

COMPOSITION AND METHOD FOR STRIPPING ORGANIC COATINGS

Field of the Invention

[0001] The present invention relates to a composition for stripping an organic coating, and in particular, to a composition for stripping an organic coating used as a protective film or an insulating film of liquid crystal displays and semiconductor devices and a stripping method using the same.

Background of the Invention

[0002] An etching process can be considered one of the most important steps of a lithographic process in the liquid crystal display and semiconductor industries. In general, an element pattern on a photoresist mask is transferred onto a photoresist by the lithographic process. Then, the ultimate goal for transferring the whole pattern onto a thin film is achieved by the etching process. This film that undergoes lithography and etching will become a part of liquid crystal displays or semiconductor elements.

[0003] For example, in the common processes for manufacturing liquid crystal displays, an organic coating of a polyimide (PI) precursor is typically formed on a glass substrate with metal electrodes, followed by a patterned photoresist mask formed on the organic coating. Next, the exposed organic coating is etched, and a photoresist-stripping liquid is utilized on the glass substrate to remove the photoresist mask, so as to form an etched polyimide precursor. Then, the polyimide precursor is heated to form a polyimide coating. Polyimide is a widely used, heat-resistant plastic which can be used as an insulating coating and can prevent oxidization of the metal layer on the substrate.

[0004] When there is a defect in an element manufactured by the lithographic process; for example, when a protective film on an aluminum wire in a semiconductor packaging process is too thin or thick or the width of an electrically conductive wire is too narrow or wide, the protective film can be removed, so that a new protective film can be formed. Thus, the glass substrate with metal electrodes can be recycled and reused.

[0005] A conventional method for stripping the etched organic coating from a glass substrate uses dangerous alkaline liquid, such as a heated sodium hydroxide aqueous solution or a hydrazine aqueous solution. Although the use of alkaline liquid can completely remove the organic coating, the treatment time has to be well controlled. In addition, some glass substrate will be dissolved by the alkaline liquid, resulting in the corrosion of the metal layer.

Summary of the Invention

[0006] In order to eliminate the disadvantages mentioned above, the present invention provides a composition for stripping an organic coating, which can safely and effectively remove the organic coating from a glass substrate without damaging the surface of the metal substrate.

[0007] The present invention further provides a method for stripping an organic coating, comprising contacting a metal substrate comprising the organic coating with the composition for stripping an organic coating to remove the organic coating from the substrate without damaging the surface of the metal substrate.

Brief Description of the Drawings

[0008] FIG. 1 shows an etched polyimide on the substrate.

[0009] FIG. 2 shows the polyimide in FIG. 1 cleaned by a conventional composition.

[0010] FIG. 3 shows the polyimide in FIG. 1 cleaned by the composition of Embodiment 1 of the present invention.

Detailed Description of the Invention

[0011] A composition of the present invention for stripping an organic coating comprises about 5 wt% to about 90 wt% of a polar solvent, about 0.01 wt% to about 50 wt% of an alkaline compound, and about 100 ppm to about 15 wt% of a metal corrosion inhibitor, based on the total weight of the composition.

[0012] The organic coatings that can be effectively removed by the composition for stripping an organic coating of the present invention include, but are not limited to, a polyimide coating and a coating formed by the resins of acrylic, novolac, epoxide or polyvinyl alcohols, preferably a polyimide coating.

[0013] The polar solvents used in the present invention are solvents having a superior affinity to the organic coating, preferably an aprotic aqueous organic solvent, including, but not limited to, glycol compounds, N-methyl pyrrolidone (NMP), N,N,-dimethyl acetamide (DMAC), N,N-dimethyl formamide (DMF), dimethyl sulfoxide (DMSO), and mixtures thereof.

[0014] The glycol compounds suitable for use in the present invention as the polar solvents are preferably carbitol and the derivatives thereof, including, but not limited to, diethylene glycol monobutyl ether (BDG), diethylene glycol monoethyl ether, diethylene glycol dimethyl ether, diethylene glycol diethyl ether, diethylene glycol dibutyl ether,

diethylene glycol acetate monobutyl ether, and mixtures thereof.

