# CONTAINERS FOR WATER BASED POLYMER COMPOSITIONS

## Field of the Invention

The present invention relates generally to containers and related components that are used for containing water based polymer compositions, to a method of producing the same and to a container comprising a water based polymer composition.

## Background of the Invention

Containers used for storing and/or dispensing water based polymer compositions (e.g. paints, varnishes, stains, inks, sealants, adhesives and the like) may be provided in a variety of shapes and sizes and typically comprise a container body and a closure means such as a lid. The containers may also comprise ancillary components such as a wipe surface to facilitate removal of excess composition from an applicator, and/or a spout structure to facilitate flow of the composition out of the container. Container components such as the container body, closure means, wipe surface and spout structure are commonly made from plastic or metal.

During use of the water based polymer composition contained in such containers, a polymer film originating from the water based polymer composition, commonly referred to in the art as a "skin", can form on the surface of those parts of the container/parts thereof which make contact with the composition. The so formed skin typically can not readily assimilate back into the bulk water based polymer composition within the container even with stirring or shaking of the composition. Skin formation on a surface of the container or related parts thereof is believed to primarily result from temperature differentials of the composition within different locations of the container or related parts thereof and subsequent loss of water (e.g. by evaporation) from the composition.

Skin formation of the water based polymer composition on container components is undesirable in that skin may dislodge from the component and fall into the bulk water based polymer composition. Where that problem does occur, application of the composition to a substrate surface, for example by brushing, can result in the transfer of the skin to the

substrate in the form of so called “skin lumps”. Spray application of the water based polymer composition can also be adversely effected by the presence of the skin in the sense it can lead to blockage of the spray equipment.

While it may be possible to remove skin from the bulk composition through, for example, filtration, this can be time consuming and is generally unacceptable to end users of such compositions.

As skin formation itself can be difficult to prevent, it is therefore desirable to minimise or avoid transfer of any skin formed on container components into the bulk water based polymer composition.

For convenience, the undesirable transfer of skin from surfaces of container components into the bulk water based polymer composition will hereinafter be referred to as “skinning”.

Metal container components do not generally present a significant skinning problem as water based polymer compositions tend to adhere quite well to the metal container components used. For example, the surface of such metal container components is typically coated with a baked epoxy layer such as EPON$^{TM}$. The baked epoxy layer is primarily used to inhibit rust of the metal components, but is also believed to promote good adhesion of skin derived from water based polymer compositions to the metal container components thereby minimising or preventing undesirable skinning.

However, containers and related components for water based polymer compositions are increasingly being manufactured from plastic materials such as polyethylene or polypropylene. Such containers can have one or more plastic components, for example a plastic container body, a plastic closure and plastic structures that function as a wipe surface and/or spout.

It is not uncommon for all components of a container for containing water based polymer compositions to be made entirely from plastic. However, such plastic container components are generally prone to skinning as most water based polymer compositions have poor

adhesion to the plastic from which they are made.

Accordingly, there has been considerable research effort to date directed toward overcoming skinning associated with the use of plastic components of containers for water based polymer compositions.

For example, one technique developed contemplates promoting adhesion between skin derived from water based polymer composition and plastic components by texturizing the surface of the plastic components to increase surface area contact between the skin and the component. However, texturization of the plastic components in this way can in some instances be difficult to practically achieve and it can also be expensive to implement.

Various techniques have also been developed whereby the surface of plastic container components that come into contact with water based polymer compositions during normal use are coated with polymer compositions that (i) adhere well to the plastic container component, and (ii) present a surface layer that comes into contact with the water based polymer composition which promotes adhesion to any formed skin. However, such techniques introduce one or more non-trivial steps in the manufacture of such plastic container components.

Despite the problem of skinning associated with using plastic container components for water based polymer compositions, the relative ease of their manufacture and cost benefits makes them particularly attractive compared with their metal counterparts.

An opportunity therefore remains to develop plastic container components for water based polymer compositions which present little if no susceptibility to skinning and derive that property via simple and cost effective means.

**Summary of the Invention**

Disclosed herein is a plastic component of or for a container suitable for a water based polymer composition, the plastic component having bonded thereto a preformed polymer

film that presents an anti-skinning surface to make contact with the water based polymer composition during use of the plastic component, wherein the anti-skinning surface has a surface tension of at least 38 dynes/cm.

Disclosed herein is a plastic component of or for a container suitable for a water based polymer composition, the plastic component having bonded thereto a preformed polymer film that presents an anti-skinning surface to make contact with the water based polymer composition during use of the plastic component, wherein the anti-skinning surface has a surface tension of at least 38 dynes/cm and is derived from a halogenated polymer formulation.

Also disclosed herein is a container comprising a water based polymer composition, the container comprising at least one plastic component having bonded thereto a preformed polymer film that presents an anti-skinning surface that is in contact or to make contact with the water based polymer composition during use of the plastic component, wherein the anti-skinning surface has a surface tension of at least 38 dynes/cm.

Disclosed herein is a container comprising a water based polymer composition, the container comprising at least one plastic component having bonded thereto a preformed polymer film that presents an anti-skinning surface that is in contact or to make contact with the water based polymer composition during use of the plastic component, wherein the anti-skinning surface has a surface tension of at least 38 dynes/cm and is derived from a halogenated polymer formulation.

Also disclosed herein is a method of producing a plastic component of or for a container suitable for a water based polymer composition, the method comprising bonding a preformed polymer film to the plastic component, the preformed polymer film having a bonding surface and an opposing anti-skinning surface having a surface tension of at least 38 dynes/cm, wherein during the bonding step the preformed polymer film bonds to the plastic component through its bonding surface and thereby presents the anti-skinning surface to make contact with the water based polymer composition during use of the plastic component.

