Title: TWO-LAYERED SHEET MATERIAL FOR WRAPPING METAL

Abstract: A sheet material for packaging metal goods to protect them from corrosion during storage has two layers bonded together only at the edges along their length. The outer layer is a woven polyolefin scrim giving mechanical strength to the material. The inner layer is a polyolefin film that incorporates a combination of volatile corrosion inhibitors and contact corrosion inhibitors. The outer layer may be a composite layer that includes polyolefin films or kraft paper.
TWO-LAYERED SHEET MATERIAL FOR WRAPPING METAL

Field of the Invention

The present invention is directed to wrapping materials for use in packaging metal goods. More particularly, it is directed to a two-layer sheet material that reduces corrosion of the wrapped metal goods during handling, transportation and storage.

Background of the Invention

Most metals are susceptible to corrosion from ambient or atmospheric conditions. The metal packaging industry has successfully developed various methods and compounds for reducing corrosion of metals during storage and use. However, the effectiveness and shelf life of metal wrapping materials still requires improvement. Developing new formulas for corrosion inhibitors and new methods of incorporating them in the packaging material are two major areas of research.

Commonly, volatile corrosion inhibitors (also called vapor phase corrosion inhibitors) are used in wrapping materials for metal items to protect them from corroding. By vaporization from a solid or liquid state, the volatile corrosion inhibitors reach the surface of the object to be protected and form a stable bond with the metal surface. The limitations for good efficiency are (1) the transfer of the inhibitors to the metallic surface, (2) the rate of transfer, and (3) the effectiveness of the packaging seal around the metal object, i.e. to prevent the inhibitor from escaping into the atmosphere.

Contact corrosion inhibitors are transferred to the metal surface by creeping of the inhibitors from the wrapping material directly to the metal. This allows the corrosion inhibitor to remain with the metal even if the package is not sealed properly.
Summary of Invention

The present invention provides a sheet material for packaging metal items so as to protect them from corrosion during storage. It has two layers, bonded together only at their edges along the length of the material, in which the other layer is a woven scrim and the inner layer is a polyolefin film having a combination of volatile corrosion inhibitors and contact corrosion inhibitors. The outer layer may be a composite layer in which one or more polyolefin films or coatings, or kraft paper, is laminated to the scrim. The inner layer can slide freely across the outer layer, permitting it to move independently of the outer layer and cling to the wrapped metal items.

The unique combination of features provided by the sheet material of the invention results in a mechanically strong and highly effective wrapping material able to constantly and adequately supply corrosion inhibitors to wrapped metal products for a substantial period of time, effectively inhibiting corrosion.

Brief Description of Drawings

Figure 1 is an enlarged cross-sectional view through the sheet material according to the first embodiment of the invention.

Figure 2 is an enlarged cross-sectional view through the sheet material according to the second embodiment of the invention.

Figure 3 is an enlarged cross-sectional view through the sheet material according to the third embodiment of the invention.
Figure 4 is an enlarged cross-sectional view through the sheet material according to the fourth embodiment of the invention.

**Detailed Description**

Figures 1 to 4 show preferred embodiments of the sheet material. In these drawings, the same or similar elements in the various embodiments are indicated by like reference numbers.

Figure 1 illustrates a first embodiment of the invention. Sheet material 2 comprises a scrim 4 and a polyolefin film 6 bonded along opposite edges 8, 10 by strips of adhesive 12. In use for wrapping metal goods, the film 6 is the inner layer, i.e. the layer that contacts the wrapped metal goods, and the scrim is the outer layer.

It will be understood that the sheet material of the invention is produced by feeding the layers off rolls and through conventional fabricating equipment, including rollers or laminators. The direction along the length of the material as processed through the production equipment is referred to herein as the "machine direction." The direction perpendicular to the machine direction is referred to herein as the "cross direction," being the direction along the width of the sheet material between edges 8 and 10.

The scrim 4 is a woven structure made of polyolefin tapes which are fabricated by methods well known in the art. The tapes are about 1.5 to 6 mm in width. The number of tapes in the machine direction is preferably in the range of 4 to 16 tapes per inch. The number of tapes in the cross direction is preferably in the range of 2 to 16 tapes per inch. The dicetex of the tapes (grams per 10,000 meters) is preferably in the range of 500 - 2,500. The weight of the scrim is preferably in the range
of 30 to 400 grams per square meter. The width of the scrim 4, and of the sheet material 2, can be any convenient width that can be processed on available production equipment and is suitable for a particular application. It is preferably in the range of 30 to 160 inches.

