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(57) Abstract

A stretch wrap plastics film having (i) on one side, a cling layer comprising a polymer of ethylene of ultra low density (ULDPE); and (ii) on the other side, a slip layer comprising a low density (high pressure) polyethylene (LDPE) comprising a solid particulate antiblock.

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PRODUCT

THIS INVENTION relates to stretch wrap. More particularly, this invention relates to stretch wrap film not only with very good mechanical properties but also with low noise.

Stretch wrap films have an established and developing commercial end-use for overwrap of goods. This includes the packaging of foodstuffs and the bundling of goods for shipping and storage : for example, the bundling of bulky amounts of woven goods such as cloth and carpets, and, in particular, the unitising of pallet loads. There is a variety of overwrapping techniques for unitising with stretch wrap film. Essentially, they involve anchoring one end of a continuous roll of stretch wrap film to the pallet and unrolling the continuous roll, usually with stretching and with relative motion between the roll and the pallet, so that the stretched film wraps the pallet and its load and thereby utilises it.

All currently available stretch wrap films, on unrolling with stretching, emit an unacceptably high level of noise. Attempts have been made to reduce this by interposing an acoustic barrier between the operator and the stretch wrap film when in service.

European patent 0 147 088 discloses a stretch wrap film having one-sided cling comprising a transparent thermoplastic A/B film structure wherein the exposed surface of layer A, in its stretched condition, has a comparatively high cling force to the exposed surface of layer B and the exposed surface of layer B has at least substantially no cling force to a layer of itself and has a slide property when the exposed surface of layer B is in contact with a layer of itself with relative motion therebetween.

This invention seeks to provide a film composition which not only has a good balance of required mechanical properties but also exhibits low noise in service.

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According, therefore, to one aspect of the present invention, there is provided a stretch wrap plastic film having i) on one side, a cling layer comprising a linear polymer of ethylene of ultra low density (ULDPE); and ii) on the other side, a slip layer comprising a low density (high pressure) polyethylene (LDPE) comprising a solid particulate antiblock.

According to another aspect of this invention, there is provided a stretch wrap plastics film having i) on one side, a cling layer comprising a polymer of ethylene preparable by polymerising ethylene using metallocene catalysis; and ii) on the other side, a slip layer comprising a low density (high pressure) polyethylene (LDPE) comprising a solid particulate antiblock.

By "ultralow density" is meant herein a density which is no greater than 910 Kgm^{-3} and which may be as little as 850 Kgm^{-3} or less. The density of the cling layer polymer of ethylene is believed to be an important parameter; specifically, it is desirable that, in i), the polymer of ethylene has a density no greater than 900 Kgm^{-3}, preferably from 860 to 890 Kgm^{-3}.

Polymers useful as the cling layer polymer may be prepared by copolymerising ethylene with a sufficient amount of at least one straight or branched chain α-olefin to cause the density to be no greater than 910 Kgm^{-3} desirably no greater than 900 Kgm^{-3}, preferably from 860 to 890 Kgm^{-3}. For example, the polymer may be a terpolymer of a longer (eg. C_8 to C_{12}) α-olefin with one or more C_3 to C_6 α-olefins. Such materials are preparable using modified Ziegler catalysts (metallocene catalysts) which can comprise one or more transition metal or lanteramide metal atoms π-bonded to one or more mono- or polynuclear ligands including a cyclopentadienyl group. The ligand is typically bulky and may include a constraint-inducing moiety. Examples of such processes are disclosed in WO 93/08221 and WO 95/07939.

By "low density (or high pressure) polyethylene (LDPE)" is meant herein a homopolymer of ethylene prepared using a free-radical initiator and high polymerisation pressure. LDPE's are found to have numerous long-chain branches in their molecular structure. Such polymers are readily available commercially.

By "linear low density polyethylene (LLDPE)" is meant herein a copolymer of ethylene with a minor amount, typically less than 20 wt.% of a C_3 to C_{12} α-olefin. Such polymers are substantially linear in that they have generally no more than 3 long chains per 1000 backbone carbon atoms. They may be prepared by Ziegler-Natta or Phillips coordination catalysis and have a density from 916 to 950 $Kgcm^{-3}$. Such polymers are also readily available commercially.

With regard to the slip layer ii) the LDPE may be blended with another olefin polymer. Where this is done this may suitably be linear low density polyethylene (LLDPE). However, it is preferred that the LDPE comprises at least 60 wt.% of the olefin polymer material. Suitably, the slip layer comprises from 7.5 to 15% of the total thickness of the stretch wrap plastics film as supplied. The antiblock in ii) may suitably comprise a siliceous material, such as silica. Desirably, the antiblock should be present in amount from 100 to 10,000, preferably from 500 to 2,500 ppm of the slip layer by weight.

It is preferred that the film comprises a core layer interposed between i) and ii). Preferably the core layer comprises an olefin polymer, with LLDPE being particularly preferred.

An attractive feature of the stretch wrap plastics films of this invention is that while they may comprise, in i), added cling agent such as polyisobutylene (PIB), it is preferred that no added cling agent is present in i).

Suitable cling agents include low molecular weight polyolefins

such as amorphous polypropylene of molecular weight less than 5000 and polyisobutylene; terpene resins; hydrogenated rosin and rosin esters; or microcrystalline wax.

The films of this invention may be prepared either by blown film or cast film technology.

In accordance with a further aspect of this invention, there is provided the use of a stretch wrap plastic film having i) on one side, a cling layer comprising ULDPE and/or a polymer of ethylene and a (meth)acrylate ester; and ii) a slip layer as herein defined in order to unitise pallet loads with a reduced level of noise. Suitably, the ethylene should contain from 20 to 30 wt.% copolymerised (meth)acrylate ester. Preferably the level of noise should be reduced to a level from 90 to 85 dB.