Disclosed herein is a method of producing a plastic component of or for a container suitable for a water based polymer composition, the method comprising bonding a preformed polymer film to the plastic component, the preformed polymer film having a bonding surface and an opposing anti-skinning surface having a surface tension of at least 38 dynes/cm that is derived from a halogenated polymer formulation, wherein during the bonding step the preformed polymer film bonds to the plastic component through its bonding surface and thereby presents the anti-skinning surface to make contact with the water based polymer composition during use of the plastic component.

It has surprisingly now been found that a plastic component of or for a container suitable for a water based polymer composition can effectively and efficiently be provided with an anti-skinning surface by bonding a preformed polymer film to a surface of the plastic component that makes contact with the water based polymer composition during normal use of the plastic component. The bonded preformed polymer film presents to the water borne polymer composition an anti-skinning surface having a surface tension of at least 38 dynes/cm. That anti-skinning surface advantageously promotes good adhesion of skin derived from the water based polymer composition to the plastic component thereby minimising or preventing skinning.

In one embodiment, the plastic component is produced by a shaping process such as a moulding process. In that case, method produces a moulded plastic component.

Therefore, also disclosed herein is a method of producing a moulded plastic component of or for a container suitable for a water based polymer composition, the method comprising moulding a shape of the plastic component while in contact with a preformed polymer film, the preformed polymer film having a bonding surface and an opposing anti-skinning surface having a surface tension of at least 38 dynes/cm, wherein during the moulding step the preformed polymer film bonds to the plastic component through its bonding surface and thereby presents the anti-skinning surface so as to make contact with the water based polymer composition during use of the plastic component.

Through use of the preformed polymer film, plastic components as described herein can advantageously be manufactured by a simple process that does not involve texturization of the component or the direct application of an anti-skinning coating composition to the component.

Where the method produces a moulded plastic component, that plastic component can advantageously be produced with an anti-skinning surface in what is essentially a one-step process. That process can not only be readily automated but is also robust, reproducible and cost effective. In particular, providing the anti-skinning surface can be integrated with a moulding step of the plastic component. That is achieved by moulding the plastic component while in contact with the preformed polymer film. The preformed polymer film has a bonding surface and an opposing anti-skinning surface with a surface tension of at least 38 dynes/cm. As part of the moulding step the preformed polymer film bonds through its bonding surface to the plastic component thereby presenting its anti-skinning surface to make contact with the water based polymer composition during use of the plastic component.

Also disclosed herein is a simple, efficient and cost effective means of providing plastic components of or for a container suitable for a water based polymer composition with an anti-skinning surface.

Where the method produces a moulded plastic component, such a moulded plastic component can advantageously be prepared using a technique known in the art as in mould labelling (IML).

IML is a technique whereby a preformed polymer film is placed within a mould used to form a moulded plastic component. The mould used will generally define the intended shape of the plastic component to be manufactured, for example the shape of a container body or a lid closure for a container body.

The plastic material from which the plastic component is to be made is introduced to a mould with the preformed polymer film and moulding of the plastic material is typically performed with the application of pressure, vacuum and/or heat. During the moulding step the

preformed polymer film bonds to the so formed moulded plastic component to become an integral part thereof.

IML is traditionally used to bond a printed preformed polymer film to an external surface of a plastic container component such as a container body or closure. Preformed polymer film used is generally printed with advertising material describing material that is to be contained within the container. The preformed polymer film is bonded to the container component such that it presents the printed information on the outside of the container to be viewed by consumers.

As will be appreciated by those skilled in the art, skinning commonly manifests itself on an internal surface of a plastic container component (e.g. container body or closure) that makes contact with water based polymer composition contained therein.

In contrast with conventional use of IML, as applied in accordance with the present teachings IML can involve bonding a preformed polymer film to an internal surface of container components such as a body or closure. Further in contrast with conventional use of IML, a preformed polymer film used in accordance with the present teachings will generally not have any printed advertising information on it at all.

Where IML is used as a technique for producing a plastic component in accordance with the present teachings, the method may be described as producing a moulded plastic component of or for a container suitable for a water based polymer composition, the method comprising moulding by in mould labelling a shape of the plastic component while in contact with a preformed polymer film.

In one embodiment, the plastic component is a moulded plastic component and forming it comprises moulding a shape of the plastic component while in contact with a preformed polymer film using injection moulding in mould labelling.

In a further embodiment, the plastic component is a moulded plastic component and forming it comprises moulding a shape of the plastic component while in contact with the preformed

polymer film using thermoforming in mould labelling.

Further aspects and embodiments of the invention are discussed in more detail below.

**Brief Description of the Drawings**

Embodiments of the invention will now be illustrated by way of example only with reference to the accompanying and non-limiting drawing in which:

Figure 1 illustrates a plastic component in accordance with the invention in the form of a container body.

**Detailed Description of the Invention**

The present invention relates to a plastic component of or for a container suitable for a water based polymer composition.

As used herein, the expression “water based polymer composition” is intended to mean compositions comprising water and polymer that presents in a fluid or flowable state. The polymer may be dissolved in the water and/or present as a dispersed phase within the water, for example in the form of a dispersion or colloidal suspension. Such compositions will typically be of a type that can form a continuous polymer mass or film upon loss of water from the composition, for example through evaporation.

Examples of such water based polymer compositions include those selected from paints, varnishes, stains, inks, adhesives and sealants.

Those skilled in the art will appreciate skinning occurs when a water based polymer composition forms a poorly adhered polymer skin on the surface of a substrate and that polymer skin transfers into the bulk water based polymer composition. Such transferred skin does not readily assimilate back in with the bulk water based polymer composition and consequently presents as an undesirable contaminant within the composition. As previously

discussed, conventional plastic components of or for a container upon which skin forms are particularly prone to skinning.

By a plastic component in accordance with the invention being “of” a container is intended to mean the plastic component forms part or all of the container body per se. The “container body” being at least a component that contains a bulk volume of the water based polymer composition.

By a plastic component in accordance with the invention being “for” a container is intended to mean a component designed to be associated or used with a container body, for example a container closure such as a lid.

