

DESCRIPTION

Title of Invention: COATED-ELECTRODE PACKAGING MATERIAL AND PACKAGE
Technical Field

The present invention relates to a coated-electrode packaging material and a package composed of coated electrodes and the packaging material in which the coated electrodes are packaged. More particularly, the present invention relates to a technique for preventing absorption of moisture by coated electrodes and damage to the coated electrodes during transport and during storage.

Background Art

Welding is an essential technique in any type of steel structure manufacturing industry. Among welding consumables, coated electrodes have been used for a long time. With a growing trend toward use of gas-metal arc welding instead of shielded metal-arc welding in domestic and foreign markets, there is a growing demand for solid wires and flux-cored wires. However, because of their ease of handling in field welding, coated electrodes are still used.

Coated electrodes have greater portability than other welding consumables and have the advantage of enabling relatively simple work in which a welder carries the required number of coated electrodes close to a structure to be welded, inserts a coated electrode into a holder connected to a power supply, and welds the structure. On the other hand, because of the high hygroscopicity of the coating of coated electrodes, the coated electrodes must be dried at a temperature in the range of 50°C to 450°C before welding.

In particular, moisture absorption after drying of coated electrodes for use in welding of high-strength materials must be strictly controlled. Such coated electrodes are therefore usually kept warm in a portable dryer until welding. Thus, a welder must carry coated electrodes in a dryer during welding and can therefore carry only a limited number of coated electrodes. Although coated electrodes may be packaged in a metal can to prevent moisture absorption, this increases manufacturing costs and the mass of the coated electrodes, also resulting in difficulties in performing further treatments after they have been installed.

Thus, there is a demand for a coated-electrode packaging material that is light-weight, has high shock resistance, requires no predrying, allows coated electrodes to be used immediately after the packaging material is opened, and can significantly reduce the workload of welders. In one proposed packaging form, a bundle of welding rods is sealed by entirely wrapping the bundle of welding rods with a laminated aluminum foil

film while a cushioning resin film is attached to each end of the bundle of welding rods. Portions of the laminated aluminum foil film protruding from the ends are wrapped around the bundle of welding rods to improve moisture barrier properties (see Patent Literature 1).

In another packaging form, welding rods in a moistureproof film bag are packed in a packing box, such as a corrugated cardboard (see Patent Literature 2). In another packaging structure, welding rods are contained in a box formed of a multilayer material, which is composed of a paperboard and a thermofusible plastic film laminated to both sides of the paperboard, and both ends of the box are superposed and heat-sealed to seal the box (see Patent Literature 2).

Citation List

Patent Literature

PTL 1: Japanese Unexamined Utility Model Registration Application Publication No. 2-83285

PTL 2: Japanese Examined Utility Model Registration Application Publication No. 4-51126

PTL 3: Japanese Unexamined Utility Model Registration Application Publication No. 61-90782

Summary of Invention

Technical Problem

However, the related art has the following problems. In the packaging form described in Patent Literature 1, wrapping the portions of the laminated aluminum foil film protruding from the ends requires complicated work and is difficult to automate in mass production in a factory. Furthermore, because of their odd packaged form, bundles of welding rods create wasted space in a packing box, such as a corrugated cardboard, and the size of the packing box is greater than necessary.

In the packaging form described in Patent Literature 2, a moistureproof polyethylene film is sealed with a tape. This results in unstable sealing and insufficient moisture barrier properties. In the packaging structure described in Patent Literature 3, the welding rods are in direct contact with the thermofusible plastic on the material side, and the material is easily torn. Furthermore, since the packaging structure is composed of a paperboard blank and a thermofusible plastic film laminated to both sides of the paperboard blank, blanks having dimensions and shape that satisfy a specified volume capacity must be prepared for each size, and it is difficult to apply the common packaging structure to different sizes.

Accordingly, it is a principal object of the present invention to provide a coated-electrode packaging material and a package that are simple to manufacture and exhibit excellent strength, resistance to moisture absorption, and shock resistance during transport.

Solution to Problem

A coated-electrode packaging material according to the present invention is composed of a box for containing one or more coated electrodes and a multi-layer resin film that covers the box.

In the packaging material, the multi-layer resin film may be composed of three or more layers, the innermost of which may have a thickness in the range of 50 to 90 μm , and the rest of which may have a thickness in the range of 5 to 30 μm .

A deposited silica film may be formed on at least one of resin layers that form the multi-layer resin film.

The box may be enclosed in a bag that is formed of the multi-layer resin film.

