

Description

The present invention relates to a light absorb-coating material which may be used in a variety of electronic and electrical devices.

In recent years many electronic devices have been developed which emit or in some way modulate light. Because of these developments, a need has arisen for a black coating which can be patterned by any of the several processes common in the microelectronics industry. This black coating may either be used to protect light-sensitive areas of a device from light or to enhance contrast between light emitting or reflecting areas on a device and those areas which should appear darker. The polymer coating must do much more than merely absorb light. Black paint, for example, could not be used. The coating should be patternable, preferably by a process already used in the industry.

One known process involves coating a positive photoresist, exposing it to light and developing the photoresist and an underlying layer in hydroxide solution. This basic process is called a wet process or a wet etch. Another process involves coating resist material on a substrate, patterning the resist, etching the substrate and then etching a sublayer under the substrate using a plasma or a reactive ion etch. This is called a dry etch in the art. Another requirement of the coating is that the polymer coating should have dielectric properties. As a part of an electrical device it should have a high dielectric strength and a high resistivity. A third requirement is that the coating should be uniform. It should adhere well to common substrates such as silicon oxide and aluminium. The coating should be a strong absorber of light at the wavelengths of interest, it should have high thermal stability and it should be durable. Also, the film thickness must be compatible with the thickness of the electrical device while still providing sufficient light attenuation.

In the art one material currently sold by Polytronics of Richardson, Texas, U.S.A. attempts to meet some of the above requirements but does not meet all of them. It contains a polymer solution filled with finely ground carbon. The polymer used is a polyimide, which imparts thermal stability, but the material can be patterned only by a wet process, it cannot be dry etched. The material has extremely low resistivity and is thus not compatible with many electronic devices. Moreover the film is not uniform due to the carbon particles, and light absorption per unit of film thickness is very low. The art has attempted to solve the problem of protecting light-sensitive areas of a device in other ways, including by depositing an insulating layer on the device and patterning a metal on top of the insulating layer. The metal shields portions of the device from light. However, this process is very

time-consuming and is more expensive than using an opaque organic film. In addition, many users do not like this system since they do not wish to reflect light because of its effects on peripheral light-sensitive devices or because the appearance of a very shiny surface is not satisfactory in their device. A further way of enhancing contrast in the art has been to deposit an anti-reflection layer, such as an indium-tin oxide, on a part of the device which should appear optically darker. These layers are very limited in that they work only over a relatively narrow band of wavelengths and they require a more complex and longer process and are difficult to rework.

One final approach which the art has used has been to use a filter which is overlaid on the device, that is, the filter is not deposited directly on the device. Due to the size and geometry of the filter and the complexity of the filter patterns these devices are limited because of problems in aligning the filter precisely with the underlying device.

The present invention solves the problems of the prior art by using a polymer, or more preferably a polymer precursor, and soluble dyes which form the uniform coating, providing this film with extremely good insulating properties, good adhesion properties, wet and dry development characteristics with a photoresist system and a very high light absorbance in a desired wavelength range from ultraviolet through the visible and through the infrared spectrum. The resulting coating material has a film thickness compatible with electronic and electrical devices and has a very high resolution of features compatible with such electrical and electronic devices. The light absorbing film demonstrates extremely good thermal, chemical and aging stability and may remain an integral part of an electrical or electronic device.

Thus, the present invention consists in a broad spectrum light absorbing coating material for microelectronic photolithography as defined in claim 1.

This coating material has a very broad range of applications. For example, it may be used to replace state of the art mask inspection systems in microelectronic photolithographic processes. Mask inspection systems allow process engineers to inspect for mask defects without taking a printer off line. Typically a glass wafer with a thin layer of chromium and a layer of photoresist are exposed in a printer. The resist is developed to provide an etch mask for the chromium, and the chromium is subsequently etched. The chromium pattern on the glass wafer is compared in a mask inspection system to the original mask pattern. Inspection systems typically employ a relatively narrow band of wavelengths e.g. in the range 450-650 nanometers for KLA instruments and 510 or 525 nano-

meters for Nippon Jido Seigyo instruments. The coating of the present invention absorbs light at these wavelengths and furnishes sufficiently high contrast for the inspection system to operate. The coating system is patterned using a positive photoresist and developer and eliminates the need for a chrome plating and etch. It thus shortens the process time for mask inspection and allows inspection to be done without additional process equipment and without using chromium, which is an environmental pollutant.

