RADIALLY FIRM SMOKING ARTICLE FILTER

The present invention relates to a filter for a smoking article, and a smoking article comprising a filter.

Combustible smoking articles, such as cigarettes, generally comprise shredded tobacco (usually in cut filler form) surrounded by a paper wrapper forming a tobacco rod. A cigarette is employed by a consumer by lighting one end thereof and burning the shredded tobacco rod. The consumer then receives mainstream smoke by drawing on the opposite end (mouth end or filter end) of the cigarette. The shredded tobacco can be a single type of tobacco or a blend of two or more types of tobacco.

Smoking articles, particularly cigarettes, generally comprise a filter aligned in end-to-end relationship with the tobacco rod or other aerosol forming substrate. Typically, the filter includes a plug of cellulose acetate tow attached to the tobacco rod or substrate by tipping paper which overlies the filter and an adjacent portion of the tobacco rod. Ventilation of mainstream smoke can be achieved with a row or rows of perforations in the tipping paper about a location along the filter.

Some consumers in certain markets such as Korea, enjoy chewing the mouth end of the filter while smoking the smoking article. Consumers generally want the filter to provide some resistance during the chewing action. However, the chewing action may deform the filter shape, which, in turn, may affect the smoking experience. Consumers may also perceive filters which are not particularly firm to be of lower quality.

It would therefore be desirable to provide a filter for a smoking article which provides for an improved sensory experience for consumers, such as an improved chewing experience.

According to a first aspect of the invention, there is provided a smoking article comprising: a tobacco rod; a filter comprising a plug of filtration material that defines a downstream end segment of the smoking article, the plug being surrounded by one or more filter wrappers; and tipping material attaching the tobacco rod and the filter; wherein the hardness of the smoking article at the downstream end segment is at least about 90%, wherein the filtration material extends to the furthest downstream end of the filter; and wherein the one or more filter wrappers have a basis weight between about 50 grams per square metre and about 100 grams per square metre, and wherein the ovality of the furthest downstream end of the smoking article, after a 50% deformation of the furthest downstream end of the smoking article, is less than about 25%.

There is provided a smoking article comprising: a tobacco rod; a filter comprising a plug of filtration material that defines a downstream end segment of the smoking article, the plug being surrounded by one or morefilter wrappers; and tipping material attaching the tobacco rod and the filter; wherein the hardness of the smoking article at the downstream end segment is at least about 90%, wherein the filtration material extends to the furthest downstream end of the filter, and wherein the one or more filter wrappers have a basis weight between about 50 grams per square metre and about 100 grams per square metre.

The inventors of the present invention have found that, in order for a consumer to be able to enjoy chewing the mouth end of the smoking article filter during the smoking experience, the mouth end must have a hardness of at least about 90%. This provides sufficient resistance for the consumer, in order to make the chewing experience more

direction of the smoking article. For example, the smoking article may be positioned on the mouth end on a transparent stage, so that an image of the mouth end of the smoking article is recorded by a suitable imaging device located below the stage. The process is repeated for a total of ten smoking articles having the same design and the average of the ten ovality measurements is recorded as the ovality for that particular design of smoking article.

To simulate the smoking of a smoking article, the smoking article is subjected to a standard smoking test under ISO conditions (35 ml puffs lasting 2 seconds each, with puffs occurring once every 60 seconds) as set out in ISO 4387:2000. In the ISO test method, the smoking article is smoked with the ventilation zone fully uncovered. Where it is necessary to measure the ovality after deformation tests performed both before and after smoking, two samples of smoking articles having the same design should be used. That is, non-deformed unsmoked smoking articles should be used for the pre-smoking deformation tests, and non-deformed smoking articles having the same design are subjected to the smoking test and used for the post-smoking deformation tests.

It is preferable that the mouth end has a low ovality after deformation. It has been found that smoking article filters having softer filter wrappers may also tend to have a low ovality after deformation. However, such filter wrappers may be too soft for the chewing experience to be enjoyable for the consumer. In accordance with the first aspect of the invention, the ovality of the furthest downstream end of the smoking article, after a 50% deformation of the furthest downstream end of the smoking article, is less than about 25%. This means that, in conjunction with a minimum hardness of at least about 90%, after a 50% deformation, the mouth end of the smoking article has a maximum ovality of about 25%. This enables the smoking experience to be enjoyed after chewing, and also provides a sufficiently hard mouth end for the chewing experience itself to be enjoyable.

Moreover, it is preferable that the mouth end return to as close to circular as possible after chewing, even after smoking. Thus, preferably, the ovality of the furthest downstream end of the smoking article, after a 50% deformation of the furthest downstream end of the smoking article, performed after the smoking article has been subjected to a smoking test (as described above), is less than about 25%.