A plastic component “for” a container may of course form an integral part of a container body and in that case in may also be described as being as being “of” a container.

In the art it is common to refer to a “container” for water based polymer compositions as comprising at least a container body and a container closure. However, the term “container” can also sometimes be used to refer only to the container body.

For convenience only, reference herein to the term “container(s)”, unless specified otherwise, can embrace a container body with or without an associated container closure.

A container body may be in the form of a pail and a container closure may be in the form of a lid.

Pail-type container bodies are well known in the art and may have any shape suitable for containing water based polymer compositions.

Generally, a container body has a circular cross section, but containers having substantially square, rectangular or ovoid cross sections are also known.

A container for use according to the invention may be of any practical size, with typical sizes

ranging from about 250ml up to greater than 50 litres. A common practical limitation placed on such containers is that they will generally be of a size that can carried by an individual user to a desired point of application of water based polymer composition contained therein.

Accordingly, while there is no technical size requirement or limitation of containers used according to the present invention, they will generally be of a size suitable to contain about 250ml to about 50 litres, or from about 1, about 2, about 4, about 10, about 12.5, about 15 or about 20 litres of water based polymer composition.

A container closure (to be used with a container body) may be provided in a variety of shapes and sizes and can engage in various ways with the container body to seal the composition therein. The size and shape of a container closure will, at least to some extent, generally be dictated by the size and shape of the container body with which it is to engage.

Those skilled in the art will appreciate the various means by which a container closure can engage with a container body to provide suitable means for sealing the water based polymer composition within the container body.

For example, a container closure and container body may engage via a screw thread, via lugs, or via snap fit.

While the function of the closure may be an important feature of a container assembly to ensure that the aqueous polymer composition is adequately contained, it will be appreciated the shape and size of the container closure and how the container closure engages the container body is not particularly important for the purposes of working the present invention.

A plastic component of or for a container in accordance with the invention may include a structure that functions to facilitate ease of use of the water based polymer composition.

For example, a plastic component of or for a container may comprise or be in the form of a wipe surface to facilitate removal of excess composition from an applicator such as a brush

or roller. In use, such a structure will generally present a relatively sharp edge that extends at least partially over an aperture in the container body such that when an applicator is wiped on the relatively sharp edge excess composition can fall back into the bulk water based polymer composition for reuse.

A plastic component in the form of a wipe surface structure may form an integral part of a container body or it may be a component separate from the container body designed to engage with the container body when in use.

A plastic component of or for a container in accordance with the invention may include a structure that functions as a spout to facilitate flow or pouring of the water based polymer composition out of a container body. Such a structure will generally extend out from the container body and be shaped to concentrate flow of the water based polymer composition through or over that structure.

Accordingly, as used herein, the term "spout" structure is not intended to define any particular shape of that structure but rather the function of concentrating flow of the water based polymer composition to facilitate transfer of the composition out of the container. A spout may therefore be of any shape or size provided it provides for that function. A spout may form an integral part of a container body or it may be a component separate from the container body designed to engage with the container body when in use.

Structures such as a wipe surface and spout may be provided as separate components in their own right or may form together a single component.

When containing a water based polymer composition, a container in accordance with the invention will generally be provided with a container closure that engages with the container body to achieve the desired closure of the container.

However, ancillary structures such as a wipe surface and/or spout may or may not be provided with the container comprising the composition at the point of sale. For example, such ancillary structures may be manufactured independent of the container body and

closure and be offered for sale to a user purchasing the composition. In that case, such ancillary structures will typically be adapted to securely engage some part of the container when in use. Those independently manufactured structures may of course also be fitted to a container body or closure to form part of the overall container assembly at the point sale.

Container components in accordance with the invention may be made from any suitable materials (e.g. plastic and/or metal) provided they comprise at least one plastic component having bonded thereto a preformed polymer film that presents an anti-skinning surface to make contact with the water based polymer composition during use of the plastic component.

Generally, the plastic component of or for the container will be selected from a container body, a container closure, a wipe surface structure, a spout structure, and combinations thereof.

In one embodiment, the plastic component is a container body.

In another embodiment, the plastic component is a container closure.

In a further embodiment, the plastic component is a wipe surface structure.

In yet a further embodiment, the plastic component is a spout structure.

A container comprising water based polymer composition in accordance with the invention may comprise a metal container body and a plastic component in the form of a container closure, wherein the plastic container closure has bonded thereto a preformed polymer film that presents an anti-skinning surface to make contact with the water based polymer composition during use of the container closure.

A container comprising water based polymer composition in accordance with the invention may comprise a metal container closure and a plastic component in the form of a container body, wherein the container body has bonded thereto a preformed polymer film that presents an anti-skinning surface to make contact with the water based polymer composition during

use of the container body.

A container comprising water based polymer composition in accordance with the invention may comprise plastic components in the form of a container body and a container closure, wherein each of the container body and closure have bonded thereto a preformed polymer film that presents an anti-skinning surface to make contact with the water based polymer composition during use of the container body and closure.

The plastic component of or for a container in accordance with the invention may be made of any suitable plastic material provided the preformed polymer film can be bonded thereto. As the preformed polymer film bonded to the plastic component is used to present an anti-skinning surface having a surface tension of at least 38 dynes/cm, the plastic material used to make the plastic component will generally not in itself provide for a surface tension of at least 38 dynes/cm.

Generally, the plastic component in accordance with the invention will be made from a plastic material selected from polyolefin, polyester, polyamide, polyacetal, acrylonitrile butadiene styrene copolymer and ethylene methacrylic acid copolymer.

Examples of polyolefins include polyethylene and polypropylene. Specific examples of polyethylene include high density polyethylene, low density polyethylene and linear low density polyethylene.

An example of polyester includes polyethylene terephthalate, polycaprolactone, polyethylene adipate and polycarbonate.