The coating of the present invention can also be used to improve the performance of projection printer automatic focus systems by coating a light absorbing film on a photoresist and thereby reducing the intensities of all reflected rays except that from the top surface itself. Focus is an important issue in semi-conductor and other microelectronic manufacture. Automatic focus mechanisms of projection printers typically employ a light source and a detector which senses reflected light. When light strikes the surface of the film, some light is reflected and some passes through the film and is reflected at the inner face of succeeding layers. These multiple reflections can cause an automatic focus mechanism to function improperly. The coating of the present invention absorbs the near infrared light emitted by the laser diodes and light emitting diodes typically used in focusing systems. It thus reduces the intensity of light reflected from all but the top surface of a multi-layer system, thus improving the performance of automatic focus systems. Typically, the coating of the present invention would be spin cast on top of a photoresist. When used in an automatic focusing system, the coating of the present invention would not include the dyes which absorb the light in the blue and near ultra-violet wave lengths typically used to expose the photoresist. The coating vehicle may be water soluble or may be solvent soluble and it is stripped when the photoresist is developed. It therefore has negligible effect on the photoresist performance. The coating is applied in such a thin layer that the thickness of the coating plus the photoresist does not exceed the depth of focus limit of the optical machinery. Typically the coating would be spin cast on top of a prebaked photoresist. The coating need not be baked but may be baked if desired, for example in a convection oven at 90 °C for half an hour to evaporate the solvent. The coating would be left intact during the focus and exposure steps in a projection printer and the coating would be immediately stripped when the exposed photoresist is immersed in or sprayed with an aqueous developer. In all other respects the automatic focusing process and equipment are conventional.

The coating material of the present invention includes a polymer or a polymer precursor and soluble dyes that are effective to form a uniform, thin, tightly bonded continuous film with good insulating properties, good adhesion properties, wet and/or dry development properties with photoresist systems and which has high light absorbance in the desired wavelength range from ultraviolet through the visible and into and through the infrared spectrum. The film thickness is compatible with electrical and electronic devices and the coating has the high resolution required by electrical and electronic devices such as microelectronic devices. The light absorbing film also demonstrates good thermal, chemical and aging stability to remain an integral part of an electrical system. The coating material is a solution containing polyimide or polyimide precursor and required solvent-soluble dyes. Because the material is not carbon or pigment filled it has very high resistivity and very high dielectric strength and does not interfere with the performance of electrical or electronic devices on which it is coated. The material can be patterned by both a wet process and a dry etch. Typically, the product is highly absorbing in the near ultraviolet and visible and even into the near infrared spectrum through 1000 nanometers. The material has no large particles since it is a solution and coatings are very uniform. The coating material of the present invention adheres very well to silicon, silicon oxide and aluminium substrates. The material has extremely high thermal stability and is highly durable. This product may be used and applied in a conventional manner. For example, the material may be spun or sprayed on any conventional electrical or microelectronic substrate. For example, spinning at 4000 rpm will typically give a film which is 5 microns thick. The material may be baked to remove solvent and to crosslink the polymer precursor. If the product is to be wet etched, a positive photoresist may be spun on top. The resist is baked, exposed and developed as is conventional in the art. The light absorbing layer formed from the coating material of the present invention may develop out where the photoresist is removed and so may be patterned at the same time as the photoresist. If the material is to be dry etched, a layer of aluminium or other suitable etch mask may be deposited on top of the light absorbing layer and patterned. The substrate is then placed in a chamber for a reactive ion or plasma etching and the light absorbing layer is etched out in areas not covered by the etch mask. After patterning, the light absorbing layer may be baked at a higher temperature to harden the polymer.

