap is also tested.

[0051] Cigarette coal temperatures are measured during smolder while suspended in air, and while resting on the ASTM test substrate (ten layers of Whatman filter paper) using a thermal imaging system comprising an infrared camera (Agema Thermovision 900). The results of these measurements are summarized in Table 3 below. As is evident from the data in Table 3, the coal temperatures are higher during free-air smolder than during smolder on the ASTM substrate. This indicates that cigarette contact with the substrate results in lowered coal temperatures due to either a heat sink effect, reduced air flow to the coal, or a combination of these effects. During smolder on the ASTM substrate the coal temperatures of the cigarettes with low self-extinction rates are 98°C - 134°C below the ignition temperatures of the sheet materials. Coal temperatures of the cigarettes with high self-extinction rates are 234°C - 338°C below the sheet material ignition temperatures.

[0052] These data suggest that the sheet materials used in the cigarettes with high self-extinction rates probably do not ignite during smolder. Examination of the ash from the cigarettes show charred but substantially intact split inner wrap in the examples with high self-extinction rates. The ash from cigarettes that had low self-extinction rates did not contain recognizable split inner wrap. This suggests that providing a split inner wrap material that does not ignite during smolder conditions is important in obtaining high cigarette self-extinction rates. The data also provide evidence of a strong correlation between sodium content, ignition temperature, and SE rate.

Table 3

Sample	Target Binder Content (%)	Measured Sodium Content (μg/g)	Sheet Ignition Temperature (°C)	Average Maximum Coal Temperature		SE Rate per ASTM Test (%)
				Free-Air (°C)	ASTM (°C)	
1*	N/A	N/A	--	555	471	--
2	15	13650	558	558	460	30
3	15	15340	575	556	476	20
4	15	20880	603	561	469	18
5	30	33240	686	496	348	85
6	--	36370	649	520	415	93
7	35	37580	676	538	366	100
*Control cigarette						

[0053] Many modifications and other embodiments of the inventions set forth herein will come to mind to one skilled in the art to which these inventions pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawing. Therefore, it is to be understood that the inventions are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

Claims

1. A cigarette comprising:

- (a) a tobacco rod having a smokable filler material contained within a circumscribing outer wrapping material; and
- (b) one or more inner wrapping strips positioned between said tobacco rod and said outer wrapping material and extending longitudinally along said tobacco rod,

wherein said one or more inner wrapping strips comprise a binder in the form of an alkali metal salt and a second alkali metal additive, and wherein said one or more inner wrapping strips comprise a total alkali metal content of at least about 30,000 μg/g, based on the total weight of the inner wrapping strips.

