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(54) **Container sealing.**

(57) A sealed container comprises a container body, an end closure member and a sealant therebetween, in which the sealant is bonded to the body and to the closure member by a bond having a peel/bond strength (as herein defined) of at least 30 Newtons.

A strong bond of this type can be obtained by providing an end closure member which carried a composition that can be activated indirectly, e.g. by induction-heating, to form a sealant bonded to the closure member and also to the container body.

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This invention relates to the sealing of containers, and in particular to the material that is used to provide a seal between a container body and an end closure, as well as to a process for forming a seal.

Much research has gone into the problem of providing a secure seal between containers and corresponding end closures. A seal must be formed between these two components after the container is filled with, say, a beverage or microwavable food. It is of course important to ensure that the contents of the sealed container do not leak out, and also to prevent bacteriological or other contamination of the contents from the ambient atmosphere.

The container may be of metal or plastic material. The closure member is usually of metal. It will often include a ring-pull or other frangible portion, in order to allow ready access to the contents.

It is conventional to crimp or otherwise form the end closure onto a flange at the open end of the container, and to provide a sealant composition between the two components. Metal cans formed in this way are described in, for example, US-A-3403813, US-A-3774560, US-A-3882763 and US-A-4089283; reference to these specifications will show various forms, and procedures for forming, container-closure seals.

In US-A-3403813, the sealant is atactic amorphous polypropylene; it states that this material has viscosity characteristics such that it provides a permanently tacky sealant between the can end and can body. In US-A-3774560, an expandable foam seam-sealing compound is used, which expands, on heating, to fill voids that may be present in the seam area.

Despite these various proposals, sealed containers of the type described suffer from various disadvantages. Firstly, it is difficult to fill all the voids that may be formed during sealing, especially when the two components are respectively of metal and plastics. Secondly, the compressive force that is applied when bringing the two components into contact leads to the possibility of buckling of relatively weak containers, e.g. of plastics. Thirdly, the stress imposed by the forming of the respective components at the area of sealing means that multi-layer plastics materials may delaminate during seaming, when the curl overlap between container and closure takes place.

According to a first aspect of the present invention, in a sealed container comprising a container body, an end closure member and a sealant therebetween, the sealant is bonded to the body and to the closure member by a bond having a peel/bond strength of at least 30, e.g. up to 50, 75, 100 or more, Newtons, by a flat seal peel test which involves flat-sealing a 15 mm wide strip of coated aluminium to a 15 mm wide strip of polypropylene, as used in a container; the samples are then peeled apart at an angle of 180° and at a speed of ~100 mm/min.

According to a second aspect of the present invention, an end closure member, of the type suitable for sealing to a container body, carries a composition that can be activated indirectly to form a sealant bonded to the closure member and also to a container body.

According to a third aspect of the present invention, a method for producing a sealed container comprises seaming a container body and an end closure member with an indirectly-activatable composition therebetween, and activating the composition so that it forms bonds to the closure member and to the container body.

The present invention is based on the utility of a strong bond between the container body and the sealant, and between the sealant and the end closure. This is in contrast to the previous use of materials which have various properties but are designed primarily to prevent the passage of contaminants in and/or contents out. Further, by contrast with the known system of treating a sealant composition to foam it in situ, the present invention can involve the use of an activatable material to form the desired bond.

The effect of the strong bond is to provide several important advantages to products and processes of the present invention. Firstly, the burst strength of the sealed container is enhanced. Secondly, the fact that a strong bond can be formed with plastics material indirectly means that little compressive force is needed when bringing the components together; the system is therefore as useful for plastics as metal containers. Thirdly, the sealant fixes the relative positions of the components in the sealed container and resists the forces that are built in during crimping; this is a particular advantage when using plastics laminates that are liable to delaminate. By creating a weld between the materials, the strength of the finished seam will be increased even if delamination has taken place during seaming. Unlike unsealed containers, further delamination will be restricted and therefore a much stronger and higher integrity container will result.

In general terms, the nature of the container body and closure member may be conventional. The container will usually be provided with a flange at its open end, to facilitate the contact between the components. The closure member may be formed with a ring-pull or other frangible portion.

The components may be combined in conventional manner, e.g. using chucks and rolls to press the components together. A hermetic joint is formed by interlocking the edges to both the closure and container components. The joint is generally produced in two operations, a sealing compound having already been

introduced between the other components, e.g. by forming a layer thereof on the closure member. The first operation forms a metal/plastic or metal/metal curl/overlap, while the second operation flattens them to produce the required seam. This operation may be followed, if necessary or desired, by activation of the sealant, e.g. by induction heating, to a temperature of, say, 150 to 200 °C.

Examples of sealant materials than can be used in the invention include the following:

Polymers that can be extruded onto aluminium or steel sheet: these include polypropylene, polyethylene and polybutylene;

Morprime-based systems;

Polyolefinic resins: these are mainly modified ethylene acrylates (trade names include Admer, Modic and Bynel);

PE-CTFE;

PE-TFE;

PTFE;

EVA;

MAA;

EAA;

Ionomers; and

Modylene P/A (carboxylic acid-modified PP).