The plastic component in accordance with the invention has bonded thereto a preformed polymer film.

By the polymer film used in accordance with the invention being “preformed” is intended to mean a stand alone polymer film that has been manufactured prior to it being bonded to the plastic component. The expression “plastic component having bonded thereto a preformed

polymer film" is therefore not intended to embrace a situation where a polymer layer is formed directly on the plastic component by coating it with a polymer based liquid coating composition.

For avoidance of any doubt, those skilled in the art could readily differentiate a plastic component that has bonded thereto a preformed polymer film over a plastic component coated with a polymer layer derived from a liquid polymer based coating composition.

The preformed polymer film will generally have a thickness ranging from about 15 microns to about 80 microns, or from about 15 microns to about 60 microns, or from about 20 microns to about 50 microns, or from about 25 microns to about 50 microns.

The preformed polymer film may be in the form of a single layer polymer film or a multi-layer polymer film.

By the expression "multi-layer polymer film" is meant polymer film having two or more polymer films laminated together.

In one embodiment, the preformed polymer film is not a multilayer polymer film.

In a further embodiment, the preformed polymer film is a single layer polymer film.

As will be discussed in more detail below, where a single- or multi-layer preformed polymer film is used, that preformed polymer film may include on a surface thereof a polymer layer derived from a liquid polymer based coating composition which provides for the anti-skinning surface.

Preformed polymer film used in accordance with the invention can be prepared using techniques well known in the art such as cast or bubble extrusion.

In one embodiment, the preformed polymer film comprises extruded polymer film.

In a further embodiment, the preformed polymer film comprises a multi-layer extruded polymer film.

In another embodiment, the preformed polymer film is in the form of a single layer extruded polymer film.

The preformed polymer film presents an anti-skinning surface. Details of the anti-skinning surface are outlined below.

The perimeter shape and dimensions of the preformed polymer film used in accordance with the invention will generally be dictated by the shape and volume of the plastic component to which the polymer film is to be bonded. Upon determining the shape and dimensions of the plastic component, those skilled in the art can readily provide for preformed polymer film having an appropriate shape and dimensions to bond to the required location on the plastic component.

The preformed polymer film may be bonded to part or all of the plastic component. The location of the plastic component to which the preformed polymer film is bonded will of course depend on the nature of the plastic component.

The preformed polymer film is bonded to the plastic component such that it presents an anti-skinning surface to make contact with the water based polymer composition during use of the plastic component. The preformed polymer film will therefore be bonded to a location(s) on the plastic component that is prone to skinning upon it coming into contact with the water based polymer composition during use of the plastic component.

Those skilled in the art will readily appreciate those parts of a container or container components prone to skinning.

Accordingly, the expression “during use of the plastic component” is intended to be indicative of location(s) on the plastic component that is prone to skinning upon it coming into contact with the water based polymer composition, with such location(s) presenting the

anti-skinning surface to make contact the water based polymer composition and minimise or prevent skinning.

Such “use” of the plastic component includes storage and/or transport of the water based polymer composition in the container, shaking of the water based polymer composition within the container, inducing flow of the water based polymer composition out of the container, and gaining access to the water based polymer composition within the container using an applicator such as a brush, roller or spray device etc.

In one embodiment, the plastic component is a container body and the preformed polymer film is bonded to an internal surface of the container body that forms contact with a water based polymer composition that is, or is to be, contained therein.

In a further embodiment, the container body is in the form of a pail having an open top end, a closed bottom wall and a side wall which extends upwardly from the bottom wall, wherein the preformed polymer film is bonded to an internal surface of the side wall and presents the anti-skinning surface to make contact with the water based polymer composition during use of the pail.

In another embodiment, the plastic component is in the form of a pail having an open top end, a closed bottom wall and a side wall which extends upwardly from the bottom wall, wherein the preformed polymer film is not bonded to the interior surface of the bottom wall which makes contact with the water based polymer composition during use of the pail.

In a further embodiment, the plastic component is in the form of a container closure and the preformed polymer film is bonded to a surface of the closure and presents the anti-skinning surface to make contact with the water based polymer composition during use of the closure.

In yet a further embodiment, the plastic component is in the form of a wipe surface and the preformed polymer film is bonded to a surface of the wipe surface and presents the anti-skinning surface to make contact with the water based polymer composition during use of the wipe surface.

In another embodiment, the plastic component is in the form of a spout and the preformed polymer film is bonded to a surface of the spout and presents the anti-skinning surface to make contact with the water based polymer composition during use of the spout.

The preformed polymer film can be made from any suitable plastic material provided it can be bonded to the plastic component and has or can be provided with the anti-skinning surface.

In one embodiment, the preformed polymer film comprises a preformed polyolefin, polyester, polyamide, polyacetal, acrylonitrile butadiene styrene copolymer or ethylene methacrylic acid copolymer film.

In another embodiment, the preformed polymer film comprises a preformed polyolefin film.

Specific examples of suitable polymers for the preformed polymer film include those described herein in the context of the plastic component.

Bonding of the preformed polymer film to the plastic component can be affected by any suitable means. For example, the preformed polymer film may be bonded to the plastic component by thermal bonding or by using an adhesive.

In one embodiment, the preformed polymer film is thermally bonded to the plastic component.

In another embodiment, the preformed polymer film is adhesively bonded to the plastic component.

The preformed polymer film used in accordance with the invention has a bonding surface and an opposing anti-skinning surface. Accordingly, the bonding surface represents one side or face of the polymer film and the anti-skinning surface represents the other side or face of the polymer film.

The bonding surface of the preformed polymer film is the side of the polymer film that is bonded to the plastic component.

Where an adhesive is used to bond the preformed polymer film to the plastic component, the adhesive may be applied to the bonding surface of the polymer film, the area of the plastic component to which the polymer film is to be bonded, or a combination thereof.

The adhesive may be applied to the bonding surface of the preformed polymer film using known applicator techniques.

