Title: CIGARETTE FILTER INCLUDING PLA LAMINATED PAPER AND CIGARETTE INCLUDING THE SAME

Abstract: A cigarette filter includes a sub-filter portion surrounded by a filter wrapping paper, a space portion with an empty space next to the sub-filter portion, and a polylactic acid (PLA) laminated paper surrounding the sub-filter portion and the space portion.
Description

Title of Invention: CIGARETTE FILTER INCLUDING PLA LAMINATED PAPER AND CIGARETTE INCLUDING THE SAME

Technical Field

[1] A cigarette filter including a polylactic acid (PLA) laminated paper and a cigarette including the same are provided.

[2] Background Art

[3] In general, in order to manufacture cigarettes, various kinds of leaf tobaccos are mixed and processed to get desired flavors and tastes.

[4] The processed leaf tobaccos are cut to prepare cut tobacco leaves, and the cut tobacco leaves are wrapped with a cigarette paper to provide a filter-less cigarette.

[5] A filter may be attached to the filter-less cigarette.

[6] A cigarette paper may include materials such as flax, wood pulps, or mixtures thereof. The cigarette paper maintains combustibility or cigarette tastes during smoking.

[7] A cigarette filter may include activated carbon, flavor materials. The cigarette filter may be a mono-filter or a multi-filter, and may be surrounded by a cigarette filter wrapping paper.

[8] The cigarette filler and the cigarette filter are connected with each other by a tipping paper, and the tipping paper may include small pores.

[9] A cigarette filter with an empty space may be a recess cigarette filter or a tube filter. The empty space may prevent the inside of the cigarette filter from being wet or deteriorated by lips or saliva.

[10] A portion of the empty space of the cigarette filter is collapsed during smoking based on a customer's smoking habit.

[II] A filter wrapping paper may be thick to increase stiffness of the cigarette filter so that a shape of the portion of the empty space may be maintained. Water permeation to the cigarette filter may decrease by coating a sizing agent to the filter wrapping paper.

[12] However, making the filter wrapping paper thick may deteriorate the workability of manufacturing a cigarette filter, and coating a sizing agent may increase environmental pollution.

Technical Problem

[14] An example may increase stiffness of the cigarette filter with an empty space and decrease water permeation to the cigarette filter.

[15] An example may maintain the workability of manufacturing a cigarette filter and decrease environmental pollution.

[16] An example may be used to achieve other problems which have not been specifically mentioned.

Solution to Problem

[18] In an example, a cigarette filter includes a sub-filter portion surrounded by a filter wrapping paper, a space portion with an empty space next to the sub-filter portion, and a polylactic acid (PLA) laminated paper surrounding the sub-filter portion and the space portion.

[19] The PLA laminated paper may include an inner paper layer, an outer paper layer, and an intermediate layer disposed between the inner paper layer and the outer paper layer.

[20] The intermediate layer may include PLA and one or more polymer materials.

[21] In an example, a cigarette includes a cigarette filler portion surrounded by a cigarette paper, the cigarette filler portion including a cigarette filler, and a cigarette filter portion connected to the cigarette filler portion, wherein the cigarette filter portion includes a sub-filter portion surrounded by a filter wrapping paper, a space portion with an empty space next to the sub-filter portion, and a polylactic acid (PLA) laminated paper surrounding the sub-filter portion and the space portion.

[22] The cigarette filter portion may be a mono-filter.

[23] The cigarette filter portion may include a first sub-filter portion surrounded by a first filter wrapping paper and a second sub-filter portion surrounded by a second filter wrapping paper, and the second sub-filter portion may be disposed between the first sub-filter portion and the space portion.

[24] The PLA laminated paper may surround the second sub-filter portion and the space portion.

[25] The PLA laminated paper may surround the first sub-filter portion, the second sub-filter portion, and the space portion.

[26] Other features will be apparent from the following detailed description, the drawings, and the claims.