By way of example, the invention will be described below in connection with a plastics or polypropylene container and a metal or aluminium end closure, although steel is an alternative metal, and of course the invention is applicable to metal container-metal end systems.

As already indicated, a Morprime/polypropylene or other material can be applied to one of the metal or plastics components, and most suitably to a metal closure member. It can be applied as a lacquer, by way of replacement for a conventional epoxy lacquer. A primary aim of the lacquer is to provide a, say, polypropylene/aluminium weld in the area of the double seam, and to provide protection of aluminium from attack by acids, e.g. in the container contents.

A suitable lacquer may comprise a dispersion of modified polypropylene or other polymer in a blend of high boiling solvents. The polypropylene can be blended with epoxy resins to provide excellent adhesion to aluminium and steel and can be used to make high strength laminations to polypropylene.

The sealant may be applied in an overall coating process. Alternatively, the sealant may be applied selectively. For example, a heat-sealing material may be applied only to the flange overlap area on the aluminium or other closure member.

In either case, bonding between a polypropylene flange and an aluminium end can be formed indirectly. For example, fusion is created by passing the seamed container through an induction field. The energy can be focused on the area of overlap by coil design, causing the aluminium to heat, and resulting in the lacquer melting and fusing to the polypropylene.

Conventional contact heating systems or ultrasonics could create the same effect as induction sealing. An important advantage of induction sealing is that the time taken to create the bond is very short, and will therefore not significantly affect existing canning line speeds. Other suitable heating systems include sonic welding, induction welding, radio-frequency welding, conduction welding, spin-welding and impulse sealing.

In addition to the advantages described above, the present invention may allow greater potential for the reduction of problems associated with reverse seam wrinkles. It may also provide wider seaming operating windows. All these advantages and effects can be achieved without any significant reduction of conventional double-seaming line speeds with a heat-sealing system.

The following Example illustrates the invention.

Example

Aluminium sheet was hand-coated with a Morprime lacquer. The Morprime lacquer basically consists of an epoxy lacquer containing a polypropylene suspension. The lacquer was applied as a thin film and cured to the surface in an oven.

The sheets were converted to ends and seamed onto 30 cm. diameter containers, and induction-sealed using a system supplied by Stanelco.

For testing, the containers were split into two groups. One group was tested without retorting, and the other group was retorted at 121 °C and then tested. The containers were tested by assessing their burst strength. The burst test involves introducing compressed air into the container in a controlled manner, and recording the pressure needed to rupture the pack's seal.

The results of the burst tests are given below:

Unretorted Containers		
	Conventional double-seamed	Induction-sealed
1st OP seam only	very low	193 kPa
2nd OP seam	131 kPa	234 kPa

Retorted Containers		
	Conventional double-seamed	Induction-sealed
1st OP seam only	very low	213 kPa
2nd OP seam	124 kPa	207 kPa

These results show that the induction-sealed containers not only possess a burst strength twice that of conventionally-seamed containers, but also possess equivalent bond strengths when only seamed with the first operation (OP) seaming roll.

In the flat seal peel test described above, results of 30-40 Newtons have been obtained by operation in accordance with the invention.

Claims

1. A sealed container comprising a container body, an end closure member and a sealant therebetween, in which the sealant is bonded to the body and to the closure member by a bond having a peel/bond strength (as herein defined) of at least 30 Newtons.

2. A container according to claim 1, in which the container body and the end closure member are each of metal.

3. A container according to claim 1, in which the container body is of plastics and the end closure member is of metal.

4. A container according to claim 1, 2 or 3, in which the sealant comprises polypropylene.

5. An end closure member, of the type suitable for sealing to a container body, which carried a composition that can be activated indirectly to form a sealant bonded to the closure member and also to a container body.

6. A member according to claim 5, in which the sealant comprises polypropylene.

7. A member according to claim 5 to 6, in which the composition can be activated by induction-heating.

8. A method for producing a sealed container, which comprises seaming a container body and an end closure member with an indirectly-activatable composition therebetween, and activating the composition so that it forms bonds to the closure member and to the container body.

9. A method according to claim 8, in which the composition is activated by induction-heating.

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EUROPEAN SEARCH REPORT

Application Number

EP 92 20 1560

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	DE-B-1 112 236 (GENERAL MILLS INC.) * column 6, line 36 - column 7, line 6; figure 3 * ---	1,2	B65D6/28 B21D51/46
Y		3,4	
X	GB-A-2 064 468 (METAL BOX LIMITED) * page 3, line 22 - line 27 * * page 4, line 92 - line 96; figure 1 * ---	5-7	
Y		4	
Y	EP-A-0 139 268 (BALL CORPORATION) * page 3, line 5 - line 6 * -----	3	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B65D
B21D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	07 SEPTEMBER 1992	SMITH C.A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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O : non-written disclosure
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E : earlier patent document, but published on, or after the filing date
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& : member of the same patent family, corresponding document

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