Depending upon the method and the application, the light absorbing layer may be a few microns to a few tens of microns in thickness.

Spinning typically yields films from one micron to ten microns in thickness. Conventional spraying may result in thicker films which may be as thick as twenty-five microns. The coating material of the present invention absorbs strongly in the near ultraviolet, the visible spectrum and the visible spectrum from 200 to 750 nanometers and, depending on the dye formulation, may absorb strongly from 200 to 1000 nanometers. For example, a five micron film of the material may transmit less than one percent of all light from 200 to 750 nanometers or from 200 to about 1000 nanometers. The coating material of the present invention is unique in that very small geometries can be patterned in it. Wet processing of a five micron thick film, for example, can resolve lines as small as five microns. Dry etching processing can resolve even smaller lines.

The resistivity of the light absorbing layer is preferably 3×10^{15} ohm-cm or more and the dielectric strength preferably exceeds 7×10^5 volts per centimeter. These are outstanding electrical characteristics for an organic film and far better than can be expected with a polymer film filled with carbon or other pigments or any conventional material.

Some specific applications for the light absorbing coating of the present invention include protecting light-sensitive circuitry and enhancement of contrast in liquid crystal displays, electro-luminescent displays, plasma displays and imaging systems, such as charge-coupled devices for telecommunications and video cameras. The light absorbing coating of the present invention may also protect light-sensitive areas of light-emitting diodes, avalanche photodiodes, and solid state lasers. The light absorbing coating of the present invention may be used to pattern apertures on light-wave modulators and other similar equipment.

The vehicle for the light absorbing layer of the present invention will typically include a polyimide precursor which reacts in use to form a polyimide resin. Examples of the precursor typically include a polyamic acid prepared by reacting oxydianiline (ODA) with pyromellitic dianhydride (PMDA) or by reacting ODA with PMDA and benzophenone tetracarboxylic dianhydride (BTDA). Other equivalent polyamic acids and polyamic acid precursors may be used. The reactants for the polyimide precursors are typically included in approximately stoichiometric amounts. Some formulations may include water-soluble polymers such as polyvinylpyrrolidone and/or other conventional resins such as novalac. The dyes may be chosen from soluble organic dyes which are effective to absorb over a broad spectrum of light or from effective combinations of dyes. Exemplary dyes are as follows: curcumin; Solvent Blue 45 (Savinyl Blue RLS Sandoz Chemical Corporation); Solvent Red 92 (Savinyl

Scarlet RLS Sandoz Chemical Corporation); Solvent Blue 44 (Savinyl Blue GLS Sandoz Chemical Corporation); Solvent Blue 35 (Hytherm Blue B-200% Morton Chemical Company); Solvent Red 111 (Morton Red AAP Morton Chemical Company); Solvent Orange 11 (Orasol Orange G Ciba Geigy Corporation); Pylakrome Green (Pylam Products); IR-99 (American Cyanamid Company); IR-125 (Exciton Chemical Company); and Solvent Red 127 (TM, Sandoz Chemical Corporation). The dyes and vehicle or vehicle precursor are included with a solvent system having a low surface energy solvent so that the entire system is cosoluble. Examples of typical solvents would include cyclohexanone.

The invention is further illustrated by reference to the following examples.

Example 1

Using the following coating formulation:
58.5% polyimide precursor (ODA and PMDA)
7.3% N-methylpyrrolidone
21.9% cyclohexanone
4.4% Solvent Blue 45
3.4% Solvent Red 92
3.9% Solvent Blue 44
0.5% curcumin,

a black coating was prepared by stirring the mix for several hours. The mix was then filtered to remove undissolved material. The coating may be used as a black background contrast coating to enhance the contrast of light emitting diode and liquid crystal displays. The coating may also be used as a background coating to eliminate scatter and reflected light in detectors such as photoelectric cells and photo diodes. The coating may be coated by conventional spin or spray techniques on a substrate, baked to cure at 90°C for 30 minutes, and at 90-130°C for 30 minutes, coated with photoresist, cured, exposed and developed by conventional processes. The coating may have a subsequent cure at 200°C for 30 minutes. The coating absorbs substantially all light between 200-750 nm.