Advantageous Effects of Invention

[28] An example may increase stiffness of the cigarette filter with an empty space, decrease water permeation to the cigarette filter, maintain the workability of manu-
facturing a cigarette filter, and decrease environmental pollution.

[29]  

**Brief Description of Drawings**

[30]  

FIG. 1 is a perspective view of the cigarette according to an example.

[31]  

FIG. 2 is a cross-sectional view of the cigarette according to an example.

[32]  

FIG. 3 is a cross-sectional view of the PLA laminated paper according to an example.

[33]  

FIG. 4 is a cross-sectional view of the cigarette according to an example.

[34]  

FIG. 5 is a cross-sectional view of the cigarette according to an example.

[35]  

**Mode for the Invention**

[36]  

Various example embodiments will be described more fully hereinafter with reference to the accompanying drawings, in which some example embodiments are shown. At least one example embodiment may, however, be embodied in many different forms and should not be construed as limited to the example embodiments set forth herein. Rather, these example embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of at least one example embodiment to those skilled in the art. In the drawings, the sizes and relative sizes of layers and regions may be exaggerated for clarity. It will be understood that when an element or layer is referred to as being "on," "connected to" or "coupled to" another element or layer, it can be directly on, connected or coupled to the other element or layer or intervening elements or layers may be present. In contrast, when an element is referred to as being "directly on," "directly connected to" or "directly coupled to" another element or layer, there are no intervening elements or layers present. Like numerals refer to like elements throughout. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items. It will be understood that, although the terms first, second, third etc. may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms are only used to distinguish one element, component, region, layer or section from another region, layer or section. Thus, a first element, component, region, layer or section discussed below could be termed a second element, component, region, layer or section without departing from the teachings of an example embodiment. Spatially relative terms, such as "beneath," "below," "lower," "above," "upper" and the like, may be used herein for ease of description to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation
depicted in the figures. For example, if the device in the figures is turned over,
elements described as "below" or "beneath" other elements or features would then be
oriented "above" the other elements or features. Thus, the exemplary term "below" can
encompass both an orientation of above and below. The device may be otherwise
oriented (rotated 90 degrees or at other orientations) and the spatially relative de-
scriptors used herein interpreted accordingly. The terminology used herein is for the
purpose of describing particular example embodiments only and is not intended to be
limiting of an example embodiment. As used herein, the singular forms "a," "an" and
"the" are intended to include the plural forms as well, unless the context clearly
indicates otherwise. It will be further understood that the terms "comprises" and/or
"comprising," when used in this specification, specify the presence of stated features,
integers, steps, operations, elements, and/or components, but do not preclude the
presence or addition of one or more other features, integers, steps, operations,
elements, components, and/or groups thereof. Example embodiments are described
herein with reference to cross-sectional illustrations that are schematic illustrations of
idealized example embodiments (and intermediate structures). As such, variations from
the shapes of the illustrations as a result, for example, of manufacturing techniques
and/or tolerances, are to be expected. Thus, example embodiments should not be
construed as limited to the particular shapes of regions illustrated herein but are to
include deviations in shapes that result, for example, from manufacturing. For
example, an implanted region illustrated as a rectangle will, typically, have rounded or
curved features and/or a gradient of implant concentration at its edges rather than a
binary change from implanted to non-implanted region. Likewise, a buried region
formed by implantation may result in some implantation in the region between the
buried region and the surface through which the implantation takes place. Thus, the
regions illustrated in the figures are schematic in nature and their shapes are not
intended to illustrate the actual shape of a region of a device and are not intended to
limit the scope of an example embodiment. Unless otherwise defined, all terms
(including technical and scientific terms) used herein have the same meaning as
commonly understood by one of ordinary skill in the art to which an example em-
bodyment belongs. It will be further understood that terms, such as those defined in
commonly used dictionaries, should be interpreted as having a meaning that is
consistent with their meaning in the context of the relevant art and will not be in-
terpreted in an idealized or overly formal sense unless expressly so defined herein.