Those skilled in the art will be able to select a suitable adhesive to bond the preformed polymer film to the plastic component having regard to what the preformed polymer film and the plastic component are made from. For example, if both the plastic component and bonding surface of the preformed polymer film are made of polyolefin, then an adhesive suitable for bonding polyolefins would be selected.

Examples of adhesives that may be used to bond the preformed polymer film to the plastic component include pressure sensitive acrylics, contact adhesive, acrylic or epoxy two-pack adhesives and polycyanoacrylates.

Where the preformed polymer film is thermally bonded to the plastic component, those skilled in the art would appreciate the bonding surface of the preformed polymer film will need to be suitably compatible with the plastic component to promote adequate thermal bonding. For example, suitable compatibility may be attained where the plastic component and the bonding surface of the preformed polymer film are made of substantially the same plastic material.

Techniques and equipment for thermally bonding plastic materials together are well know in the art and can be used in accordance with the invention.

Generally, thermal bonding is achieved through application of heat and pressure (or vacuum)

to the plastic component when in contact with the preformed polymer film. The pressure (or vacuum) force promotes intimate contact between the plastic component and preformed polymer film while the heat promotes thermal fusion of the two parts and creates the required bond.

In one embodiment, the bonding surface of the preformed polymer film is of the same type of polymer that forms the plastic component to which it is bonded.

On the opposing side to the bonding surface, the preformed polymer film has an anti-skinning surface. Upon bonding the preformed polymer film to the plastic component, the anti-skinning surface is orientated so it can make contact with the water based polymer composition during use of the plastic component. In other words, in accordance with the invention the anti-skinning surface is presented on the plastic component in a location prone to skinning.

By the preformed polymer film having or presenting an "anti-skinning" surface is meant that surface of the polymer film has little if no susceptibility to skinning. In practice that manifests itself by skin derived from the water based polymer composition having good adhesion to the anti-skinning surface thereby minimising or preventing skinning.

Without wishing to be limited by theory, it is believed the anti-skinning character of the anti-skinning surface is provided at least in part by that surface having a surface tension of at least 38 dynes/cm.

Those skilled in the art will appreciate that surface tension can be readily measured using standard test ink sets available from companies such as 3DT LLC (USA). Such standard test ink sets contain ink samples having a range of known wetting tensions that can be sequentially applied to the test surface of interest. The surface tension of the surface to be tested is said to correspond to that of the ink which first, in sequential test order (i.e. low dyne to high dyne), enables a continuous line to be drawn on the test surface and hold its integrity for at least 3 seconds.

In one embodiment, the surface tension of the anti-skinning surface ranges from 38 to about 46 dynes/cm.

Polymer material from which the preformed polymer film is made may inherently present a surface of that film having a surface tension of at least 38 dynes/cm. For example, the preformed polymer film may be made from polymer having a surface tension of at least 38 dynes/cm. In that case, the preformed polymer film can simply be bonded to the plastic component.

Polymer material from which the preformed polymer film is made may not inherently present a surface of that film having a surface tension of at least 38 dynes/cm. In that case, a precursor preformed polymer film will need a surface thereof treated so as to provide a surface tension of at least 38 dynes/cm.

There is no particular limitation on the technique used to treat such a precursor preformed polymer film to provide for the preformed polymer film having the anti-skinning surface.

Techniques for treating such a precursor preformed polymer film to provide for the anti-skinning surface include flame treatment, corona spark discharge treatment, application of a coating composition, high energy plasma treatment, application of an oxidation composition and combinations thereof.

Some techniques for treating such a precursor preformed polymer film to provide for a surface tension of at least 38 dynes/cm can only temporarily impart the required surface tension to the polymer film. For example, corona spark discharge treatment of a preformed polymer film may impart a surface tension of at least 38 dynes/cm to the film for several months. Depending on the intended application of the container component, use of such a preformed polymer film in accordance with the invention may or may not be adequate provide for a desired long term anti-skinning effect.

If a more permanent presentation of a surface tension of at least 38 dynes/cm for the preformed polymer film is required, it may desirable to provide that surface by applying an

anti-skinning coating composition to the preformed polymer film.

To assist with adhesion of an anti-skinning coating composition to the preformed polymer film, it may also be desirable to apply the anti-skinning composition to a surface of the preformed polymer film that itself has a surface tension of at least 38 dynes/cm. For example, a preformed polymer film used in accordance with the invention may be prepared by (i) providing a polymer film having a surface with a surface tension of at least 38 dynes/cm that is derived from one or more of corona spark discharge, flame, high energy plasma treatment and application of an oxidation composition, and (ii) applying an anti-skinning coating composition to that surface.

In one embodiment, the anti-skinning surface of a preformed polymer film used in accordance with the invention is provided by an anti-skinning coating composition that has been applied to preformed polymer film.

In a further embodiment, the anti-skinning surface of a preformed polymer film used in accordance with the invention is provided by an anti-skinning coating composition that has been applied to a surface of a preformed polymer film which has a surface tension of at least 38 dynes/cm.

In another embodiment, the anti-skinning surface of a preformed polymer film used in accordance with the invention is provided by an anti-skinning coating composition that has been applied to a surface of a preformed polymer film which has a surface tension of at least 38 dynes/cm that is derived from one or more of corona spark discharge, flame, high energy plasma treatment and application of an oxidation composition.

Anti-skinning coating compositions are known in the art and can advantageously be used to provide for the anti-skinning surface of preformed polymer films used in accordance with the invention. Such coating compositions include both one-pack and two-pack coating compositions. Suitable anti-skinning coating compositions include those based on epoxy, isocyanate and halogenated polymer formulations, as well as acrylic, polyamide, polyimide, polyurethane and polyvinylbutyral based polymer formulations.

The anti-skinning coating compositions may be water based or solvent based compositions.