Example 2

Using the following coating formulation:
58.5% polyimide precursor (DDA and PMDA)
7.3% N-methylpyrrolidone
21.0% cyclohexanone
4.0% Solvent Blue 45
3.4% Solvent Red 92
4.3% Pylakrome Green
0.5% curcumin,

a black coating was prepared, as described for Example 1.

Example 3

Using the following coating formulation:

58.5% polyimide precursor (DDA and PMDA)

7.3% N-methylpyrrolidone

21.9% cyclohexanone

4.4% Solvent Blue 35

3.4% Solvent Red 92

3.9% Solvent Blue 44

0.5% curcumin,

a black coating was prepared, as described for Example 1.

Example 4

Using the following coating formulation:

57.5% polyimide precursor (DDA and PMDA)

7.3% N-methylpyrrolidone

21.9% cyclohexanone

4.4% Solvent Blue 45

3.4% Solvent Red 111 3.9% Solvent Blue 44

1.5% Solvent Orange 11,

a black coating was prepared, as described for Example 1.

Example 5

Using the following coating formulation:

58.5% polyimide precursor (DDA, BTDA, and PMDA)

7.3% N-methylpyrrolidone

21.9% cyclohexanone

4.4% Solvent Blue 45

3.4% Solvent Red 92

3.9% Solvent Blue 44

0.5% curcumin,

a black coating was prepared, as described for Example 1.

Example 6

Using the following coating formulation:

43.9% polyimide precursor (DDA and PMDA)

11.7% N-methylpyrrolidone

35.2% cyclohexanone

3.3% Solvent Blue 45

2.6% Solvent Red 92

2.9% Solvent Blue 44

0.4% curcumin,

a black coating was prepared, as described for Example 1.

Example 7

Using the following coating formulation:

57.5% polyimide precursor (ODA and PMDA)

7.3% N-methylpyrrolidone

21.9% cyclohexanone

4.4% Solvent Blue 45

3.4% Solvent Red 92

3.9% Solvent Blue 44

0.5% curcumin

5 1.0% IR-99,

a black coating was prepared, as described for Example 1. The coating absorbs substantially all light between 200 and 1000nm. This coating is especially useful as a background and contrast coating for light emitting diodes and sensors which operate in the near infrared range.

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Example 8

Using the following coating formulation:

43.9% polyimide precursor (ODA and PMDA)

7.3% N-methylpyrrolidone

21.9% cyclohexanone

4.4% Solvent Blue 45

20 3.4% Solvent Red 92

3.9% Solvent Blue 44

0.5% curcumin

1.0% IR-125,

a black coating was prepared as described for Example 7.

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Example 9

Using the following coating formulation:

30 56.5% polyimide precursor (ODA and PMDA)

7.3% N-methylpyrrolidone

21.9% cyclohexanone

4.4% Solvent Blue 35

3.4% Solvent Red 111

35 3.9% Solvent Blue 44

1.5% Solvent Orange 11

1.0% IR-125,

a black coating was prepared, as described for Example 7.

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Example 10

Using the following coating formulation:

43.1% polyimide precursor (DDA and PMDA)

45 11.7% N-methylpyrrolidone

35.2% cyclohexanone

3.3% Solvent Blue 45

2.6% Solvent Red 92

2.9% Solvent Blue 44

50 0.4% curcumin

0.8% IR-125,

a black coating was prepared as described for Example 7.

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Example 11

Using the following coating formulation:

57.5% polyimide precursor (DDA, PMDA, BTDA)

7.3% N-methylpyrrolidone

21.9% cyclohexanone

0.4% Solvent Blue 45

0.4% Solvent Red 92

3.9% Solvent Blue 44

0.5% curcumin

1.0% IR-125,

a black coating was prepared, as described for Example 7.