[37] A cigarette filter and a cigarette according to an example are described in detail with
reference to FIGS. 1 to 3.

[38] FIG. 1 is a perspective view of the cigarette according to an example, FIG. 2 is a
cross-sectional view of the cigarette according to an example, and FIG. 3 is a cross-
sectional view of the PLA laminated paper according to an example.

[39] Referring to FIGS. 1 and 2, a cigarette 1 includes a cigarette column portion 10 combusted by fire and a cigarette filter portion 20 filtering cigarette smoke.
[40] The cigarette column portion 10 and the cigarette filter portion 20 are connected with each other by a tipping paper 29.
[41] The cigarette column portion 10 includes a cigarette filler 11, and is surrounded by a cigarette paper 19.
[42] The cigarette filter portion 20 includes a sub-filter portion 21 and a space portion 24.
[43] The sub-filter portion 21 may an acetate tow in a fiber shape or a filament shape.
[44] The space portion 24 is empty and may prevent a mouth contact portion of the cigarette filter from being wet by lips or salvia such that cigarette filter functions may not deteriorate.
[45] The cigarette filter portion 20 may include at least one of flavor material and at least one of adsorption agent.
[46] The cigarette filter portion 20 a mono-filter including the sub-filter portion 21.
[47] The cigarette filter portion 20 may be a multi-filter including several sub-filters.
[48] For example, as illustrated in FIGS. 3 or 4, the cigarette filter portion 20 may be a double-filter, a triple-filter, or a quadruple-filter.
[49] In addition, each length of the sub-filters in a multi-filter may be adjusted appropriately.
[50] The cigarette filter portion 20 may be surrounded by one or more wrapping papers, and wrapping papers may have porosity with various values based on kinds of the cigarette.
[51] The sub-filter portion 21 is surrounded by a cigarette filter wrapping paper 28.
[52] The sub-filter portion 21 and the space portion 24 are surrounded by a polylactic acid (PLA) laminated paper 25.
[53] PLA has high stiffness, high damp-proof, and high biodegradability.
[54] In terms of intrinsic characteristics of PLA, stiffness of the PLA laminated paper 25 may increase, water permeation into the PLA laminated paper 25 may decrease, and biodegradability of the PLA laminated paper 25 may increase.
[55] Accordingly, the space portion 24 surrounded by the PLA laminated paper 25 may not be distorted or collapsed.
[56] As illustrated in FIG. 3, the PLA laminated paper 25 includes an inner paper layer 258, an outer paper layer 259, and an intermediate layer 251 disposed between the inner paper layer 258 and the outer paper layer 259.
[57] The intermediate layer 251 may include PLA.
[58] PLA has weak thermal stability, but the PLA laminated paper 25 may have improved thermal stability and improved stiffness because the intermediate layer 251 including
PLA is disposed between the inner paper layer 258 and the outer paper layer 259.

The PLA laminated paper 25 may be manufactured by an extrusion process with a T-die.

For example, an inner paper and an outer paper may be provided from opposite sides, respectively. A polymer material including PLA may be extruded though a T-die to dispose between the inner paper and the outer paper, and accordingly, the inner paper layer 258, the intermediate layer including PLA, and the outer paper layer 259 may be manufactured.

A corona treatment may be applied to the inner paper and the outer paper such that adhesion strength between the paper and the intermediate layer 251 may increase, and accordingly the PLA laminated paper 25 may not be exfoliated in-between layers during manufacturing cigarette filters using the PLA laminated paper 25, and the workability of manufacturing cigarette filters may improve.

In addition, the thickness of the intermediate layer 251 may be controlled by adjusting the thickness of the polymer material extruded through the T-die.

For example, the thickness of the intermediate layer including PLA may be about 10 µm to about 100 µm.

The thickness of the intermediate layer 251 may be controlled by adjusting the thickness of the inner and outer papers.

