WEB-WOUND ROLLS WITH WEB EDGE TREATMENT BY PRINTABLE ADHESIVE COMPOSITIONS

TECHNICAL FIELD

The present disclosure relates to web-wound rolls having a web edge treatment with a printed adhesive region, and processes to make the same.

BACKGROUND

Winding impression defects are very common in a web-wound roll process for winding or rolling continuous films or webs. An inside pressure distribution of a web-wound roll can be made by, for example, surface roughness of the roll core, wrinkles, foreign matters, etc., which can generate impression defects and/or film deformation. Various approaches have been described in, for example, PCT Publication No. WO 2011030684 (Maeda), and Japanese Patent Application Publication Nos. JP 201346966 and JP 2012247727 to reduce the winding impression defects.

SUMMARY

There is a desire to reduce winding impression defects in web-wound roll processes. While soft winding can be effective to reduce winding impression defects, soft winding may generate telescoping issues. The present disclosure provides soft winding processes for forming web-wound rolls that does not generate telescoping issues. The term “soft winding process” used herein refers to a web-wound roll process with a winding tension, for example, not greater than 2 N/cm, typically between 0.01 N/cm and 2 N/cm.

According to a first aspect of the present disclosure, there is provided an article including: a continuous web having a first major side and a second major side opposite to the first major side, and a first web edge and a second web edge opposite to the first web edge to define a width of the continuous web; and one or more stripes of adhesive dots disposed at a zone on one or both of the first and second major sides and adjacent to one or both of the web edges, the zone being continuous and extending along the respective web edges, a width ratio of the zone and the web being between 0.05 and 0.2, wherein the continuous web is rolled upon itself in multiple revolutions with a winding tension not greater than 2 N/cm, and the one or more stripes of adhesive dots are positioned between the adjacent revolutions and in direct contact with the adjacent revolutions to be sufficiently tacky to prevent telescoping defects.

According to a second aspect of the present disclosure, there is provided a method of forming a wound web, including: providing a continuous web comprising a substrate having a first major side and a second major side opposite to the first major side, and a first web edge and a second web edge opposite to the first web edge to define a width of the continuous web; dispensing a curable ink composition in discrete quantities at a zone on one or both of the first and second major sides and adjacent to one or both of the web edges, the zone being continuous and extending along the respective web edges, a width ratio of the zone and the web being between 0.05 and 0.2; curing the ink composition to form one or more discrete quantities of adhesive; and winding the substrate upon itself in multiple revolutions with a winding tension not greater than 2 N/cm, wherein the one or more discrete quantities of adhesive are positioned between the adjacent revolutions and in direct contact with the adjacent revolutions to be sufficiently tacky to prevent telescoping defects.

Disclosed herein is an ink-jet printable composition of matter capable of being UV cured into a pressure sensitive adhesive. The composition includes i) between about 50 to 99.89 parts by weight of hydroxyalkyl acrylate having 2 to 6 carbon alkyl, ii) between about 0 to 49.89 parts by weight of ethylenically unsaturated monomer including one or more of vinyl, acrylate, and (meth)acrylate monomer, iii) between about 0.01 to 5.0 parts by weight of a multi-functional acrylate or oligomer having (meth)acryl functional groups, and iv) between about 0.1 to 10 parts by weight of a photo-initiator. The viscosity of the composition is between about 1 to 50 mPa-s, and the surface tension of the composition is between about 20 to 40 dyn/cm. In some embodiments, the hydroxyalkyl acrylate can be or include 4-hydroxybutyl acrylate (4-HBA).

In yet another embodiment, the disclosure provides method of forming an array of adhesive dots on a substrate. The method includes providing the above ink-jet printable composition, dispensing one or more discrete quantities of the ink-jet printable composition onto the substrate with an ink-jet printer, and exposing the quantities of the ink-jet printable composition to ultraviolet (UV) radiation, forming the array of adhesive dots.

An improvement in soft winding processes is disclosed in copending and co-assigned patent application PCT US2015/066089 (Yoshida et al.), “Web-Wound Rolls with Microsphere Treated Edge and Methods of Making Same.” The present disclosure provides a simplified process made possible by the discovery of a printable (e.g., ink-jet printable) composition. In some embodiments, the printable composition can be cured *in situ* into an adhesive (e.g., pressure sensitive adhesive or PSA) that has sufficient tackiness and with sufficient cohesion to separate one revolution in a web-wound roll from the next.