2. The cigarette of Claim 1, wherein the total alkali metal content of said one or more inner wrapping strips is at least about 32,000 $\mu\text{g/g}$, or at least about 34,000 $\mu\text{g/g}$, or at least about 36,000 $\mu\text{g/g}$.
3. The cigarette of Claim 1 or 2, wherein the binder is an alkali metal salt of alginate or a cellulose derivative or a mixture thereof.
4. The cigarette of Claim 3, wherein the binder is selected from the group consisting sodium alginate, potassium alginate, sodium carboxymethyl cellulose, and mixtures thereof.
5. The cigarette of one of Claims 1 to 4, wherein the binder is present in said one or more inner wrapping strips in an amount of about 2 to about 40 weight percent, based on the total weight of the inner wrapping strips, or the binder is present in said one or more inner wrapping strips in an amount of at least about 30 to about 40 weight percent.
6. The cigarette of one of Claims 1 to 5, wherein the second alkali metal additive is selected from the group consisting of sodium phosphate, sodium hydroxide, potassium hydroxide, sodium carbonate, sodium acetate, sodium oxalate, sodium malate, sodium chloride, and sodium levinulate.
7. The cigarette of one of Claims 1 to 6, wherein the inner wrapping strips have an ignition temperature of at least about 625°C, or of at least about 650°C, or of at least about 675°C.
8. The cigarette of one of Claims 1 to 7, wherein the inner wrapping strips further comprise tobacco, wood pulp, glycerin, and water.
9. The cigarette of one of Claims 1 to 8, wherein the inner wrapping strips have a basis weight of about 70 to about 125 g/m^2 , or of about 80 to about 100 g/m^2 .
10. The cigarette of one of Claims 1 to 9, wherein the inner wrapping strips have a porosity of less than about 10 Coresta.
11. The cigarette of one of Claims 1 to 10, wherein said one or more inner wrapping strips comprise 1 to 8 strips, each strip having a width of about 2 to about 10 mm, or said one or more inner wrapping strips comprise 2 to 5 strips, each strip having a width of about 2 to about 6 mm.
12. The cigarette of one of Claims 1 to 11, further comprising a filter element connected to the tobacco rod at one end of the tobacco rod.
13. The cigarette of one of Claims 1 to 12, wherein the amount of the alkali metal salt binder and the second alkali metal additive are selected so as to provide a total alkali metal content of at least about 32,000 $\mu\text{g/g}$, based on the total weight of the inner wrapping strips.
14. The cigarette of one of Claims 1 to 13, wherein said inner wrapping strips comprise an amount of alkali metal sufficient to enable the cigarette to exhibit a self-extinction rate of at least 75 percent according to ASTM E 2187-02b.
15. The cigarette of one of Claims 1 to 14, wherein the second alkali metal additive is present in the inner wrapping strips in an amount of about 1 to about 20 weight percent, based on the total weight of the inner wrapping strips, or the second alkali metal additive is present in the inner wrapping strips in an amount of about 1 to about 10 weight percent, based on the total weight of the inner wrapping strips.

Patentansprüche

1. Zigarette, umfassend:

- (a) ein Tabakstäbchen mit einem rauchbaren Füllmaterial, welches innerhalb eines umschreibenden Außenumhüllungsmaterials enthalten ist; und
- (b) einen oder mehrere Innenumhüllungsstreifen, welche zwischen dem Tabakstäbchen und dem Außenumhüllungsmaterial positioniert sind und sich longitudinal entlang dem Tabakstäbchen erstrecken,

wobei der eine oder die mehreren Innenumhüllungsstreifen einen Binder in der Form eines Alkalimetallsalzes und

ein zweites Alkalimetalladditiv umfassen und wobei der eine oder die mehreren Innenumhüllungsstreifen einen Gesamtalkalimetallgehalt von mindestens ungefähr 30 000 µg/g umfassen, basierend auf dem Gesamtgewicht der Innenumhüllungsstreifen.