Controlling the PLA laminated paper 25 not to be thick, the circularity of the cigarette filter may be maintained and the workability of manufacturing cigarette filters may improve.

Internal sizing may be applied to an inner paper, and internal sizing and surface sizing may be applied to an outer paper.

In manufacturing process of the laminated paper, the surface with lower smoothness of the paper may be exposed and the opposite surface with higher smoothness of the paper may contact the intermediate layer 251.

An inner paper or an outer paper has about 1.2 of bulkiness.

For example, the thickness of the inner paper may be about 30 µm, the basis weight of the inner paper may be about 25 g/m², the thickness of the outer paper may be about 70 µm to about 75 µm, the basis weight of the outer paper may be about 50 g/m² to about 60 g/m².

The intermediate layer 251 may one or more polymer materials with PLA to decrease the hardness of PLA, and accordingly the circularity of the cigarette filter may be maintained and the workability of manufacturing cigarette filters also may be maintained.

The polymer material may be a biodegradable polymer such as PLA, or a non-biodegradable polymer.
A biodegradable polymer may be, for example, PBS (polybutylene succinate), PHA (polyhydroxy alkanoate), TPS (thermoplastic starch), PE (polyethylene), PP (polypropylene), PET (polyethylene terephthalate), PETI (Poly(ethylene terephthalate-co-isophthalate)), PTT (polytrimethylene terephthalate), PBT (polybutylene terephthalate), PBAT (poly(butylene adipate-co-terephthalate)), PA (polyamide), PCL (polycaprolactone), PGA (polyglycol acid), PHB (polyhydroxy butyrate), or mixtures thereof.

One or more polymer materials may be mixed in various content ratios.

In an example, a cigarette is described in detail with reference to FIG. 4.

As aforementioned with respect to FIG. 1 to FIG. 3, the same description as the cigarette regarding FIG. 1 to FIG. 3 may be omitted.

FIG. 4 is a cross-sectional view of the cigarette according to an example.

As illustrated in FIG. 4, the cigarette filter portion 20 includes two sub-filter portions 22 and 23, and a space portion 24.

Each of the two sub-filter portions 22 and 23 may have an acetate tow in a fiber shape or a filament shape.

The cigarette filter portion 20 is a double filter including the two sub-filter portions 22 and 23, and the length of each of the two sub-filter portions 22 and 23 may be adjusted appropriately based on target characteristics of the cigarette filter.

The cigarette filter portion 20 may be surrounded by one or more wrapping papers, the porosity of the wrapping papers may have various values based on kinds of the cigarette.

The two sub-filter portions 22 and 23 are surrounded by cigarette filter wrapping papers 27 and 26, respectively.

The sub-filter portion 23 and the space portion 24 are surrounded by the PLA laminated paper 25.

In terms of intrinsic characteristics of PLA, stiffness of the PLA laminated paper 25 may increase, water permeation into the PLA laminated paper 25 may decrease, and biodegradability of the PLA laminated paper 25 may increase.

Accordingly, the space portion 24 surrounded by the PLA laminated paper 25 may not be distorted or collapsed.

The PLA laminated paper 25 includes an inner paper layer 258, an outer paper layer 259, and an intermediate layer 251 disposed between the inner paper layer 258 and the outer paper layer 259.

The two sub-filter portions 22 and 23 are surrounded by one cigarette filter wrapping paper 28 to connect with each other.

In an example, a cigarette is described in detail with reference to FIG. 5.

As aforementioned with respect to FIG. 1 to FIG. 3, the same description as the
cigarette regarding FIG. 1 to FIG. 3 may be omitted.

FIG. 5 is a cross-sectional view of the cigarette according to an example.

As illustrated in FIG. 5, the cigarette filter portion 20 includes two sub-filter portions 22 and 23, and a space portion 24.

Each of the two sub-filter portions 22 and 23 may have an acetate tow in a fiber shape or a filament shape.