Example 12

Using the following coating formulation:

225g polyimide precursor (ODA and PMDA)

27g Novolac

211 ml N-methylpyrrolidone

692 ml cyclohexanone

56 g Solvent Red 127

8 g Solvent Red 92

a mask inspection coating was prepared by stirring the mix for several hours. The mix was then filtered to 0.45 microns to remove undissolved material. The coating may be applied by spinning or other techniques. For example, it may be spin coated to a thickness of 0.3 micron on a glass wafer and used in place of a chromium layer in a mask inspection system. A 0.3 micron film of the coating absorbs at least about 90% of the light used by mask inspection systems, about 500-600 nm.

Example 13: Using the following coating formulation:

4.8 g 15K polyvinylpyrrolidone

95.2 g H₂O

1.0 g IR-125, i.e. anhydro-1,1-dimethyl-2-{7-[1,1-dimethyl-3-(4-sulfobutyl)-2-(1H)-benz(e)-indolinylidene]-1,3,5-heptatrienyl}-(4-sulfobutyl)-1H-benz(e)indolium Hydrozide Sodium Salt

An automatic focus coating was prepared by stirring the PVP in room temperature water until dissolved, about one hour. The IR-125 was added to the solution and stirred for about three hours. The solution was then filtered to remove undissolved dye and polymer. The coating may be applied by spin coating to a film thickness of 700 angstroms. The coating absorbs the light in the 650 - 1000 nanometer range used by automatic focus mechanisms.

Claims

1. A broad spectrum light absorbing coating material for microelectronic photolithography comprising a vehicle which is a polyimide or a polyimide precursor and at least one soluble light absorbing dye in a solvent therefor, the at least one dye being selected such that coating material will absorb light from in the ultraviolet range, across the visible range and into the

infrared range, so that the material appears black to the naked eye, and, when the material is coated on a microelectronic photolithographic substrate, the majority, preferably at least 90%, of all of the light in said spectrum is absorbed by the material, the resulting coating having a high electrical resistivity, a high dielectric strength and providing a uniform, tightly adhering coating, the coating further being developable and etchable by wet and dry etch processes, so as to produce images having fine line resolution.

2. A light absorbing coating material according to claim 1 wherein the vehicle is a polyamic acid precursor of a polyimide resin.

3. A light absorbing coating material according to claim 2 wherein the vehicle is oxydianiline and pyromellitic dianhydride, the vehicle components being present in approximately stoichiometric amounts.

4. A light absorbing coating material according to claim 3, wherein the vehicle further comprises benzophenone tetracarboxylic dianhydride, the vehicle components being present in approximately stoichiometric amounts.

5. A light absorbing coating material according to any one of claims 1 to 4, wherein the range in which the material absorbs light is from 200 to 750 nm, when coated on a substrate.

6. A light absorbing coating material according to one of the claims 1 to 4, wherein the range over which the coating material absorbs light is from 200 to 1000 nm.

7. A light absorbing coating material according to any one of the preceding claims, wherein the at least one dye is selected from curcumin, Solvent Blue 45, Solvent Red 92, Solvent Blue 44, Solvent Blue 35, Solvent Red 111, Solvent Orange 11, Pylakrome Green, IR-99, IR-125 and Solvent Red 127 and mixtures thereof.

8. A light absorbing coating material according to any one of the preceding claims, wherein the coating has an electrical volume resistivity of at least 3×10^{15} ohm-cm, when coated on a substrate.

9. A light absorbing coating material according to any one of the preceding claims, wherein the coating has a dielectric strength of at least 7×10^5 V/cm, when coated on a substrate.

7.3% N-methylpyrrolidone

21.9% cyclohexanone

2.4% Solvent Blue 45

2.4% Solvent Red 92

3.9% Solvent Blue 44

0.5% curcumin

1.0% IR-125,

a black coating was prepared, as described for Example 7.

Example 12

Using the following coating formulation:

225g polyimide precursor (ODA and PMDA)

27g Novolac

211 ml N-methylpyrrolidone

692 ml cyclohexanone

56 g Solvent Red 127

8 g Solvent Red 92

a mask inspection coating was prepared by stirring the mix for several hours. The mix was then filtered to 0.45 microns to remove undissolved material. The coating may be applied by spinning or other techniques. For example, it may be spin coated to a thickness of 0.3 micron on a glass wafer and used in place of a chromium layer in a mask inspection system. A 0.3 micron film of the coating absorbs at least about 90% of the light used by mask inspection systems, about 500-600 nm.