[0015] The content of the polar solvents used in the present invention is about 5 wt% to about 90 wt%, preferably about 20 wt% to about 85 wt%, based on the total weight of the composition.

[0016] The alkaline compounds used in the present invention are preferably selected from the group consisting of amino alcohol compounds, quarternary amine compounds, and mixtures thereof.

[0017] The amino alcohol compounds suitable for use in the present invention as the alkaline compounds are preferably selected from the group consisting of monoethanolamine (MEA), N-methyl ethanolamine, N-N-dimethyl ethanolamine, N-ethyl ethanolamine, N-methyl-N-ethyl ethanolamine, N,N-diethyl ethanolamine, and mixtures thereof.

[0018] The quarternary amine compounds suitable for use in the present invention as the alkaline compounds are preferably selected from the group consisting of trimethylanilinium hydroxide, benzyltrimethylammonium hydroxide, choline hydroxide, tetramethylammonium hydroxide (TMAH), tetrapropylammonium hydroxide, and mixtures thereof.

[0019] The content of the alkaline compounds used in the present invention is about 0.01 wt% to about 50 wt%, preferably about 0.1 wt% to about 50 wt%, based on the total weight of the composition.

[0020] The metal corrosion inhibitors used in the present invention are preferably selected from the group consisting of benzotriazole derivatives, sugar alcohol derivatives, and organic phenol compounds, and mixtures thereof.

[0021] The sugar alcohol derivatives suitable for use in the present invention as the metal corrosion inhibitors are preferably selected from the group consisting of maltitol, polydextrose, xylitol, lactitol, mannitol, maltitol syrups, isomaltitol, sorbitol, and mixtures thereof.

[0022] The organic phenol compounds suitable for use in the present invention as the metal corrosion inhibitors are preferably catechol.

[0023] The amount of the metal corrosion inhibitors used in the present invention is about 100 ppm to about 15 wt%, preferably about 500 ppm to about 12 wt%, based on the total weight of the composition.

[0024] The composition for stripping an organic coating of the present invention may optionally comprise additional components well known by persons having ordinary skill in the art, for example, a surfactant for lowering the surface tension or for preventing the organic coating from adhere to the substrate.

[0025] Since the polar solvents and the alkaline compounds have a superior affinity to the organic coating, the composition of the present invention can effectively remove the organic coating from the glass substrate. In addition, to prevent a metal layer on the glass substrate from being etched, the composition of the preset invention comprises the metal corrosion inhibitor, which can prevent damage to the surface of the metal substrate, and thus the metal substrate from which the organic coating is removed can be recycled and reused.

[0026] The present invention further provides a method for stripping an organic coating, comprising contacting a metal substrate comprising the organic coating with the composition

for stripping an organic coating to remove the organic coating from the substrate without damaging the surface of a metal substrate.

[0027] In the method, the preferred stripping temperature ranges from about 40°C to about 90°C, and the preferred stripping time ranges from about 5 minutes to about 30 minutes.

[0028] The invention is described in detail with reference to the following non-limiting examples. Any modifications and variations that can be easily achieved by people skilled in the art are included in the scope of the disclosure of the specification and appended claims.

Embodiments

(1) Test of removal effect of the organic coating:

[0029] A. The following compositions for stripping the organic coating in Table 1 were prepared.

Table 1

Embodiment	TMAH	DMSO	choline	MEA	mannitol
1	46%	50%			4%
2		66%	30%		4%
3	33%	58%		5%	4%

[0030] B. A metal substrate having an etched polyimide was immersed in the composition for stripping the polyimide for about 5 minutes to about 30 minutes at a temperature ranging from about 40°C to about 90°C. The results were shown in Table 2.

Table 2

Embodiments 1 to 3			
Immersion temperature		40°C to 65°C	65°C to 90°C
Immersion time	5 to 15 minutes	O	O
	15 to 30 minutes	O	O

[0031] C. The metal substrate was washed with deionized water.