The cigarette filter portion 20 is a double filter including the two sub-filter portions 22 and 23, and the length of each of the two sub-filter portions 22 and 23 may be adjusted appropriately based on target characteristics of the cigarette filter.

The cigarette filter portion 20 may be surrounded by one or more wrapping papers, the porosity of the wrapping papers may have various values based on kinds of the cigarette.

The two sub-filter portions 22 and 23 are surrounded by cigarette filter wrapping papers 27 and 26, respectively.

The two sub-filter portions 22 and 23 and the space portion 24 are surrounded by the PLA laminated paper 25, and accordingly the two sub-filter portions 22 and 23 are connected with each other.

In terms of intrinsic characteristics of PLA, stiffness of the PLA laminated paper 25 may increase, water permeation into the PLA laminated paper 25 may decrease, and biodegradability of the PLA laminated paper 25 may increase.

Accordingly, the space portion 24 surrounded by the PLA laminated paper 25 may not be distorted or collapsed.

The PLA laminated paper 25 includes an inner paper layer 258, an outer paper layer 259, and an intermediate layer 251 disposed between the inner paper layer 258 and the outer paper layer 259.

Hereinafter, embodiments are illustrated in more detail with reference to examples. However, they are exemplary embodiments and are not limiting.

**Example 1**

PLA and PBS are mixed with the weight ratio of 80:20 to prepare a composition. The composition is extruded through a T-die in-between an inner paper and an outer paper to manufacture a PLA laminated paper.

The melting temperature of the used PLA is about 170 degrees Celsius to about 180 degrees Celsius, and the melting index is about 7.5 g/lOmin to about 8.0 g/lOmin.

The thickness of the extruded composition is about 20 m.

A used inner paper has the basis weight of about 24.1 g/m², the thickness of about 33.2 µm, the smoothness of about 0.73 T and about 1.78 W, and the sizing time of about 0.5 sec. A used outer paper has the basis weight of 59.7 g/m², the thickness of
about 75.3 μητ, the smoothness of about 138.3 T and about 47.1 W, and the sizing time of about 19.8 sec.

The entire thickness of the PLA laminated paper is about 122 μητ.

Using the manufactured PLA laminated paper, a cigarette filter portion as the same as illustrated FIG. 4 is manufactured, and then a cigarette is manufactured by combining the cigarette filter portion and a cigarette filler portion.

Comparative Example 1

A cigarette filter portion is manufactured by the same process as Example 1, except that a filter wrapping paper with the basis weight of about 90 g/m² and the thickness of about 112 μητ instead of the PLA laminated paper is used, and then a cigarette is manufactured by combining the cigarette filter portion and a cigarette filler portion.

Physical Property and Workability

Fifty cigarette filters as according to Example 1 and fifty cigarette filters as according to Comparative Example 1 are manufactured, and physical properties thereof and the workability of manufacturing cigarette filters are measured, and results are shown in Table 1.

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Cigarette filter of Example 1</th>
<th>Cigarette filter of Comparative Example 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circumference (mm)</td>
<td>average</td>
<td>15.995</td>
</tr>
<tr>
<td></td>
<td>deviation</td>
<td>0.032</td>
</tr>
<tr>
<td>Absorption resistance (mmH2O)</td>
<td>average</td>
<td>285.9</td>
</tr>
<tr>
<td></td>
<td>deviation</td>
<td>10.9</td>
</tr>
<tr>
<td>Circularity (%)</td>
<td>average</td>
<td>91.35</td>
</tr>
<tr>
<td></td>
<td>deviation</td>
<td>0.78</td>
</tr>
<tr>
<td>Filter length (mm)</td>
<td>average</td>
<td>80.03</td>
</tr>
<tr>
<td></td>
<td>deviation</td>
<td>0.09</td>
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<tr>
<td>Space portion length (mm)</td>
<td>average</td>
<td>8.03</td>
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<tr>
<td></td>
<td>deviation</td>
<td>0.23</td>
</tr>
</tbody>
</table>
As shown in Table 1, the workability and physical properties of Example 1 is similar to the workability and physical properties of Comparative Example 1.