Various unexpected results and advantages may be obtained in exemplary embodiments of the disclosure. One such advantage of exemplary embodiments of the present disclosure is that continuous films or webs can be wound by a soft winding process without generating any significant telescoping issues. In contrast, conventional approaches such as, for example, taper reducing tension, knurling of roll edge, insertion of spacer, or the combinations thereof, may not achieve the advantages of the present disclosure. For example, while a process using taper reducing wind tension control may be effective to reduce the winding impression, the effect of such process is limited by factors of web handling which depends on the web properties and equipment capability. While knurling on both web edges may provide the space between adjacent layers of wounded film and may reduce the inner pressure thereof, it is difficult to obtain stable knurling process with thin films or webs since it is easy to create critical damages on web edges. While insertion of spacer at both web edges may reduce the inner wound pressure, it would be difficult to control the position, thickness, and/or flexibility of spacer to achieve the effects.

CLAIMS

1. An article comprising:

a continuous web having a first major side and a second major side opposite to the first major side, and a first web edge and a second web edge opposite to the first web edge to define a width of the continuous web; and

one or more stripes of adhesive dots disposed at a zone on one or both of the first and second major sides and adjacent to one or both of the web edges, the zone being continuous and extending along the respective web edges, a width ratio of the zone and the web being between 0.05 and 0.2,

wherein the continuous web is rolled upon itself in multiple revolutions with a winding tension not greater than 2 N/cm, and the one or more stripes of adhesive dots are positioned between the adjacent revolutions and in direct contact with the adjacent revolutions to be sufficiently tacky to prevent telescoping defects.

2. The article of claim 1, wherein the adhesive dots each have a dome shape.

3. The article of claim 1, wherein each of the adhesive dots has a cured ink composition with a glass transition temperature (Tg) no greater than about 25 ^{o}C.

4. The article of claim 3, wherein the cured ink composition includes one or more pressure sensitive adhesives (PSA).

5. The article of claim 3, wherein the cured ink composition is obtained by curing a curable ink composition.

6. The article of claim 5, wherein the curable ink composition comprises:

between about 50 to 99.89 parts by weight of hydroxyalkyl acrylate having 2 to 6 carbon alkyl;

between about 0 to 49.89 parts by weight of ethylenically unsaturated monomer including one or more of vinyl, acrylate, and (meth)acrylate monomer;

between about 0.01 to 5.0 parts by weight of a multi-functional acrylate or oligomer having (meth)acryl functional groups; and

between about 0.1 to 10 parts by weight of a photo-initiator.

7. The article of claim 5, wherein the ink composition is curable by ultraviolet (UV) light.

8. The article of claim 5, wherein the curable ink composition has a viscosity of about 1 to about 50 mPa-s.

9. The article of claim 5, wherein the curable ink composition has a surface tension of about 20 to about 40 dyn/cm.

10. The article of claim 5, wherein the curable ink composition is ink-jet printable.

11. The article of claim 1, wherein the continuous web having a substrate includes a flexible polymeric film.

12. The article of claim 1, wherein the continuous web is a multi-layer optically clear laminate that includes a release liner, and the one or more stripes of adhesive dots are disposed on a surface of the release liner along one or more of the web edges.

13. A method of forming a wound web, comprising:

providing a continuous web comprising a substrate having a first major side and a second major side opposite to the first major side, and a first web edge and a second web edge opposite to the first web edge to define a width of the continuous web;

dispensing a curable ink composition in discrete quantities at a zone on one or both of the first and second major sides and adjacent to one or both of the web edges, the zone being continuous and extending along the respective web edges, a width ratio of the zone and the web being between 0.05 and 0.2;

curing the ink composition to form one or more discrete quantities of adhesive; and

winding the substrate upon itself in multiple revolutions with a winding tension not greater than 2 N/cm,

wherein the one or more discrete quantities of adhesive are positioned between the adjacent revolutions and in direct contact with the adjacent revolutions to be sufficiently tacky to prevent telescoping defects.

14. The method of claim 13, wherein the substrate is wound in a roll-to-roll process.