Preferably, the tipping material includes a ventilation zone at a location about the filter. The ventilation zone may comprise perforations through the tipping material. The amount of ventilation, including the number, layout, position and size of perforations, may be selected to provide the desired level of ventilation, before and after chewing.

Preferably the perforations extend through the filter wrapper or wrappers surrounding the plug of filtration material. Alternatively, the filter wrapper or wrappers may be porous. The tipping material may be standard pre-perforated tipping material. Alternatively, the tipping

Preferably, the tobacco is provided in the form of tobacco lamina, processed tobacco materials, such as volume expanded or puffed tobacco, processed tobacco stems, such as cut-rolled or cut-puffed stems, reconstituted tobacco materials, blends thereof, and the like.

In some preferred embodiments, the tobacco is in the form of cut filler, that is, in the form of shreds or strands cut into widths ranging from about 2.5 mm to about 1.2 mm or even about 0.6 mm. Preferably, the lengths of the strands range from between about 6 mm to about 75 mm.

Preferably, the tobacco rod has a tobacco packing density of at least about 200 mg/cm^{-3}. More preferably, the tobacco rod has a tobacco packing density of at least about 220 $mgcm^{-3}$. More preferably, the tobacco rod has a tobacco packing density of at least about 240 mg/cm^{-3}.

According to a second aspect of the invention, there is provided, a filter for a smoking article, the filter comprising: a plug of filtration material that defines a downstream end segment of the filter; one or more filter wrappers surrounding the plug of filtration material; wherein the hardness of the filter at the downstream end segment is at least about 90%, wherein the filtration material extends to the furthest downstream end of the filter; and wherein the one or more filter wrappers have a basis weight between about 50 grams per square metre and about 100 grams per square metre, and wherein the ovality of the furthest downstream end of the filter, after a 50% deformation of the furthest downstream end of the filter, is less than about 25%.

There is also provided a filter for a smoking article, the filter comprising: a plug of filtration material that defines a downstream end segment of the filter; one or more filter wrappers surrounding the plug of filtration material; wherein the hardness of the filter at the downstream end segment is at least about 90%, and wherein the filtration material extends to the furthest downstream end of the filter, and wherein the one or more filter wrappers have a basis weight between about 50 grams per square metre and about 100 grams per square metre.

By providing a filter having a hardness of at least 90% at the mouth end and providing filtration material extending to the mouth end, the sensory experience for a consumer may be improved. For example, this is because the filter mouth end provides enough resistance to deformation for the likes of chewing to be enjoyable for a consumer.

Preferably, the hardness of the filter at the downstream end segment is at least about 92%. Preferably, the hardness of the filter at the downstream end segment is no more than about 94%.

The inventors of the present invention have also found that, in order for a consumer to be able to continue to enjoy the smoking experience after chewing the mouth end, it is

preferable that the mouth end return to as close to circular as possible after chewing. That is to say, preferably, the mouth end has a low ovality after chewing (that is, after deformation). Therefore, preferably, the ovality of the furthest downstream end of the filter, after a 50% deformation of the furthest downstream end of the filter, is less than about 25%.

As discussed in relation to the first aspect of the invention, the one or more filter wrappers may comprise any suitable material or combination of materials.

Preferably, the one or more filter wrappers have a basis weight greater than about 50 grams per square metre (gm^{-2}). Preferably, the one or more filter wrappers have a basis weight less than about 100 gm^{-2}. More preferably, the one or more filter wrappers have a

Filters according to the present invention may advantageously be used in filter cigarettes and other smoking articles in which tobacco material is combusted to form smoke.

According to a third aspect, the invention is directed to a use of a filter, or a method of using a filter, in a smoking article, the filter comprising: use of a filter in a smoking article, the filter comprising: a plug of filtration material that defines a downstream end segment of the smoking article; one or more filter wrappers surrounding the plug of filtration material; wherein the hardness of the filter at the downstream end segment is at least about 90%, wherein the filtration material extends to the furthest downstream end of the filter; and wherein the one or more filter wrappers have a basis weight between about 50 grams per square metre and about 100 grams per square metre, and wherein the ovality of the furthest downstream end of the filter, after a 50% deformation of the furthest downstream end of the filter, is less than about 25%.

There is also disclosed use of a filter, or a method of using a filter, in a smoking article, the filter comprising: a plug of filtration material that defines a downstream end segment of the smoking article; one or more filter wrappers surrounding the plug of filtration material; wherein the hardness of the filter at the downstream end segment is at least about 90%, and wherein the filtration material extends to the furthest downstream end of the filter, and wherein the one or more filter wrappers have a basis weight between about 50 grams per square metre and about 100 grams per square metre.