- 5 **2.** Zigarette nach Anspruch 1, wobei der Gesamtalkalimetallgehalt des einen oder der mehreren Innenumhüllungsstreifen mindestens ungefähr 32 000 µg/g oder mindestens ungefähr 34 000 µg/g oder mindestens ungefähr 36 000 µg/g beträgt.
- 10 **3.** Zigarette nach Anspruch 1 oder 2, wobei der Binder ein Alkalimetallsalz von Alginat oder einem Cellulosederivat oder eine Mischung hiervon ist.
- 15 **4.** Zigarette nach Anspruch 3, wobei der Binder ausgewählt ist aus der Gruppe, welche aus Natriumalginat, Kaliumalginat, Natriumcarboxymethylcellulose und Mischungen hiervon besteht.
- 20 **5.** Zigarette nach einem der Ansprüche 1 bis 4, wobei der Binder in dem einen oder in den mehreren Innenumhüllungsstreifen in einer Menge von ungefähr 2 bis ungefähr 40 Gew.% vorliegt, basierend auf dem Gesamtgewicht der Innenumhüllungsstreifen, oder wobei der Binder in dem einen oder in den mehreren Innenumhüllungsstreifen in einer Menge von mindestens ungefähr 30 bis ungefähr 40 Gew.% vorliegt.
- 25 **6.** Zigarette nach einem der Ansprüche 1 bis 5, wobei das zweite Alkalimetalladditiv ausgewählt ist aus der Gruppe, welche aus Natriumphosphat, Natriumhydroxid, Kaliumhydroxid, Natriumcarbonat, Natriumacetat, Natriumoxalat, Natriummalat, Natriumchlorid und Natriumlävinulat besteht.
- 30 **7.** Zigarette nach einem der Ansprüche 1 bis 6, wobei die Innenumhüllungsstreifen eine Zündtemperatur von mindestens ungefähr 625 °C oder von mindestens ungefähr 650 °C oder von mindestens ungefähr 675 °C aufweisen.
- 35 **8.** Zigarette nach einem der Ansprüche 1 bis 7, wobei die Innenumhüllungsstreifen ferner Tabak, Holzpulpe, Glycerin und Wasser umfassen.
- 40 **9.** Zigarette nach einem der Ansprüche 1 bis 8, wobei die Innenumhüllungsstreifen ein Flächengewicht von ungefähr 70 bis ungefähr 125 g/m² oder von ungefähr 80 bis ungefähr 100 g/m² aufweisen.
- 45 **10.** Zigarette nach einem der Ansprüche 1 bis 9, wobei die Innenumhüllungsstreifen eine Porosität von weniger als ungefähr 10 Coresta aufweisen.
- 50 **11.** Zigarette nach einem der Ansprüche 1 bis 10, wobei der eine oder die mehreren Innenumhüllungsstreifen 1 bis 8 Streifen umfassen, wobei jeder Streifen eine Breite von ungefähr 2 bis ungefähr 10 mm aufweist, oder wobei der eine oder die mehreren Innenumhüllungsstreifen 2 bis 5 Streifen umfassen, wobei jeder Streifen eine Breite von ungefähr 2 bis ungefähr 6 mm aufweist.
- 55 **12.** Zigarette nach einem der Ansprüche 1 bis 11, ferner umfassend ein Filterelement, welches mit dem Tabakstäbchen an einem Ende des Tabakstäbchens verbunden ist.
- 13.** Zigarette nach einem der Ansprüche 1 bis 12, wobei die Menge des Alkalimetallsalzbinders und des zweiten Alkalimetalladditivs so gewählt ist, dass ein Gesamtalkalimetallgehalt von mindestens ungefähr 32 000 µg/g, basierend auf dem Gesamtgewicht der Innenumhüllungsstreifen, bereitgestellt wird.
- 14.** Zigarette nach einem der Ansprüche 1 bis 13, wobei die Innenumhüllungsstreifen eine Menge an Alkalimetall umfassen, die ausreichend ist, um die Zigarette zu befähigen, eine Selbstlöschrates von mindestens 75 % nach ASTM E 2187-02b zu zeigen.
- 15.** Zigarette nach einem der Ansprüche 1 bis 14, wobei das zweite Alkalimetalladditiv in den Innenumhüllungsstreifen in einer Menge von ungefähr 1 bis ungefähr 20 Gew.% vorliegt, basierend auf dem Gesamtgewicht der Innenumhüllungsstreifen, oder wobei das zweite Alkalimetalladditiv in den Innenumhüllungsstreifen in einer Menge von ungefähr 1 bis ungefähr 10 Gew.% vorliegt, basierend auf dem Gesamtgewicht der Innenumhüllungsstreifen.