Scrim 4 has high mechanical and tensile strength in both the machine and cross directions. During production of the tapes, they are stretched from three to five times their original length by passing through hot pinch rolls to align polymer chains within the body of the tapes to increase their strength. It is a function of the scrim to impart mechanical strength to sheet material 2.

The scrim 4 may be fabricated of any suitable polyolefin, including high density polyethylene, low density polyethylene and polypropylene.

Film 6 is an extruded film made of any suitable polyolefin, including polyethylene (low density or high density) or polypropylene. The thickness is preferably in the range of 0.5 - 4 mils. The polyolefin of film 6 can be the same as or different from the polyolefin of scrim 4. Film 6 is impermeable to air and water, providing a barrier to protect the wrapped goods from the atmosphere.

Polyolefin film 6 incorporates both a volatile corrosion inhibitor and a contact corrosion inhibitor. Preferably, the volatile corrosion inhibitor is present in concentrations of 0.1 to 5 percent by weight (i.e. relative to the weight of the inner layer). Preferably, the contact corrosion inhibitor is present in concentrations of 0.5 to 15 percent by weight. The volatile and contact corrosion inhibitors can be selected from ones well known in the art. For example, the volatile corrosion inhibitor can be a nitrite compound such as dicyclohexylammonium
nitrite; the contact corrosion inhibitor can be an alkali metal nitrite or benzoate, such as sodium nitrite or sodium benzoate. Any of a wide variety of volatile and contact corrosion inhibitors known in the art can be selected for use in the invention. The volatile corrosion inhibitors are transferred to the metal surface by volatilizing from the solid phase and inhibit corrosion by forming a protective layer around the metal surface. The contact corrosion inhibitors protect by creeping from the film to the metal surface. The sheet material is preferably able to supply corrosion inhibitors to the metal item for a period of up to two years, effectively inhibiting corrosion.

The film 6, being substantially impermeable to gases, forms a barrier that holds the volatile corrosion inhibitor, released from the film, in proximity to the wrapped item, preventing the volatile corrosion inhibitor from escaping into the atmosphere.

The scrim 4 is bonded to the film 6 by strips of adhesive 12 along edges 8 and 10, i.e. along the edges in the machine direction. The strips of adhesive are narrow relative to the total width of the sheet material. They are preferably in the range of 0.5 - 3 inches. The layers may alternatively be bonded by means of melt bonding or sonic bonding, or other suitable means. The two layers of the sheet material are accordingly unattached except at their edges 8 and 10, and are accordingly free to slide relative to one another across their middle part and thereby work independently have each other in protecting the wrapped item. Not being laminated to the scrim, the inner layer is more free to cling to the wrapped metal item. The natural tendency of a polyolefin film to hold a static charge promotes static cling of the film to the metal item. The close contact of the film 6 and the wrapped item is conducive to transfer of the contact corrosion inhibitor to the metal item.
The embodiments of the sheet material shown in Figs. 2 to 4 differ from that in Fig. 1 in having a composite outer layer. The inner layer (film 6) and the bonding of the inner and outer layers along their edges in the machine direction, remains the same.

Referring next to Figure 2, which illustrates a second embodiment of the invention, the sheet material 20 differs from sheet material 2 in having a film 22 laminated to the outer side of scrim 4. The film 22 is a coating of polyolefin applied to the scrim to impart additional protection against the transmission of air and water into contact with the wrapped item. The film 22 is preferably from 0.5 to 3 mils in thickness and has a weight of 12 to 72 grams per square meter. The polyolefin of film 22 may be any suitable polyolefin, including high and low density polyethylene and polypropylene. It can be the same as or different from the polyolefin of scrim 4 and of film 6.

A third embodiment of the sheet material is shown in Fig. 3. Sheet material 30 differs from sheet material 20 in having the film 32 laminated to the inner side of scrim 4. The film 32 is preferably from 0.5 to 3 mils in thickness and has a weight of 12-72 grams per square meter. The polyolefin of film 32 which may be any suitable polyolefin, including high and low density polyethylene and polypropylene. It can be the same as or different from the scrim 4 and film 6.