[0032] D. The metal substrate was observed with a scanning electron microscope (SEM) to check whether there is any residue of the polyimide on the metal substrate.

[0033] FIGs. 1 to 3 are scanning electron microscope photos. FIG. 1 shows an etched polyimide on the substrate. FIG. 2 shows the polyimide cleaned by a conventional composition, in which the etched polyimide was not completely removed. FIG. 3 shows the polyimide cleaned by a composition of Embodiment 1 of the present invention, in which a favorable polyimide removal effect is clearly shown.

(2) Metal corrosion test:

[0034] A. The compositions for stripping polyimide comprising a metal corrosion inhibitor (such as sugar alcohol derivatives or organic phenol compounds) and without a metal corrosion inhibitor were prepared.

[0035] B. A metal substrate having an etched polyimide was immersed in the composition for stripping polyimide for about 5 minutes to about 30 minutes at a temperature ranging from about 4°C to about 90°C.

[0036] C. The metal substrate was washed with deionized water.

[0037] D. The etching rate of the metal conductor on the substrate was measured by a four-point probe method.

[0038] The experimental results were shown in Table 3. In comparison with the composition without the metal corrosion inhibitor, the composition comprising the metal corrosion inhibitor of the present invention for stripping the organic coating can effectively decrease the etching rate of the metal substrate, and prevent damage to the surface of the metal substrate.

Table 3

	Etching rate (Å/min)
The composition comprising the inhibitor	<10
The composition without the inhibitor	>10000

[0039] Although the present invention is disclosed as above with preferable embodiments, they are not intended to limit the present invention. It will be apparent to any one skilled in the art that some variations and modifications can be made without departing from the scope of spirit of the invention. In view of the foregoing, the scope of the right protected by the present invention should be defined by the appended claims.

What is claimed is:

1. A composition for stripping an organic coating, consisting essentially of 5 wt% to 90 wt% of a polar solvent, 0.01 wt% to 50 wt% of an alkaline compound, and 100 ppm to 15 wt% of metal corrosion inhibitors, based on the total weight of the composition, wherein the polar solvent is selected from the group consisting of glycol compounds, N-methyl pyrrolidone (NMP), N,N-dimethyl acetamide (DMAC), N,N-dimethyl formamide (DMF), dimethyl sulfoxide (DMSO), and mixtures thereof; the alkaline compound is selected from the group consisting of amino alcohol compounds, quarternary amine compounds, and mixtures thereof; and the metal corrosion inhibitor is sugar alcohol derivatives.
2. The composition for stripping an organic coating according to Claim 1, wherein the organic coating is a polyimide coating.
3. The composition for stripping an organic coating according to Claim 1, wherein the glycol compound is selected from the group consisting of diethylene glycol monobutyl ether (BDG), diethylene glycol monoethyl ether, diethylene glycol dimethyl ether, diethylene glycol diethyl ether, diethylene glycol dibutyl ether, diethylene glycol acetate monobutyl ether, and mixtures thereof.
4. The composition for stripping an organic coating according to Claim 1, wherein the amino alcohol compound is selected from the group consisting of monoethanolamine (MEA), N-methyl ethanolamine, N,N-dimethyl ethanolamine, N-ethyl ethanolamine, N-methyl-N-ethyl ethanolamine, N,N-diethyl ethanolamine, and mixtures thereof.
5. The composition for stripping an organic coating according to Claim 1, wherein the quarternary amine compound is selected from the group consisting of trimethylanilinium hydroxide, benzyltrimethylammonium hydroxide, choline hydroxide, tetramethylammonium hydroxide, tetrapropylammonium hydroxide, and mixtures thereof.
6. The composition for stripping an organic coating according to Claim 1, wherein the sugar alcohol derivative is selected from the group consisting of maltitol, polydextrose, xylitol, lactitol, mannitol, maltitol syrups, isomaltitol, sorbitol, and mixtures thereof.
7. A method for stripping an organic coating, comprising contacting a metal substrate comprising the organic coating with the composition for stripping an organic coating according to any one of Claims 1 to 6 to remove the organic coating from the substrate.