Revendications

1. Cigarette comprenant :

- 5 (a) une tige de tabac ayant un matériau de charge susceptible d'être fumé contenu à l'intérieur d'un matériau enveloppant externe limitant ; et
(b) une ou plusieurs bandes enveloppantes internes positionnées entre ladite tige de tabac et ledit matériau enveloppant externe et s'étendant longitudinalement le long de la tige de tabac,
- 10 où lesdites une ou plusieurs bandes enveloppantes internes comprennent un liant sous la forme d'un sel d'un métal alcalin et un additif en un second métal alcalin et où lesdites une ou plusieurs bandes enveloppantes internes comprennent une teneur totale en métal alcalin d'au moins environ 30 000 µg/g, par rapport au poids total des bandes enveloppantes internes.
- 15 2. Cigarette selon la revendication 1, où la teneur totale en métal alcalin desdites une ou plusieurs bandes enveloppantes internes est d'au moins environ 32 000 µg/g ou d'au moins environ 34 000 µg/g ou d'au moins environ 36 000 µg/g.
- 20 3. Cigarette selon la revendication 1 ou 2, où le liant est un sel de métal alcalin de type alginate ou un dérivé cellulosique ou un mélange de ceux-ci.
4. Cigarette selon la revendication 3, où le liant est sélectionné dans le groupe constitué de l'alginate de sodium, l'alginate de potassium, la carboxyméthylcellulose sodique et leurs mélanges.
- 25 5. Cigarette selon l'une quelconque des revendications 1 à 4, où le liant est présent dans lesdites une ou plusieurs bandes enveloppantes internes en une quantité d'environ 2 à environ 40 % en poids, par rapport au poids total des bandes enveloppantes internes, ou le liant est présent dans lesdites une ou plusieurs bandes enveloppantes internes en une quantité d'au moins environ 30 à environ 40 % en poids.
- 30 6. Cigarette selon l'une quelconque des revendications 1 à 5, où l'additif en second métal alcalin est sélectionné dans le groupe constitué du phosphate de sodium, de l'hydroxyde de sodium, de l'hydroxyde de potassium, du carbonate de sodium, de l'acétate de sodium, de l'oxalate de sodium, du malate de sodium, du chlorure de sodium et du lévénulate de sodium.
- 35 7. Cigarette selon l'une quelconque des revendications 1 à 6, où les bandes enveloppantes internes ont une température de calcination d'au moins environ 625°C ou d'au moins environ 650°C ou d'au moins environ 675°C.
8. Cigarette selon l'une quelconque des revendications 1 à 7, où les bandes enveloppantes internes comprennent en outre du tabac, de la pulpe de bois, du glycérol et de l'eau.
- 40 9. Cigarette selon l'une quelconque des revendications 1 à 8, où les bandes enveloppantes internes ont un poids de base d'environ 70 à environ 125 g/m² ou d'environ 80 à environ 100 g/m².
10. Cigarette selon l'une quelconque des revendications 1 à 9, où les bandes enveloppantes internes ont une porosité inférieure à environ 10 Coresta.
- 45 11. Cigarette selon l'une quelconque des revendications 1 à 10, où lesdites une ou plusieurs bandes enveloppantes internes comprennent 1 à 8 bandes, chaque bande ayant une largeur d'environ 2 à environ 10 mm, ou lesdites une ou plusieurs bandes enveloppantes internes comprennent 2 à 5 bandes, chaque bande ayant une largeur d'environ 2 à environ 6 mm.
- 50 12. Cigarette selon l'une quelconque des revendications 1 à 11, comprenant en outre un élément filtrant relié à la tige de tabac à une extrémité de la tige de tabac.
- 55 13. Cigarette selon l'une quelconque des revendications 1 à 12, où la quantité de liant de type sel de métal alcalin et l'additif en second métal alcalin sont sélectionnés de façon à fournir une teneur totale en métal alcalin d'au moins environ 32 000 µg/g, par rapport au poids total des bandes enveloppantes internes.

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14. Cigarette selon l'une quelconque des revendications 1 à 13,
où lesdites bandes enveloppantes internes comprennent une quantité de métal alcalin suffisante pour permettre à la cigarette de faire preuve d'un taux d'auto-extinction d'au moins 75 % selon la norme ASTM E 2187-02b.

15. Cigarette selon l'une quelconque des revendications 1 à 14,
où l'additif en second métal alcalin est présent dans les bandes enveloppantes internes en une quantité d'environ 1 à environ 20 % en poids, par rapport au poids total des bandes enveloppantes internes, ou l'additif en second métal alcalin est présent dans les bandes enveloppantes internes en une quantité d'environ 1 à environ 10 % en poids par rapport au poids total des bandes enveloppantes internes.