Where the anti-skinning coating compositions are solvent based, the solvent may include aromatic hydrocarbons such as toluene, xylene and other similar, common petroleum fractional cuts, cyclic and non-cyclic aliphatic hydrocarbons such as heptane and cyclohexane, alcohols such as isopropanol and n-butanol, esters such as ethyl, isopropyl and n-butyl acetates, ketones such as methylethylketone, di-acetone alcohol and methyl isobutyl ketone and ether and glycol ether solvents such as propylene glycol methyl ether.

In one embodiment, the anti-skinning coating composition comprises ethyl acetate.

In one embodiment, the anti-skinning coating composition is a halogenated polymer formulation.

Examples of suitable halogenated polymers include, but are not limited to, chlorinated polymers such as chlorinated rubber, chlorinated polyolefins and co-polymers of vinyl chloride such as a vinyl chloride/vinyl acetate co-polymer, and combinations thereof.

Specific examples of halogenated polymer formulation include, but are not limited to, Luxaprime UMP and Luxachlor T sold by Dulux Australia.

Specific examples of acrylic based anti-skinning formulations include, but are not limited to, a range of Dulux Acrylic Roof coating primers, for example those sold under the name Armorspray series.

A specific example of an epoxy based anti-skinning formulation, includes, but is not limited to, Dulux Zincanode 402 series.

Specific examples of PVB (poly-vinyl butyral) based formulations but not limited to are the Luxiprime Etch series sold by Dulux which include both PVB as a single polymer and PVB / epoxy polymer in combinations.

An anti-skinning compositions may be applied to a (precursor) preformed polymer film surface by conventional means such as offset printing, pad or tampo printing, screen printing, flexo printing, gravure printing, inkjet printing, application by roller, brush or spray, and combinations thereof.

As an example, polyolefins such as polyethylene and polypropylene typically provide for polymer films having a surface tension of about 30 dynes/cm. Such polymer films per se are not suitable for use as a preformed polymer film in accordance with the invention. However, such a polyolefin film may be used to prepare a preformed polymer film for use in accordance with the invention. In that case, the precursor preformed polyolefin film will have a surface thereof treated as described herein so as to provide a surface tension of at least 38 dynes/cm.

The required surface treatment may, for example, involve applying to one side of the precursor preformed polyolefin film an anti-skinning coating composition as described herein.

The required surface treatment may also, for example, involve treating one side of the precursor preformed polyolefin film with one or more of corona spark discharge, flame, high energy plasma treatment and application of an oxidation composition to provide for a surface having a surface tension of at least 38 dynes/cm and then applying to that surface an anti-skinning coating composition as described herein.

The so formed treated polyolefin film will then provide for an anti-skinning surface on one side of the film and a bonding surface on the opposing side of the polymer film and can function as a preformed polymer film used in accordance with the invention.

In one embodiment, the preformed polymer film comprises a single layer of preformed polymer film having an anti-skinning surface derived from an anti-skinning coating composition.

Figure 1 illustrates a cross-section of a plastic component in accordance with the invention in the form of a container body (10). The side walls only of the container body have a preformed polymer film bonded thereto (20). In the magnified portion of Figure 1, the side wall of the container body (30) has a single layer preformed polymer film (40) bonded to it, and that bonded film presents an anti-skinning surface (50) to make contact with the water based polymer composition during use of the container body.

A plastic component in accordance with the invention is produced by a method comprising bonding a preformed polymer film to the plastic component.

Bonding of the preformed polymer film to the plastic component may be achieved by any suitable means.

For example, a preformed plastic component may have the preformed polymer film bonded to it by a technique comprising thermal bonding or adhesive bonding. In such a bonding step, the preformed polymer film makes contact with the preformed plastic component and bonding is promoted thermally or adhesively. That type of process can be readily automated using techniques known in the art.

In one embodiment, the method of the invention comprises producing the plastic component by a moulding process and the resulting product is a moulded plastic component. The step of moulding the plastic component can advantageously be integrated with the step of bonding the preformed polymer film to the component. This is achieved by moulding the plastic component while in contact with the preformed polymer film. As part of the moulding step the preformed polymer film bonds through its bonding surface to the plastic component thereby presenting its anti-skinning surface to make contact with the water based polymer composition during use of the plastic component. This form of the invention provides a simple, efficient and cost effective means of providing plastic components of or for a container suitable for a water based polymer composition with an anti-skinning surface.

In another embodiment, the method comprises moulding a shape of the plastic component while in contact with a preformed polymer film, wherein during the moulding step the

preformed polymer film bonds to the plastic component through its bonding surface and thereby presents the anti-skinning surface so as to make contact with the water based polymer composition during use of the plastic component.

The present invention may therefore also provide a method of producing a moulded plastic component of or for a container suitable for a water based polymer composition, the method comprising moulding a shape of the plastic component while in contact with a preformed polymer film, the preformed polymer film having a bonding surface and an opposing anti-skinning surface having a surface tension of at least 38 dynes/cm, wherein during the moulding step the preformed polymer film bonds to the plastic component through its bonding surface and thereby presents the anti-skinning surface so as to make contact with the water based polymer composition during use of the plastic component.

Shape forming processes for producing plastic components are well known in the art and include injection moulding and thermoforming. In both cases, heat, pressure and/or vacuum are applied to a plastic material to form the shaped plastic component. The shape of the plastic component is determined by the shape of a mould used during the process.

Where a moulded plastic component is produced in accordance with the method of the invention, the preformed polymer film bonds to the plastic component during the moulding step. To achieve that in practice, the preformed polymer film will generally be positioned within a mould used to form the moulded plastic component.

As discussed, IML is a known technique whereby a preformed polymer film is placed within a mould used to form a moulded plastic component.

IML can advantageously be used in producing the plastic component in accordance with the invention.

In one embodiment, the plastic component is a moulded plastic component and forming it comprises moulding by in mould labelling a shape of the plastic component while in contact with the preformed polymer film.

