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LUMINESCENT EDGING FOR ARTICLES

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ABSTRACT OF THE DISCLOSURE

Thermoplastic films having incorporated therein an ultra-violet light sensitizer are disposed about and adhered to the edges of a fabric article, thereby forming a protective border about the edges of the article to prevent unraveling and facilitating quality control inspection.

BACKGROUND OF THE INVENTION

This invention relates to the process of using luminescent films to facilitate quality control inspection. More particularly, this invention relates to the process of using luminescent films by applying them as an edging to other mediums, such as toweling, cloth, tape, or paper to facilitate quality control inspection by utilizing the unique nature of the films when inspected under ultra-violet light.

Many institutions are presently engaged in manufacturing non-disposable industrial and institutional hand towels, baby diapers and the like. Usually, appropriate lengths of fabric are cut for use from large rolls. These articles are found to suffer a low re-use rate, since severe commercial laundering procedures tend to cause the articles to unravel at the cut edges. Typical industrial practice to prevent unraveling is to hem the cut edge by sewing. However, conventional sewing techniques are slow, costly and do not substantially prolong the life of the article since flaws also develop in the uncut or machine direction edges. Often an attempt is made to prevent unraveling at the machine direction edges by weaving selvage into the fabric. Selvage is a narrow border often of different or heavier threads than the fabric and usually in a different weave. Bordering the machine edges with selvage does not usually provide satisfactory results because to the best of our knowledge there is no practical method to determine if the bordering is continuous and without flaws. Flaws in the border provides sites where unraveling can begin. Another disadvantage of selvage is that the heavier thread and different weave causes a disparity in color between the fabric and the border which is displeasing to the eye. In many instances, this color differential can create the impression that the fabric is soiled about its edges.

Accordingly, the instant invention is directed to a method for preventing unraveling of a fabric article, such as towels, hand cloths, tapes, paper, diapers, and the like, by disposing a transparent film about the edges of the article. The film edging so disposed has properties which make it easy to determine that the edging is continuous and without flaws, thereby facilitating quality control inspection. Since the film edging is transparent, the prepared article is uniform in color.

SUMMARY OF THE INVENTION

According to the instant invention, a transparent and apparently colorless film that has unique properties under ultra-violet light is applied to the cut edge sof woven fabric articles of preselected shape, such as towels, diapers and the like, to form a narrow, protective bordering disposed about the cut edges. Articles having these films so disposed are protected against unraveling and provide a simple method for determining whether the protective border is continuous and without flaws. The protective

bordering may be disposed about all edges of the article, machine direction as well as cut edges, to eliminate the undesirable features of selvage.

It is a critical feature of this invention that the films applied as a border are sensitive to ultra-violet light. In one embodiment of this invention, films fluoresce under ultra-violet light and in another embodiment films absorb ultra-violet light and appear dark. This sensitivity to ultra-violet light provides a novel method for implementing quality control inspection since a discontinuity in the film border is readily detected, even by the human eye, when the article edges are passed under ultra-violet light.

DESCRIPTIOS OF THE PREFERRED EMBODIMENTS

In this invention, thermoplastic films and preferably films derived from polyamides, usually characterized as nylon films, having incorporated therein an ultra-violet light sensitizer are disposed about and adhered to the edges of a woven fabric article of preselected shape, thereby forming a protective border about the edges of the article to prevent unraveling.

The preferred nylon films useful in the practice of this invention are prepared from linear polyamide substances of the general type characterized by high molecular weight, film-forming properties and the presence of recurring carbonamide groups as an integral part of the polymer chain, said groups being separated by at least two carbon atoms. Other general charcteristics include high melting point, pronounced crystllinity and a high degree of resistance to attack by a wide variety of organic and inorganic materials, except mineral acids, formic acid, and the phenols. Under hydrolysis with strong mineral acids, the polymers revert to the reactants from which they are formed.

The polyamides useful in preparing films for this invention include those that can be made by heating a self-polymerizable monoamino-monocarboxylic acid or the lactam thereof in the presence of a suitable accelerator, said lactam being characterized by a chain length of at least 5 carbon toms between a carboxyl and amino group. The most common polymides, illustrative of the foregoing, are prepared by condensing ϵ-caprolactam in the presence of an accelerator, such as ω-aminocaproic acid. This polymerization is usually conducted in the melt, and if desired in the presence of a solvent, such as a phenol. It generally occurs with remarkable smoothness and leads to highly polymeric products applicable for various purposes. For example, an ϵ-caprolactam melt is formed and reacted in situ in the presence of a small amount of ω-aminocaproic acid at temperatures between 250° and 280° C. under a nitrogen blanket containing no more than about 20 p.p.m. of oxygen, until the desired film-forming viscosity is reached. The polymerizate is then extruded from the reaction vessel, pelletized, washed, dried and drawn into a film through a conventional extrusion die.

Nylon films are preferred in the practice of this invention because they tend to resist soiling, maintain the integrity of their seal with the fabric and withstand the severe commercial laundering procedures used for industrial and institutional hand towels. Although nylon films are preferred in the practice of this invention, other thermoplastic films, such as those prepared from polyvinylchloride, may be used provided they are inert to the ultra-violet light sensitive additives.