The absorption resistance of Example 1 is higher than the absorption resistance of Comparative Example 1 because the thickness of the PLA laminated paper is thicker than the filter wrapping paper by about 10 µm.

However, the thickness of the PLA laminated paper is controlled by adjusting the thickness of the inner and outer papers and the extrusion thickness, based on various uses of the PLA laminated paper.

For example, the PLA laminated paper which the thickness is adjusted may be applied to an ultra-slim cigarette product with the circumference of the cigarette filter of about 16.7 mm, and may be also applied to a regular cigarette product with the circumference of the cigarette filter of about 24.2 mm.

Distortion Strength

The distortion strength is measured in the maximum force applied to a test target when the test target is pressed by about 2 mm depth in a constant speed in a dry or wet condition, using a crushing strength measuring instrument.

In a dry condition drying the test target, the distortion strength is measured at a distance of about 2 mm from an end point of the cigarette in a mouth contact portion.

In a wet condition dipping the test target in water of about 0.2 mL for about 10 seconds, the distortion strength is measured at a distance of about 2 mm from an end point of the cigarette in a mouth contact portion.

Thirty cigarette filters as according to Example 1 and thirty cigarette filters as according to Comparative Example 1 are manufactured, and the distortion strength thereof are measured, and results are shown in Table 2.

<table>
<thead>
<tr>
<th></th>
<th>Cigarette filter of Example 1</th>
<th>Cigarette filter of Comparative Example 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>cv %</td>
<td>N</td>
</tr>
<tr>
<td>Dry condition</td>
<td>2.56</td>
<td>1.79</td>
</tr>
<tr>
<td>Wet condition</td>
<td>1.48</td>
<td>0.99</td>
</tr>
</tbody>
</table>

As shown in Table 2, the distortion strength of the cigarette filter of Example 1 is
greater than the distortion strength of the cigarette filter of Comparative Example 1 by about 43% in the dry condition, and the distortion strength of the cigarette filter of Example 1 is greater than the distortion strength of the cigarette filter of Comparative Example 1 by about 50% in the wet condition.

[132] The increasing ratio of the distortion strength in the wet condition is greater than the increasing ratio of the distortion strength in the dry condition because the PLA laminated paper is prevented from water permeation better than the filter wrapping paper.

[133] The moisture permeability of the PLA film with about 20 μm thickness is about 300-500 g/m² for 24 hours at about 38 degrees Celsius and about 100%RH, and the moisture permeability of the filter wrapping paper PLA film is difficult to be measured.

[134] Forty cigarette filters as according to Example 1 and forty cigarette filters as according to Comparative Example 1 are manufactured, and the distortion strength thereof are measured, and results are shown in Table 3.

[135] Table 3

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cigarette filter of Example 1</th>
<th>Cigarette filter of Comparative Example 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>cv %</td>
</tr>
<tr>
<td>Dry condition</td>
<td>2.19</td>
<td>9.2</td>
</tr>
<tr>
<td>Wet condition</td>
<td>0.70</td>
<td>11.6</td>
</tr>
</tbody>
</table>

[137] As shown in Table 3, the distortion strength of the cigarette filter of Example 1 is greater than the distortion strength of the cigarette filter of Comparative Example 1 by about 37% in the dry condition, and the distortion strength of the cigarette filter of Example 1 is greater than the distortion strength of the cigarette filter of Comparative Example 1 by about 66% in the wet condition.

[138] While this disclosure has been described in connection with what is presently considered to be practical exemplary embodiments, it is to be understood that at least one example embodiment is not limited to the disclosed embodiments, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

[140]
Claims

[Claim 1] A cigarette filter, comprising:
- a sub-filter portion surrounded by a filter wrapping paper,
- a space portion with an empty space next to the sub-filter portion, and
- a polylactic acid (PLA) laminated paper surrounding the sub-filter portion and the space portion.