In a further embodiment the in mould labelling is injection moulding in mould labelling.

In another embodiment, the in mould labelling is thermoforming in mould labelling.

Techniques, equipment and materials used for conventional IML can advantageously be used in accordance with the present invention.

However, unlike the conventional application of IML, use of IML in accordance with the present invention requires the preformed polymer film to be located in the mould such that its bonding surface bonds to the plastic component during the moulding step and presents the anti-skinning surface to make contact with the water based polymer composition during use of the plastic component. Lay up of the preformed polymer film within the mould may therefore have a reverse profile compared with the conventional application of IML.

For example, the conventional manufacture of a container body using injection moulding IML will provide for a container body having a label presented on the outside of the container body. In that case, the preformed polymer film label will generally be laid up on the female component of the mould.

In contrast, a container body as a plastic component in accordance with the present invention will generally be produced by bonding the preformed polymer film to the internal surface of the container body. Application of injection moulding IML in accordance with the present invention to produce a container body will therefore lay up the preformed polymer film on the male component of the mould so as to locate and bond the preformed polymer film to the internal surface of the so formed container body.

The invention will now be further described with reference to the following non-limiting examples.

**Examples**

The preformed polymer film used in the Examples was a standard printing substrate polypropylene film (PP film) supplied by The Flint Group (Aust), Dandenong South. The PP films used were white or clear having a thickness of 30-40 micron. The as purchased PP film had a surface treated by corona spark discharge to provide for a surface tension of that surface (the printing surface) of at least 38 dynes $cm^{-1}$.

The PP film was used in its as purchased form or the PP film was surface treated with an anti-skinning coating composition and then used. Surface treating the PP film with an anti-skinning coating composition comprised coating the printing surface of the film with Dulux Group Plastic Pail Lining composition, 403G0038-B (a 30% solids chlorinated polymer composition), using a #12 wire wound applicator bar. The applied coating composition was found to have a dry film thickness of 12 – 15 micron as measured using an Elcometer™ thickness gauge. The surface of the PP film coated with the anti-skinning coating composition was found to have a surface tension of at least 38 dynes $cm^{-1}$.

Surface tension was measured using a series of "Dynes Pens" containing liquids of varying but know wetting tensions.

The containers used in the examples were standard circular 4 lt opaque white polypropylene plastic pails and matching lids. These pails/lids were not surface treated and presented a surface tension of 32 dynes $cm^{-1}$.

PP films (with and without applied anti-skinning coating composition) were adhered to the insides of several pails and lids using an aerosol based contact-type adhesive. Care was taken to roll the film carefully around the inside such a smooth and even application was achieved without any air bubbles. Adhesion of the PP films to the pails/lids presented the printing surface or the anti-skinning coating composition surface outwardly (i.e. not in the direction of the pail/lid).

The length of the adhered PP film was several cm less than the inside perimeter of the pail. It was located approximately 2 cm from the top edge of the pail.

For the inside surface of the lids, a similar procedure was used except circular samples of the PP film with a diameter slightly smaller than the lid ID were used.

The following examples were prepared:

Example 1: Pail and lid with adhered PP film having applied anti-skinning coating composition;
Example 2: Pail and lid with adhered PP film as purchased (i.e. no applied anti-skinning coating composition);
Example 3 (comparative): Pail and lid with no adhered PP film (i.e. Pail and lid as purchased with no surface treatment).
Example 4: PP film with acrylic polymer based anti-skinning solution applied to the treated (at least 38 dynes $cm^{-1}$) surface;
Example 5: PP film with epoxy polymer based anti-skinning solution applied to treated (at least 38 dynes $cm^{-1}$) surface; and
Example 6: PP film with PVB (poly vinyl butyral) polymer based anti-skinning solution applied to treated (at least 38 dynes $cm^{-1}$) surface.

In Examples 1 and 2 the applied PP film was orientated such that the anti-skinning surface was oriented to the inside of the pail and lid to ensure that this surface would contact the water based polymer product composition. To confirm the correct orientation of the PP film the surface tension of the pail/lid was measured and found to be at least 38 dynes $cm^{-1}$.

In Examples 4, 5 and 6 the anti-skin coated PP films were prepared by applying the respective solutions as described above, to the treated surfaces by use of a #12 wire wound coating bar with wire diameter sufficient to obtain a dried film thickness of not more than 20 microns and not less than 10 microns, depending on the specific properties of respective solutions. The width of the applied coatings on the treated PP films was adjusted such that a strip of approximately 1.5 cm of plain, treated PP was left on either side.

To perform the anti-skinning test on Examples 1, 2 and 3, the containers were filled with paint, in this case Dulux Professional Low Sheen White water based acrylic paint.

Two different anti-skinning test procedures were undertaken.

For the first test, 1.5 litres of the paint were introduced to the pails of Examples 1-3. Lids were securely placed on each pail and the closed pails were inverted for 24 hours to ensure thorough paint wetting of the inside surfaces.

The pails were then placed under infra-red heating lamps at a distance from the lamp such that the outer surface of the lid at the centre point was held at 50° C for three hours measured by attached contact thermocouples.

This test provides an accelerated assessment of the anti-skinning properties of the pails/lids.

At the end of the three hours the pails were taken from the test rig, allowed to cool and the lids removed. Dried paint areas were assessed for paint adhesion by a simple scratch test with either a finger nail or a similarly profiled tool such as a flat screw driver tip.

Examples 1 and 2 showed good adhesion of the paint film to the pail/lid surface thereby demonstrating anti-skinning properties. Example 1 showed better paint adhesion compared with Example 2 as determined by the absence of any pieces of paint removal greater than 2-3 mm.

On the other hand Example 3 showed poor adhesion of the paint film as determined by long shards of dried paint up to 3-4 cm in length being readily peeled off the pail/lid surface indicating a clear skinning problem.