Example 13: Using the following coating formulation:

4.8 g 15K polyvinylpyrrolidone

95.2 g H₂O

1.0 g IR-125, i.e. anhydro-1,1-dimethyl-2-{7-[1,1-dimethyl-3-(4-sulfobutyl)-2-(1H)-benz(e)-indolinylidene]-1,3,5-heptatrienyl}-(4-sulfobutyl)-1H-benz(e)indolium Hydrozide Sodium Salt

An automatic focus coating was prepared by stirring the PVP in room temperature water until dissolved, about one hour. The IR-125 was added to the solution and stirred for about three hours. The solution was then filtered to remove undissolved dye and polymer. The coating may be applied by spin coating to a film thickness of 700 angstroms. The coating absorbs the light in the 650 - 1000 nanometer range used by automatic focus mechanisms.

Claims

1. A broad spectrum light absorbing coating material for microelectronic photolithography comprising a vehicle which is a polyimide or a polyimide precursor and at least one soluble light absorbing dye in a solvent therefor, the at least one dye being selected such that coating material will absorb light from in the ultraviolet range, across the visible range and into the

infrared range, so that the material appears black to the naked eye, and, when the material is coated on a microelectronic photolithographic substrate, the majority, preferably at least 90%, of all of the light in said spectrum is absorbed by the material, the resulting coating having a high electrical resistivity, a high dielectric strength and providing a uniform, tightly adhering coating, the coating further being developable and etchable by wet and dry etch processes, so as to produce images having fine line resolution.

2. A light absorbing coating material according to claim 1 wherein the vehicle is a polyamic acid precursor of a polyimide resin.

3. A light absorbing coating material according to claim 2 wherein the vehicle is oxydianiline and pyromellitic dianhydride, the vehicle components being present in approximately stoichiometric amounts.

4. A light absorbing coating material according to claim 3, wherein the vehicle further comprises benzophenone tetracarboxylic dianhydride, the vehicle components being present in approximately stoichiometric amounts.

5. A light absorbing coating material according to any one of claims 1 to 4, wherein the range in which the material absorbs light is from 200 to 750 nm, when coated on a substrate.

6. A light absorbing coating material according to one of the claims 1 to 4, wherein the range over which the coating material absorbs light is from 200 to 1000 nm.

7. A light absorbing coating material according to any one of the preceding claims, wherein the at least one dye is selected from curcumin, Solvent Blue 45, Solvent Red 92, Solvent Blue 44, Solvent Blue 35, Solvent Red 111, Solvent Orange 11, Pylakrome Green, IR-99, IR-125 and Solvent Red 127 and mixtures thereof.

8. A light absorbing coating material according to any one of the preceding claims, wherein the coating has an electrical volume resistivity of at least 3×10^{15} ohm-cm, when coated on a substrate.

9. A light absorbing coating material according to any one of the preceding claims, wherein the coating has a dielectric strength of at least 7×10^5 V/cm, when coated on a substrate.



10. A light absorbing coating according to any preceding claim, suitable for improving the performance of automatic focus equipment used in microelectronic photolithography, wherein the light range across which the material absorbs includes the spectrum of light used in the automatic focus process, and wherein the coating is readily removable by subsequent processing of the substrate.

11. A light absorbing coating material according to any of claims 1 to 9, for mask inspection systems used in microelectronic photolithography, wherein the light range across which the material absorbs includes the spectrum used in mask inspection systems, the material being imagable and developable in the mask inspection process.