Features and advantages described in relation to one aspect of the invention may also be applicable to another aspect of the invention.

The invention will be further described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 illustrates the definition of hardness;

Figure 2 illustrates the definition of ovality, using a perfect circle;

Figure 3 illustrates the definition of ovality, using an oval;

Figure 4 illustrates a perspective view of an apparatus for determining the hardness of a filter or a smoking article, in a first configuration;

Figure 5 illustrates a side view of the apparatus of Figure 4, in a first configuration;

Figure 6 illustrates a side view of the apparatus of Figure 4, in a second configuration;

Figure 7 is a graph showing hardness (%) for six types of filter (within a smoking article), both smoked and unsmoked;

Figure 8 is a graph showing hardness (%) for six types of filter (not within a smoking article),

Figure 9 is a graph showing ovality (%) for three types of unsmoked filters; and

Figure 10 is a graph showing ovality (%) for three types of smoked filters.

As discussed previously, the inventors of the present invention have noted that, in order for a consumer to be able to enjoy chewing the mouth end of the smoking article filter during the smoking experience, the mouth end must have a hardness of at least about 90%.

The hardness of various types of smoking article was tested using a known DD60A Densimeter (manufactured and made commercially available by Heinr. Borgwaldt GmbH, Germany) device, which was fitted with a measuring head for cigarettes and with a cigarette receptacle, as described above. The samples were tested by following the method which is recommended for the known DD60A Densimeter device (manufactured and made commercially available by Heinr. Borgwaldt GmbH, Germany). That is, a sample of

CLAIMS

1. A smoking article comprising:

a tobacco rod;

a filter comprising a plug of filtration material that defines a downstream end segment of the smoking article, the plug being surrounded by one or more filter wrappers; and

tipping material attaching the tobacco rod and the filter;

wherein the hardness of the smoking article at the downstream end segment is at least about 90%,

wherein the filtration material extends to the furthest downstream end of the filter; and wherein the one or more filter wrappers have a basis weight between about 50 grams per square metre and about 100 grams per square metre, and wherein the ovality of the furthest downstream end of the smoking article, after a 50% deformation of the furthest downstream end of the smoking article, is less than about 25%.

2. A smoking article according to claim 1, wherein the hardness of the smoking article at the downstream end segment is at least about 92%.

3. A smoking article according to claim 1 or claim 2, wherein the hardness of the smoking article at the downstream end segment is no more than about 94%.

4. A smoking article according to any preceding claim, wherein the ovality of the furthest downstream end of the smoking article, after a 50% deformation of the furthest downstream end of the smoking article, performed after the smoking article has been subjected to a smoking test, is less than about 25%.

5. A smoking article according to any preceding claim, wherein the one or more filter wrappers have a basis weight between about 65 grams per square metre and about 85 grams per square metre.

6. A smoking article according to any preceding claim, wherein the one or more filter wrappers have a bending stiffness of at least about 0.08 N in the machine direction of the filter wrapper.

7. A smoking article according to any preceding claim, wherein the one or more filter wrappers have a bending stiffness of at least about 0.04 N in the cross direction of the filter wrapper.

8. A smoking article according to any preceding claim, wherein the filter comprises filtration material extending along the whole length of the filter.

9. A filter for a smoking article, the filter comprising:

a plug of filtration material that defines a downstream end segment of the filter;

one or more filter wrappers surrounding the plug of filtration material;

wherein the hardness of the filter at the downstream end segment is at least about 90%,

wherein the filtration material extends to the furthest downstream end of the filter; and wherein the one or more filter wrappers have a basis weight between about 50 grams per square metre and about 100 grams per square metre, and wherein the ovality of the furthest downstream end of the filter, after a 50% deformation of the furthest downstream end of the filter, is less than about 25%.

10. A filter according to claim 9, wherein the hardness of the filter at the downstream end segment is at least about 92%.

11. A filter according to claim 9 or claim 10, wherein the hardness of the filter at the downstream end segment is no more than about 94%.

12. A filter according to any of claims 9 to 11, wherein the one or more filter wrappers have a basis weight between about 50 grams per square metre and about 100 grams per square metre.

13. Use of a filter in a smoking article, the filter comprising:

a plug of filtration material that defines a downstream end segment of the smoking article;

one or more filter wrappers surrounding the plug of filtration material;

wherein the hardness of the filter at the downstream end segment is at least about 90%,

wherein the filtration material extends to the furthest downstream end of the filter; and

wherein the one or more filter wrappers have a basis weight between about 50 grams per

square metre and about 100 grams per square metre, and wherein the ovality of the furthest downstream end of the filter, after a 50% deformation of the furthest downstream end of the filter, is less than about 25%.