[Claim 2] The cigarette filter of claim 1, wherein:
- the PLA laminated paper comprises an inner paper layer, an outer paper layer, and an intermediate layer disposed between the inner paper layer and the outer paper layer.

[Claim 3] The cigarette filter of claim 2, wherein:
- the intermediate layer comprises PLA and one or more polymer materials.

[Claim 4] A cigarette, comprising:
- a cigarette filler portion surrounded by a cigarette paper, the cigarette filler portion comprising a cigarette filler, and
- a cigarette filter portion connected to the cigarette filler portion wherein the cigarette filter portion comprises:
  - a sub-filter portion surrounded by a filter wrapping paper,
  - a space portion with an empty space next to the sub-filter portion, and
  - a polylactic acid (PLA) laminated paper surrounding the sub-filter portion and the space portion.

[Claim 5] The cigarette of claim 4, wherein:
- the cigarette filter portion is a mono-filter.

[Claim 6] The cigarette of claim 4, wherein:
- the cigarette filter portion comprises a first sub-filter portion surrounded by a first filter wrapping paper and a second sub-filter portion surrounded by a second filter wrapping paper, and the second sub-filter portion is disposed between the first sub-filter portion and the space portion.

[Claim 7] The cigarette of claim 6, wherein:
- the PLA laminated paper surrounds the second sub-filter portion and the space portion.

[Claim 8] The cigarette of claim 6, wherein:
- the PLA laminated paper surrounds the first sub-filter portion, the second sub-filter portion, and the space portion.

[Claim 9] The cigarette of any one of claim 4 to claim 8, wherein:
the PLA laminated paper comprises an inner paper layer, an outer paper layer, and an intermediate layer disposed between the inner paper layer and the outer paper layer.

[Claim 10] The cigarette of claim 9, wherein:
the intermediate layer comprises PLA and one or more polymer materials.
A. CLASSIFICATION OF SUBJECT MATTER
A24D 3/06(2006.01)i, A24D 3/04(2006.01)i, A24D 1/00(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)
A24D 3/06; A24D 3/04; A24D 3/10; B05D 3/02; A24D 1/02; A24D 3/14; A24D 1/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS (KIPO internal) & Keywords: Cigarette, tipping paper, wrapping paper, PLA, polyactic acid.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tr>
<td>X</td>
<td>WO 2011-080007 A1 (BRITISH AMERICAN TOBACCO (INVESTMENTS) LIMITED et al.) 07</td>
<td>1-2, 4, 6-8</td>
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<tr>
<td></td>
<td>July 2011</td>
<td></td>
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<tr>
<td></td>
<td>See claim 1; figures 1, 7, 9, and 11; and page 7, lines 14-25, page 18, lines</td>
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<tr>
<td></td>
<td>14-25, and page 15, line 26 - page 16 line 30</td>
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<tr>
<td>Y</td>
<td>US 2012-0017925 A1 (SEBASTIAN ANDRIES D. et al.) 26 January 2012</td>
<td>3, 5, 9, 10</td>
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<td>See paragraph [0016] and figure 1</td>
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<td>A</td>
<td>WO 2011-077138 A1 (BRITISH AMERICAN TOBACCO (INVESTMENTS) LIMITED et al.) 30</td>
<td>1-10</td>
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<td>June 2011</td>
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<td></td>
<td>See claims 1-2</td>
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</table>

Further documents are listed in the continuation of Box C.

See patent family annex.

Date of the actual completion of the international search
25 September 2013 (25.09.2013)

Date of mailing of the international search report
25 September 2013 (25.09.2013)

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City,
302-701, Republic of Korea
Facsimile No. +82-42-472-7140

Authorized officer
KIM Hong Rye
Telephone No. +042813363
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
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