Patentansprüche

1. Über ein breites Spektrum lichtabsorbierendes Beschichtungsmaterial für die mikroelektronische Fotolithografie, das ein Vehikel, bei dem es sich um ein Polyimid oder einen Polyimid-Vorläufer handelt, und mindestens einen löslichen lichtabsorbierenden Farbstoff in einem dafür vorgesehenen Lösungsmittel umfaßt, wobei der mindestens eine Farbstoff derart ausgewählt wird, daß das Beschichtungsmaterial Licht aus dem Ultraviolettbereich, über den sichtbaren Bereich und in den Infrarotbereich absorbieren wird, so daß das Material dem bloßen Auge schwarz erscheint und, wenn das Material auf ein mikroelektronisches fotolithografisches Substrat gestrichen wird, das meiste, bevorzugt mindestens 90%, des gesamten Lichts in diesem Spektrum von dem Material absorbiert wird, wobei die resultierende Beschichtung einen hohen spezifischen elektrischen Widerstand und eine hohe Durchschlagsfestigkeit besitzt und eine gleichmäßige, stark haftende Beschichtung bereitstellt, wobei die Beschichtung ferner entwicklungsfähig und mittels Naß- und Trockenätzverfahren ätzbar ist, um Bilder mit feinliniger Auflösung bereitzustellen.

2. Lichtabsorbierendes Beschichtungsmaterial nach Anspruch 1, worin das Vehikel ein Polyamidsäure-Vorläufer eines Polyimidharzes ist.

3. Lichtabsorbierendes Beschichtungsmaterial nach Anspruch 2, worin das Vehikel Oxydianilin und das Dianhydrid der Pyromellithsäure ist, wobei die Vehikelbestandteile in circa stöchiometrischen Mengen vorliegen.

4. Lichtabsorbierendes Beschichtungsmaterial nach Anspruch 3, worin das Vehikel des weiteren das Dianhydrid der Benzophenon-tetracarboxylsäure umfaßt, wobei die Vehikelbestandteile in circa stöchiometrischen Mengen vorliegen.

5. Lichtabsorbierendes Beschichtungsmaterial nach einem der Ansprüche 1 bis 4, worin der Bereich, in dem das Material Licht absorbiert, zwischen 200 und 750 nm liegt, wenn es auf ein Substrat gestrichen wird.

6. Lichtabsorbierendes Beschichtungsmaterial nach einem der Ansprüche 1 bis 4, worin der Bereich, über den das Beschichtungsmaterial Licht absorbiert, zwischen 200 und 1000 nm liegt.

7. Lichtabsorbierendes Beschichtungsmaterial nach einem der vorangehenden Ansprüche, worin der mindestens eine Farbstoff unter Curcumin, Solvent Blau 45, Solvent Rot 92, Solvent Blau 44, Solvent Blau 35, Solvent Rot 111, Solvent Orange 11, Pylakrome Grün, IR-99, IR-125 und Solvent Rot 127 und Mischungen davon ausgewählt wird.

8. Lichtabsorbierendes Beschichtungsmaterial nach einem der vorangehenden Ansprüche, worin die Beschichtung einen spezifischen elektrischen Durchgangswiderstand von mindestens 3×10^{15} Ohm cm besitzt, wenn sie auf ein Substrat gestrichen wird.

9. Lichtabsorbierendes Beschichtungsmaterial nach einem der vorangehenden Ansprüche, worin die Beschichtung eine Durchschlagsfestigkeit von mindestens 7×10^5 V/cm besitzt, wenn sie auf ein Substrat gestrichen wird.

10. Lichtabsorbierende Beschichtung nach einem der vorangehenden Ansprüche, die zur Verbesserung der Leistung einer Autofokuseinrichtung geeignet ist, die in der mikroelektronischen Fotolithografie eingesetzt wird, worin der Lichtbereich, über den das Material absorbiert, das im Autofokusverfahren benutzte Lichtspektrum einschließt, und worin die Beschichtung durch nachfolgende Verarbeitung des Substrats leicht entfernbar ist.

11. Lichtabsorbierendes Beschichtungsmaterial nach einem der Ansprüche 1 bis 9 für bei der mikroelektronischen Fotolithografie benutzte Maskenprüfsysteme, worin der Lichtbereich, über den hinweg das Material absorbiert, das in Maskenprüfsystemen benutzte Spektrum



einschließt, wobei das Material in dem Maskenprüfverfahren zur Bildgebung und Entwicklung fähig ist.