The box may be formed of paper or synthetic paper.

A package according to the present invention includes one or more coated electrodes in the packaging material.

In the package, the box may be sealed with the multi-layer resin film.

Advantageous Effects of Invention

Since a packaging material according to the present invention is composed of a box and a multi-layer film that covers the box, the present invention can provide a package containing coated electrodes that has excellent strength, resistance to moisture absorption, and shock resistance during transport without requiring complicated work.

Brief Description of Drawings

[Fig. 1] Fig. 1(a) is a schematic perspective view of a packaging material according to a first embodiment of the present invention, and Fig. 1(b) is a cross-sectional view thereof.

[Fig. 2] Fig. 2 is a cross-sectional view of an exemplary structure of a multi-layer resin film illustrated in Fig. 1.

Description of Embodiments

Embodiments of the present invention will be described in detail below. The present invention is not limited to these embodiments.

First Embodiment

First, a packaging material according to a first embodiment of the present invention will be described below. Fig. 1(a) is a schematic perspective view of a

packaging material according to a first embodiment of the present invention, and Fig. 1(b) is a cross-sectional view thereof. As illustrated in Figs. 1(a) and 1(b), a packaging material 1 according to the present embodiment is used to wrap coated electrodes 10 and is composed of a box 2 that contains one or more coated electrodes 10 and a multi-layer resin film 3 that covers the box 2.

[Box 2]

The box 2 is necessary to maintain the shape and improve handleability during transport and during use. This effects are particularly significant when the number of coated electrodes 10 is decreased. For example, if the packaging material 1 easily loses its shape, it is difficult to reseal the box 2 while some of the coated electrodes 10 remain. The box 2 may be made of any material and is preferably made of paper or synthetic paper. The box 2 made of paper or synthetic paper is light weight and rarely loses its shape. Paper or synthetic paper is also more advantageous than other materials, such as plastics, in terms of manufacturing costs.

[Multi-Layer Resin Film 3]

Fig. 2 is a cross-sectional view of an exemplary structure of the multi-layer resin film 3. As illustrated in Fig. 2, the multi-layer plastic film 3 is composed of two or more resin layers and imparts shock resistance, waterproofness, and resistance to moisture absorption to a package containing the coated electrodes 10. These effects are insufficient when a monolayer plastic film is used. The multi-layer plastic film 3 of the packaging material 1 according to the present embodiment can absorb a shock during transport and block moisture from the outside air. Thus, coated electrodes can be used without drying immediately after the packaging material is opened.

The multi-layer resin film 3 may be formed into a bag. In this case, the box 2 containing the coated electrodes 10 is put into a bag that is formed of the multi-layer resin film 3, and an end of the bag is sealed to manufacture a package having a sealed structure. This simplifies the process and facilitates automation of packaging.

The type of resin that forms each of resin layers 3a to 3d of the multi-layer resin film 3 is not particularly limited and may be a general-purpose resin, for example, a polyolefin resin, such as polyethylene or polypropylene, a nylon resin, a polyester resin, or a poly(ethylene terephthalate) resin. The number of resin layers that form the multi-layer resin film 3 may be two or more, preferably three or more in terms of shock resistance, waterproofness, and resistance to moisture absorption.

In order to improve sealing performance and workability, the innermost layer in contact with the box 2 (innermost layer 3a) is preferably formed of a heat-sealable

thermoplastic resin. This allows the inside of the packaging material to be easily sealed. In order to improve waterproofness and resistance to moisture absorption, the outermost layer in contact with the outside air (outermost layer 3d) is preferably formed of a resin having low water permeability.

(Thickness)

The thickness of each of the resin layers 3a to 3d of the multi-layer resin film 3 is not particularly limited. Preferably, the innermost layer has a thickness in the range of 50 to 90 μm , and each of the other layers 3b to 3d has a thickness in the range of 5 to 30 μm . The coated electrodes 10 are made of a hard material produced by mixing an oxide, a fluoride, a silicate, a carbonate, or a metal powder with water glass and baking the mixture to form a coating around a steel rod called a core wire.

In the package, the coated electrodes 10 in the box 2 are not in direct contact with the multi-layer resin film 3. However, high stress tends to be applied to the box 2 at a front end and a holder portion, that is, both ends of each of the coated electrodes 10. Thus, the multi-layer resin film 3 should have certain strength. An increase in the thickness of the multi-layer resin film 3, however, results in poor workability. Thus, the innermost layer 3a of the multi-layer resin film 3 in contact with the box 2 preferably has a greater thickness than the other layers 3b to 3d. Thus, the multi-layer resin film 3 can have certain strength without compromising workability.