The fourth embodiment is shown in Fig. 4. Sheet material 40 differs from sheet material 2 in that it includes a layer of kraft paper 42 laminated to the inner side of scrim 4 by means of laminating polyolefin layer 44. The kraft paper 42 preferably has a weight in the range of 200 grams per square meter. It imparts strength and moisture-absorbency to the outer layer. The laminating layer 44 can be any suitable polyolefin, including high and low density polyethylene and polypropy-
lene. It can be the same as or different from the polyolefin of scrim 4 and film 6. It has a thickness in the range of 0.5 to 2 mils.

The corrosion inhibitors are incorporated into the resin used to make the film of the sheet material by methods well known in the art. Typically, the compositions are compounded with a carrier resin in a master batch, which is then mixed and diluted with the base resin used to make the film.

Although the invention has been described in terms of specific embodiments, it is not intended that the invention be limited to these embodiments. Various modifications within the scope of the invention will be apparent to those skilled in the art. For example, instead of a layer of kraft paper, a layer of non-woven fibers can be used. One or more layers may include pigments or other additives, such as flame retardants and UV-resistant compositions, making the product more suitable for particular applications. The outer surface may be treated with an anti-skid coating. The scope of the invention is defined by the claims that follow.
WHAT IS CLAIMED IS:

1. A sheet material for wrapping metal goods, comprising:
   5 (a) A first layer comprising a polyolefin film for contact with 
        said metal goods and incorporating 
        (i) a contact corrosion inhibitor; and 
        (ii) a volatile corrosion inhibitor; and 
   (b) a second layer comprising a woven polyolefin scrim, said 
   10 second layer being attached to said first layer at narrow, spaced-apart 
   strips along two parallel edges of said first and second layers.

2. A sheet material according to claim 1 wherein said scrim com- 
   15 prises high density polyethylene tapes.

3. A sheet material according to claim 1 wherein said scrim com- 
   20 prises polypropylene tapes.

4. A sheet material according to claim 2 or 3 wherein said tapes 
   25 have a width of 1.5 to 6 mm.

5. A sheet material according to any one of claims 2-4 wherein said 
   scrim comprises 4 to 16 tapes per inch in the machine direction 
   and 2 to 16 tapes per inch in the cross direction.

6. A sheet material according to any preceding claim wherein said 
   scrim has a weight in the range of 30-400 grams per square 
   meter.

7. A sheet material according to any preceding claim wherein said 
   polyolefin film is polyethylene.
8. A sheet material according to any preceding claim wherein said polyolefin film is polypropylene.

9. A sheet material according to any preceding claim wherein said first and said second layers are attached by means of adhesive.

10. A sheet material according to any preceding claim wherein said contact corrosion inhibitor comprises 0.5 to 15 percent by weight of said polyolefin film.

11. A sheet material according to any preceding claim wherein said volatile corrosion inhibitor comprises 0.1 to 5 percent by weight of said polyolefin film.

12. A sheet material according to any preceding claim wherein said sheet material has a width in the range of 30 to 160 inches.

13. A sheet material according to any preceding claim wherein said second layer further comprises a polyolefin film laminated to said scrim on an outer side thereof.

14. A sheet material according to claim 13 wherein said laminated polyolefin film has a thickness in the range of 0.5 to 3 mils.

15. A sheet material according to claim 13 or 14 wherein said second layer further comprises a polyolefin film laminated to said scrim on an inner side thereof.

16. A sheet material according to any one of claims 1-14 wherein said second layer further comprises a sheet of kraft paper bonded to said scrim on an inner side thereof.
17. A sheet material according to claim 16 wherein said kraft paper has a weight in the range of 30 to 200 grams per square meter.

18. A sheet material according to claim 16 or 17 further comprising a polyolefin film laminated to and between said scrim and said kraft paper.

19. A sheet material according to claim 18 wherein said polyolefin film laminated to and between said scrim and said kraft paper has a thickness in the range of 0.5 to 2 mils.
## A. CLASSIFICATION OF SUBJECT MATTER

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According to International Patent Classification (IPC) or to both national classification and IPC.

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched.

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>US 5 958 805 A (QUINONES VICTOR MANUEL) 28 September 1999 (1999-09-28) column 2, line 64 -column 4, line 27 claim 1</td>
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Further documents are listed in the continuation of box C. Patent family members are listed in annex.

* Special categories of cited documents:
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Authorized officer: Stinchcombe, J

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