The following Examples illustrate the invention.

In preparing the AB or ABC extrudates of the present invention core layer formulation can be fed into the feed hopper of a conventional rotating screw extruder. The extruder screw employed can have a 6 inch (15 cm) diameter and a length to diameter ratio of about 24:1. Satellite extruders are employed for the extrusion of the cling and slip layers. The satellite extruders each comprise a conventional extruder having an extruder screw with a 3.5 inch (7.8 cm) diameter and a length to diameter ratio of about 24:1. Molten resin streams from the satellite extruders are fed into a cast film die affixed to the end of the core extruder through an adaptor specifically designed to join the streams from the satellite extruder to the core stream so that they interface with the molten surface of the core layer.

In these Examples the layers were :

COMPARATIVE EXAMPLE 1

Cling layer A	7.5	ethylene/methylacrylate copolymer (EMA) comprising 28 wt.% copolymerised methylacrylate EXXON XC 101 : 100%
Core layer B	77.5	linear low density polyethylene (LLDPE) BP 7209 : 100%
Slip layer C	15	LLDPE DOW 2045/low density (high pressure) polyethylene (LDPE) BP 5320 : blend 75/25.

COMPARATIVE EXAMPLE 2

LAYER	GAUGE (%)	COMPOSITION
Cling layer A	10	ultra low density polyethylene (ULDPE) DOW KC 88 52 : 100%
Core layer B	75	as Comparative Example 1.
Slip layer C	15	as Comparative Example 1.

EXAMPLE 3

Cling layer A	10	as Comparative Example 2.
Core layer B	75	as Comparative Example 1.

Slip layer C	15	LDPE BP 5320 : 100% polymer plus 3000 ppm talc.

EXAMPLE 4

Cling layer A	10	as Comparative Example 2.
Core layer B	75	as Comparative Example 1.
Slip layer C	15	as Example 3 but with 1500 ppm talc instead of 3000 ppm.

EXAMPLE 5

Cling layer A	10	EMA comprising 24% MA: 100%.
Core layer B	75	as Comparative Example 1.
Slip layer C	15	as Example 3.

EXAMPLE 6

Cling layer A	10	as Example 5
Core layer B	75	as Comparative Example 1.
Slip layer C	15	as Example 4.

TABLE 1

EXAMPLE	CLING	SLIP	UNWIND FORCE (daN)	NOISE (dB)
CE1	very good	OK	5.7	103
CE2	excellent	OK	8.0	95
3	good	OK	3.0	96
4	very good	OK	4.45	85
5	good	OK	2.5	85
6	very good	OK	3.1	85

EXAMPLE 7

Cling layer A	ULDPE DOW INSITE POE density 875 Kgm^{-3}, prepared by metallocene catalysis.
Core layer B	as Comparative Example 1.
Slip layer C	as Example 4.

EXAMPLE 8

Cling layer A	ULDPE DOW INSITE POP density 902 Kgm^{-3}, prepared by metallocene catalysis.
Core layer B	as Comparative Example 1.

EXAMPLE 9

LAYER	COMPOSITION
Cling layer A	LLDPE density 903 Kgm^{-3}.
Core layer B	as Comparative Example 1.
Slip layer C	as Example 4.

The results are shown in the following Table 2.

TABLE 2

EXAMPLE	CLING	SLIP	UNWIND FORCE (daN)	NOISE (dB)	HAZE (ASIM 1003)
7	very good	OK	4.5	85	3.6
8	poor	OK	1.4	85	5
9	poor	OK	1.6	88	4.6

CLAIMS

1. A stretch wrap plastics film having

i) on one side, a cling layer comprising a polymer of ethylene of ultra low density (ULDPE); and

ii) on the other side, a slip layer comprising a low density (high pressure) polyethylene (LDPE) comprising a solid particulate antiblock.

2. A stretch wrap plastics film having

i) on one side, a cling layer comprising a polymer of ethylene preparable by polymerising ethylene using metallocene catalysis; and

ii) on the other side, a slip layer comprising a low density (high pressure) polyethylene (LDPE) comprising a solid particulate antiblock.

3. A stretch wrap plastics film according to claim 1 or 2 wherein, in i), the polymer of ethylene has a density no greater than 900 Kgm^{-3}.

4. A stretch wrap plastics film according to claim 3 wherein the density is from 860 to 890 Kgm^{-3}.

5. A film according to any preceding claim wherein, in ii), the LDPE is blended with another olefin polymer.

6. A film according to claim 5 wherein in ii), the LDPE is blended with linear low density polyethylene (LLDPE).

7. A film according to claim 5 or 6 wherein, in ii), the LDPE comprises at least 60 wt.% of the olefin polymer material.

8. A film according to any preceding claim wherein, in ii), the antiblock comprises a siliceous material.

9. A film according to any preceding claim wherein, in ii), the antiblock comprises from 100 to 10000 ppm of the slip layer by weight.

10. A film according to claim 9 wherein the antiblock comprises from 500 to 2500 ppm of the slip layer by weight.

11. A film according to any preceding claim which comprises a core layer interposed between i) and ii).

12. A film according to claim 11 wherein the core comprises an olefin polymer.

13. A film according to claim 12 wherein the olefin polymer comprises LLDPE.

14. A film according to any preceding claim which comprises no added cling agent.

15. A film according to any preceding claim which is a blown film.

16. A film according to any preceding claim which is a cast film.

17. Use of stretch wrap plastic film having i) on one side, a cling layer comprising a ULDPE and/or a polymer of ethylene and a (meth)acrylate ester; and ii) a slip layer as defined in any one of claims 1 or 5 to 10 in order to unitise pallet loads with a reduced level of noise.