In one embodiment of the instant invention the film adhered to the fabric edges and forming a narrow border thereon possesses a fluorescent quality. The film fluoresces due to the incorporation therein of a fluorescent pigment. The choice of pigment depends upon the polymeric nature and melt temperature of the film to which it is added.

It is also desirable that the pigmented film be substantially colorless in natural light, yet highly fluorescent in ultra-violet light. The amount of pigment added to the film to obtain the desirable fluorescent quality depends on film thickness and the nature of other inert components which may be added to the film, such as optical whiteners.

The most desirable nylon films are prepared by melt extruding poly-ε-caprolactam through a lay-flat die; the resulting film being between 1½ to 5 mils thick and preferably about 2 mils thick. These films desirably contain a fluorescent concentration between 0.01 and 0.5% by weight on the polymer and preferably between 0.1 and .2% by weight on the polymer. Films prepared in this manner fluoresce readily under ultra-violet light and are flexible enough to withstand usual commercial handling. Suitable fluorescent pigments that may be used in the practice of this invention are sold under the name Day-Glo, a trademark of Switzer Brothers, Inc.

In another preferred embodiment of this invention, the poly-ε-caprolactam film contains between 0.01 and 0.5% by weight on the polymer, and preferably not more than about 0.2% by weight on the polymer of an ultra-violet absorber. When the film containing an ultra-violet light absorber is adhered to fabric edging and viewed in ultra-violet light, it shows up as a dark strip against the fabric background. A suitable ultra-violet light absorber is sold under the tradename Tinuvin 328 (manufactured by Geigy Chemical Corp.).

These ultra-violet light sensitive films may be adhered to fabric edges as a narrow border by any conventional sealing method. However, it is preferable to heat seal a narrow strip of the film along the fabric edge, encompassing the fabric edge and forming a narrow border on and about the fabric surfaces.

The ultra-violet sensitive components can be added at various stages in the preparation of films modified according to this invention. The components can be added to the polyamide melt, during the polymerization cycle or injected during extrusion. Other methods of effecting the addition include impregnating the prepared polyamide pellets with an aqueous emulsion of the component and applying an aqueous emulsion of the component to the drawn film as a finish. We have found that it is most desirable to add the component prior to drawing the polymer into a film, preferably by dry blending washed and dried polymer chips with the component prior to drawing.

Various additional components may be added to the film-forming reactants either prior to or during polymerization without adversely affecting the improvements of this invention, said components including; stabilizing agents such as manganese compounds, copper compounds and hindered phenols which protect the polymer against adverse effects of heat, ageing, oxidation, and light; reinforcing particles such as silica and adhesion-promoting agents.

Fabric articles prepared in accordance with the embodiments of this invention are passed under ultra-violet light and a discontinuity in the film border is readily detected. Any discontinuity in the film border provides a site where unraveling of the fabric may begin.

In accordance with this invention, the fabric articles described herein may readily be separated into different commercial grades for uses appropriate with the useful life of the article.

Having described this invention and discussed several embodiments thereof, it is not intended that this invention be limited by any of the details of description unless otherwise specified in the accompanying claims.

What is claimed is:

1. An article having edges resistant to unraveling comprising:

(a) a woven fabric of preselected shape and having edges thereabout;

(b) a transparent thermoplastic film which will change its appearance while exposed to ultra-violet light because it is sensitive to ultra-violet light disposed about and adhered to said edges of said woven fabric, and forming a protective border about said edges to prevent unraveling.

2. The article described in claim **1** wherein said thermoplastic film is prepared from a polyamide.

3. The article described in claim **2** wherein said polyamide film is prepared from poly-ε-caprolactam.

4. The article described in claim **3** wherein said thermoplastic film fluoresces upon exposure to ultra-violet light.

5. The article described in claim **3** wherein said thermoplastic film darkens upon exposure to ultra-violet light.

6. In a process for preparing woven fabric articles of preselected shapes and having edges thereabout, said edges being resistant to unraveling, the improvement which comprises:

(a) disposing a transparent thermoplastic film which will change its appearance while exposed to ultra-violet light because it is sensitive to ultra-violet light about said edges;

(b) adhering said thermoplastic film about said edges and an upper and lower fabric surface to form a protective border about said edges, said border being a means for preventing unraveling; and

(c) passing said protective border under ultra-violet light to detect discontinuities in said protective border.

7. The process described in claim **6** wherein said ultra-violet light sensitive thermoplastic film is adhered about said fabric edges by heat sealing said film to said fabric to form said protective border.

8. The process described in claim **7** wherein said ultra-violet light sensitive film fluoresces when exposed to ultra-light sensitive film fluoreces when exposed to ultra-violet light.

9. The process described in claim **7** wherein said ultra-violet light sensitive film darkens when exposed to ultra-violet light.

10. The process described in claim **7** wherein said thermoplastic film is prepared substantially from a polyamide.

11. The process described in claim **10** wherein said polyamide is poly-ε-caprolactam.

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