The second of the test procedure was designed to mimic long term transport of plastic pails of water based paint. In that test three litres of the above paint was placed into each pail of Examples 1-3. The pails were securely lidded and held in the inverted position for 24 hours to ensure that full coverage and wetting out of the upper inside areas of the pails and insides of each lid was achieved. After that period the pails were turned right side up and placed in an oven held at 40°C for four weeks.

At the end of that time the pails were removed, allowed to cool and opened. As before with the first test, evidence for anti skinning behaviour was evaluated by assessing the paint adhesion on all examples, in this instance on both the inside lid as well as the upper areas of the pail surface covered by the attached preformed polymer films.

The anti-skinning results obtained for this test were similar to test 1 in that Examples 1 and 2 exhibited good anti-skinning properties. Example 1 showed better paint adhesion compared with Example 2 as determined by the absence of any pieces of paint removal greater than 2-3 mm.

On the other hand Example 3 showed poor adhesion of the paint film as determined by long shards of dried paint up to 3-4 cm in length being readily peeled off the pail/lid surface indicating a clear skinning problem.

To perform anti-skinning tests on the coated films as described in Examples 4, 5 and 6 the films were simply taped out flat and the same Dulux Professional Low Sheen White water based acrylic paint as used on Examples 1-3 was applied lengthwise down each PP strip using a #55 coating bar to obtain dried paint thicknesses of approximately 75 microns such that the dried paint film on each of the PP strips covered both the plain and the anti-skinning solution coated areas.

After the paint on each of the films of Examples 4, 5 and 6 had dried the anti-skinning (adhesion) properties were tested by the same finger nail scratch test as above comparing the adhesion over the plain PP and the anti-skin coated areas.

In all three Examples (Examples 4, 5 and 6) the paint that had dried over the anti-skin coated areas of each film exhibited good adhesion whereas the paint over the plain, non, anti-skin coated area had little or no adhesion.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will

be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.

**Claims:**

1. A plastic component of or for a container suitable for a water based polymer composition, the plastic component having bonded thereto a preformed polymer film that presents an anti-skinning surface to make contact with the water based polymer composition during use of the plastic component, wherein the anti-skinning surface has a surface tension of at least 38 dynes/cm and is derived from a halogenated polymer formulation.

2. The plastic component according to claim 1 in the form of a container body, a container closure, a wipe surface, a spout or a combination of two or more thereof.

3. The plastic component according to claim 2, wherein the container body is of a size suitable to contain from about 250ml to about 50 litres of water based polymer composition.

4. The plastic component according to claim 2 or 3, wherein the container body is in the shape of a pail.

5. The plastic component according to any one of claims 1 to 4, wherein the plastic component is made of polyolefin, polyester, polyamide, polyacetal, acrylonitrile butadiene styrene copolymer, ethylene methacrylic acid copolymer and combinations thereof.

6. The plastic component according to any one of claims 1 to 5, wherein the preformed polymer film is thermally bonded to the plastic component.

7. The plastic component according to any one of claims 1 to 5, wherein the preformed polymer film is adhesively bonded to the plastic component.

8. The plastic component according to any one of claims 1 to 7, wherein the preformed polymer film comprises a polyolefin, polyester, polyamide, polyacetal, acrylonitrile butadiene styrene copolymer, or ethylene methacrylic acid copolymer film.

9. The plastic component according to any one of claims 1 to 8, wherein the halogenated

polymer formulation comprises chlorinated rubber, chlorinated polyolefin, co-polymer of vinyl chloride or combinations thereof.

10. A container comprising a water based polymer composition, the container comprising at least one plastic component having bonded thereto a preformed polymer film that presents an anti-skinning surface that is in contact or to make contact with the water based polymer composition during use of the plastic component, wherein the anti-skinning surface has a surface tension of at least 38 dynes/cm and is derived from a halogenated polymer formulation.

11. The container according to claim 10, wherein the plastic component is selected from a container body, a container closure, a wipe surface, a spout and combinations thereof.

12. A method of producing a plastic component of or for a container suitable for a water based polymer composition, the method comprising bonding a preformed polymer film to the plastic component, the preformed polymer film having a bonding surface and an opposing anti-skinning surface having a surface tension of at least 38 dynes/cm that is derived from a halogenated polymer formulation, wherein during the bonding step the preformed polymer film bonds to the plastic component through its bonding surface and thereby presents the anti-skinning surface to make contact with the water based polymer composition during use of the plastic component.

13. The plastic component according to claim 12, wherein the preformed polymer film is adhesively bonded to the plastic component.

14. The plastic component according to claim 12, wherein the preformed polymer film is thermally bonded to the plastic component.

15. The method according to claim 12 which produces a moulded plastic component and comprises moulding a shape of the plastic component while in contact with the preformed polymer film, wherein during the moulding step the preformed polymer film bonds to the plastic component through its bonding surface and thereby presents the anti-skinning surface

so as to make contact with the water based polymer composition during use of the plastic component.

16. The method according to claim 15, wherein moulding the shape of the plastic component is performed by thermoforming.

17. The method according to claim 15, wherein moulding the shape of the plastic component is performed by injection moulding.

18. The method according to any one of claims 12 to 17, wherein the plastic component is in the form selected from a container body, a container closure, a wipe surface, a spout and combinations thereof.

19. The method according to any one of claims 12 to 18, wherein the plastic component is made of polyolefin, polyester, polyamide, polyacetal, acrylonitrile butadiene styrene copolymer, ethylene methacrylic acid copolymer and combinations thereof.

20. The method according to any one of claims 12 to 19, wherein the preformed polymer film comprises of polyolefin, polyester, polyamide, polyacetal, acrylonitrile butadiene styrene copolymer, or ethylene methacrylic acid copolymer film.

21. The method according to any one of claims 12 to 20, wherein the halogenated polymer formulation comprises chlorinated rubber, chlorinated polyolefin, co-polymer of vinyl chloride or combinations thereof.