Revendications

1. Matériau de revêtement absorbant la lumière dans un large spectre pour la photolithographie microélectronique comprenant un véhicule qui est un polyimide ou un précurseur de polyimide et au moins un colorant soluble absorbant la lumière dans un solvant pour celui-ci, ledit au moins un colorant étant choisi de telle manière que le matériau de revêtement va absorber la lumière allant de la plage de l'ultraviolet, à travers la plage du visible et dans la plage de l'infra-rouge, de telle sorte que le matériau apparaît noir à l'oeil nu et que, lorsque le matériau recouvre un substrat pour photolithographie microélectronique, la majorité et, de préférence, au moins 90 % de toute la lumière dans ledit spectre est absorbée par le matériau, le revêtement résultant présentant une résistivité électrique élevée, une résistance disruptive élevée et fournissant un revêtement uniforme de forte adhérence, le revêtement pouvant en outre être développé et gravé par les modes opératoires de gravure par voie humide et par voie sèche, de manière à produire des images ayant une fine résolution linéaire. 10
2. Matériau de revêtement absorbant la lumière selon la revendication 1, dans lequel le véhicule est un acide polyamique précurseur d'une résine polyimide. 20
3. Matériau de revêtement absorbant la lumière selon la revendication 2, dans lequel le véhicule est l'oxydianiline et le di-anhydride pyromellitique, les composants du véhicule étant présents en quantités approximativement stoechiométriques. 25
4. Matériau de revêtement absorbant la lumière selon la revendication 3, dans lequel le véhicule comprend, en outre, du dianhydride de l'acide benzophénone tétracarboxylique, les composants du véhicule étant présents en quantités approximativement stoechiométriques. 30
5. Matériau de revêtement absorbant la lumière selon l'une quelconque des revendications 1 à 4, dans lequel la plage dans laquelle le matériau absorbe la lumière va de 200 à 750 nm lorsqu'il recouvre un substrat. 35

6. Matériau de revêtement absorbant la lumière selon l'une quelconque des revendications 1 à 4, dans lequel la plage dans laquelle le matériau absorbe la lumière va de 200 à 1.000 nm. 40
7. Matériau de revêtement absorbant la lumière selon l'une quelconque des revendications précédentes, dans lequel ledit au moins un colorant est choisi parmi la curcumine, le Bleu Solvant 45, le Rouge Solvant 92, le Bleu Solvant 44, le Bleu Solvant 35, le Rouge Solvant 111, l'Orangé Solvant 11, le Vert Pylakrome, le IR-99, IR-125 et le Rouge Solvant 127 et leurs mélanges. 45
8. Matériau de revêtement absorbant la lumière selon l'une quelconque des revendications précédentes, dans lequel le revêtement a une résistivité électrique volumétrique d'au moins 3×10^{15} ohms-cm lorsqu'il recouvre un substrat. 50
9. Matériau de revêtement absorbant la lumière selon l'une quelconque des revendications précédentes, dans lequel le revêtement a une résistance disruptive d'au moins 7×10^5 V/cm lorsqu'il recouvre un substrat. 55
10. Matériau de revêtement absorbant la lumière selon l'une quelconque des revendications précédentes adéquat pour améliorer la performance d'un équipement de focalisation automatique utilisé en photolithographie microélectronique dans lequel la plage de lumière dans laquelle le matériau absorbe comprend le spectre de la lumière utilisée dans le mode opératoire de focalisation automatique et dans lequel le revêtement est facilement enlevé par traitement subséquent du substrat. 60
11. Matériau de revêtement absorbant la lumière selon l'une quelconque des revendications 1 à 9, pour les systèmes d'inspection de caches utilisés dans la photolithographie microélectronique, dans lequel la plage de lumière dans laquelle le matériau absorbe comprend le spectre utilisé dans les systèmes d'inspection de caches, le matériau pouvant être représenté par une image et développé dans le traitement d'inspection de caches. 65