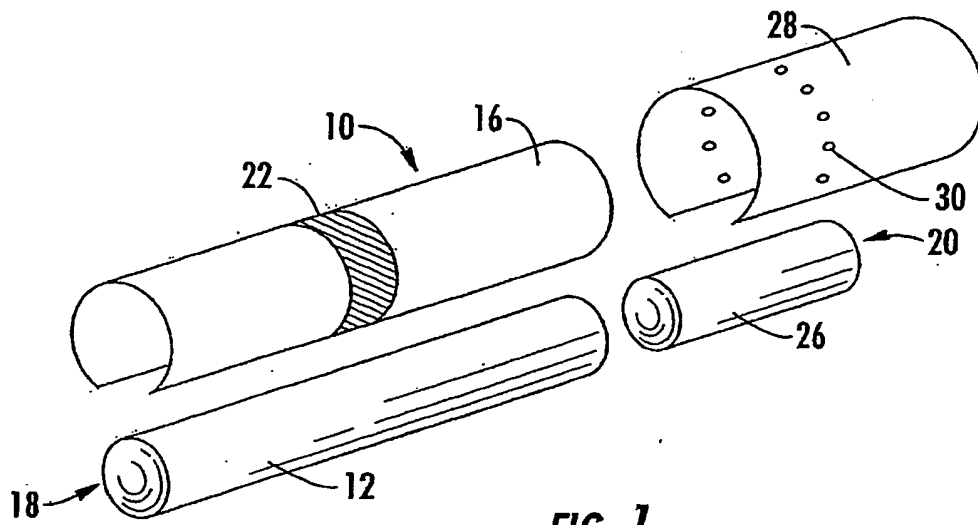


FIG. 1

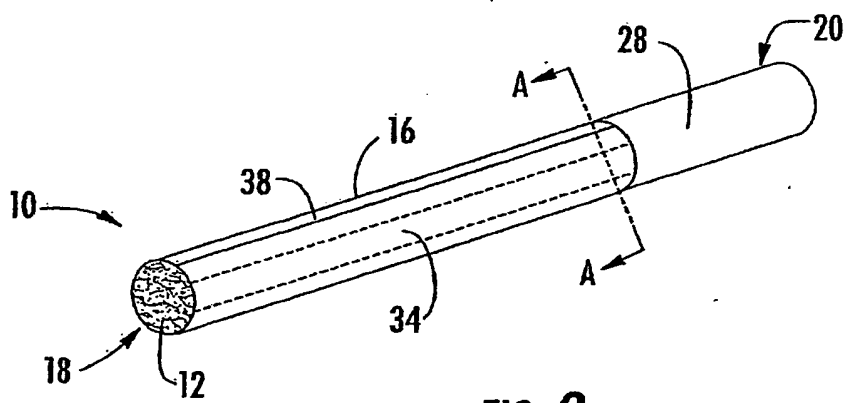


FIG. 2

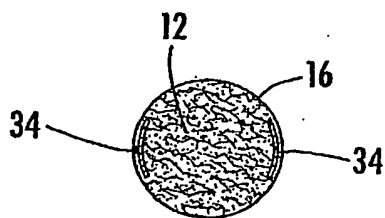


FIG. 3

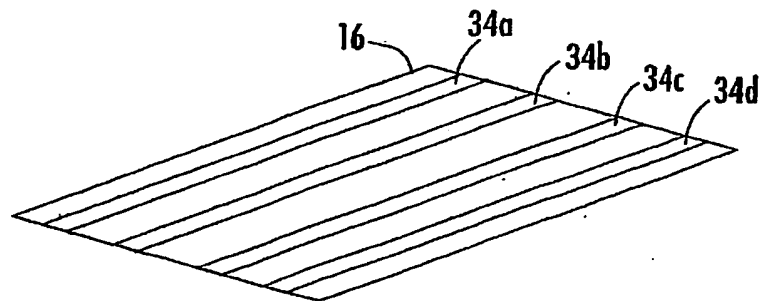


FIG. 4

REFERENCES CITED IN THE DESCRIPTION

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