When the innermost layer 3a has a thickness of less than 50 μm , the multi-layer resin film 3 may have insufficient strength. When the innermost layer 3a has a thickness of more than 90 μm , a portion of the multi-layer resin film 3 in contact with a corner of the box 2 may not follow the deformation and may be torn. When the other layers 3b to 3d have a thickness of less than 5 μm , adhesion between the layers 3b to 3d may be decreased, and a tear may be made. When the other layers 3b to 3d have a thickness of more than 30 μm , because of its poor deformability, a portion of the multi-layer resin film 3 in contact with a corner of the box 2 may not follow the deformation and may be torn.

(Deposited Silica Film)

A deposited silica film is preferably formed on at least one of the resin layers 3a to 3d of the multi-layer resin film 3. The deposited silica film is effective in increasing the strength of the multi-layer resin film 3 and dramatically decreasing oxygen or water permeability of the multi-layer resin film 3. Thus, the deposited silica film in the multi-layer resin film 3 improves resistance to moisture absorption and shock resistance of the packaging material 1 and can prevent absorption of moisture by the coated electrodes 10

or damage to the coated electrodes 10 even in a more severe environment. Because of its flexibility, resistance to bending, and slight elasticity, the deposited silica film has high puncture strength and, as compared with metallic foil, such as aluminum foil, there is no need to worry about loss of function due to a pore at a corner.

As described above in detail, the packaging material 1 according to the present embodiment, which is composed of the box 2 made of paper or synthetic paper and the multi-layer resin film 3 that covers the box 2, has high shock resistance, in spite of its light weight and small size. Since the coated electrodes 10 are contained in the box 2, it is easy to house the coated electrodes 10 in the manufacture of a package and repackage the coated electrodes 10. The packaging material 1 rarely loses its shape and is resistance to moisture absorption.

Second Embodiment

A package according to a second embodiment of the present invention will be described below. The package according to the present embodiment contains one or more coated electrodes 10 in the packaging material 1 according to the first embodiment. The package according to the present embodiment including the packaging material 1 has high shock resistance, waterproofness, and resistance to moisture absorption and prevents absorption of moisture by the coated electrodes and damage to the coated electrodes.

The box 2 of the package is preferably sealed with the multi-layer resin film 3. This improves the effect of preventing absorption of moisture by the coated electrodes and obviates the need for a drying process before use.

EXAMPLES

The advantages of the present invention will be more specifically described with reference to examples and comparative examples of the present invention. In the present example, a package containing coated electrodes in a packaging material illustrated in Fig. 1 was evaluated for various properties. For comparison purposes, a package having no box and a package including a monolayer resin film were also evaluated in the same manner.

A box 2 was made of paper. A multi-layer resin film 3 was composed of a first layer (innermost layer) formed of polyethylene, a second layer formed of nylon, a third layer formed of polyester, and a fourth layer formed of polypropylene. In Examples 12 to 17 and Comparative Examples 2 and 3, a multi-layer resin film including a deposited silica layer was used.

The "resistance to moisture absorption" was evaluated by leaving a package that

contained 2 kg of coated electrodes 10 to stand at a temperature of 30°C and at a humidity of 80%Rh for one month and measuring a change in water content of the coating of the coated electrodes. The water content of the coating was measured using a Karl Fischer water determination method according to JIS K 0113 under the conditions of 750°C-Air. As a result, an increase in water content of more than 0.01% was rated as poor (cross), an increase in water content of more than 0.005% and 0.01% or less was rated as fair (triangle), an increase in water content of more than 0.003% and 0.005% or less was rated as good (circle), an increase in water content of more than 0.001% and 0.003% or less was rated as excellent (double circle), and an increase in water content of 0.001% or less was rated as quite excellent (double circle plus).

The "strength" was evaluated by stacking five boxes each containing 20 kg of 10 packages each containing 2 kg of the coated electrodes 10, subjecting the boxes to a transport test (transport distance: approximately 500 km), and rating the state of the packages in the lowest box. As a result, packages having a tear in the packaging material were rated as poor (cross), packages having no tear but having a mark of the boxes and relatively large expansion and contraction were rated as fair (triangle), packages having no tear but having a mark of the boxes and small expansion and contraction were rated as good (circle), packages having no tear and no expansion and contraction but having a mark of the boxes were rated as excellent (double circle), and packages having no tear, no mark of the interior, and no expansion and contraction were rated as quite excellent (double circle plus). Table 1 summarizes the results.

[Table 1]

	Presence of box	Thickness of resin layers				Presence of deposited silica layer	Resistance to moisture absorption	Strength	Overall rating
		First layer	Second layer	Third layer	Fourth layer				
Example 1	Yes	70	20	-	-	No	Δ	Δ	Δ
Example 2	Yes	40	15	15	-	No	Δ	Δ	Δ
Example 3	Yes	95	25	20	-	No	○	Δ	Δ
Example 4	Yes	60	40	20	-	No	○	Δ	Δ
Example 5	Yes	55	25	35	-	No	○	Δ	Δ
Example 6	Yes	90	20	20	-	No	○	○	○
Example 7	Yes	55	25	25	35	No	⊕	Δ	Δ
Example 8	Yes	50	10	20	-	No	○	○	○
Example 9	Yes	50	15	5	-	No	○	○	○
Example 10	Yes	50	25	20	-	No	○	○	○
Example 11	Yes	85	25	15	-	No	○	○	○
Example 12	Yes	70	20	10	30	First layer	+⊕	+⊕	+⊕
Example 13	Yes	75	15	5	-	Second layer	+⊕	⊕	⊕
Example 14	Yes	65	5	15	10	First layer	+⊕	+⊕	+⊕
Example 15	Yes	65	30	20	-	Second layer	+⊕	⊕	⊕
Example 16	Yes	60	30	30	5	First layer + second layer	+⊕	+⊕	+⊕
Example 17	Yes	70	20	25	15	First layer + second layer + third layer	+⊕	+⊕	+⊕
Comparative example 1	No	90	5	20	-	No	×	×	×
Comparative example 2	No	65	10	15	-	First layer	×	×	×
Comparative example 3	No	70	15	20	-	First layer	×	×	×
Comparative example 4	Yes	55	-	-	-	No	×	×	×

As shown in Table 1, the packages according to Comparative Examples 1 to 3, in which only the multi-layer resin film 3 was used for packaging without using the box 2, and the package according to Comparative Example 4, in which the box 2 and a monolayer resin film were used in combination for packaging, easily adsorbed moisture and had low strength.

In contrast, the packages according to Examples 1 to 17, in which the box 2 and the multi-layer resin film 3 were used for packaging, had high resistance to moisture absorption and high strength. Among them, Examples 6 and 8 to 17, in which the innermost layer had a thickness in the range of 50 to 90 μm and the other layers had a thickness in the range of 5 to 30 μm , had higher resistance to moisture absorption and higher strength than Example 1, in which the multi-layer resin film 3 was composed of two layers, Examples 2 and 3, in which the innermost layer had a thickness of 40 and 95 μm , respectively, and Examples 4, 5, and 7, in which the layers other than the innermost layer had a thickness of 40, 35, and 35 μm . In particular, the packages according to Examples 12 to 17, in which the innermost layer had a thickness in the range of 60 to 75 μm , the other layers had a thickness in the range of 5 to 30 μm , and the multi-layer resin film 3 including a deposited silica layer was used, had greatly improved resistance to moisture absorption and strength.

It was confirmed from these results that the present invention can provide a coated-electrode packaging material that is simple to manufacture and exhibits excellent strength, resistance to moisture absorption, and shock resistance during transport.

CLAIMS

[Claim 1]

A coated-electrode packaging material, comprising:
a box for containing one or more coated electrodes; and
a multi-layer resin film that covers the box, wherein
the box is formed of paper or synthetic paper,
the multi-layer resin film has a thickness in the range of 115 to 130 μm ,
the multi-layer resin film is composed of four layers, the innermost of which has a
thickness in the range of 50 to 90 μm , and the rest of which have a thickness in the range
of 5 to 30 μm ,
a first layer that is the innermost is formed of polyethylene, a second layer is
formed of nylon, a third layer is formed of polyester, and a fourth layer is formed of
polypropylene, and
a deposited silica film is formed on at least one of the four layers.

[Claim 2]

The coated-electrode packaging material according to Claim 1, wherein the box is
enclosed in a bag that is formed of the multi-layer resin film.

[Claim 3]

A package, comprising one or more coated electrodes packaged in the packaging
material according to Claim 1 or 2.

[Claim 4]

The package according to Claim 3, wherein the box is sealed with the multi-layer
resin film.