Description

The present invention relates to an optical recording medium having at least an optical absorptive layer and a light reflective layer on a transparent substrate, as defined in the preamble of Claim 1 and as known from JP-A-60 110636, a method for recording information on such an optical information recording medium, and a method for producing said optical recording medium.

As an optical information recording medium capable of recording data by irradiation of a laser beam, an optical information recording medium is known which has a recording layer composed of e.g. a layer of a metal such as Te, Bi or Mn or a layer of a dye such as cyanine, mellocyanine or phthalocyanine and which is designed to record data in such a manner that when irradiated with a laser beam, the recording layer is deformed, sublimed, evaporated or modified to form pits. Further, an optical information recording medium having a recording layer of a dye and a reflective layer of a metal formed on a light transmitting substrate is known.

On the other hand, optical information recording media of so called ROM (read only memory) type wherein data are already recorded, and no further data are recordable or the recorded data are no longer erasable or rewritable, are widely practically employed in the sound recording and information treating fields. Optical information recording media of this type have no such a recording layer as described above. Pits corresponding to data to be reproduced are already formed on a substrate of e.g. polycarbonate by e.g. press molding, a reflective layer of a metal such as Au, Ag, Cu or Al is formed thereon, and a protective layer is further provided thereon.

The most typical optical information recording medium of this ROM type is a compact disc so-called CD which is widely used in the sound recording and information treating fields. The specification for read-out signals for this CD is standardized, and the reproducing or play back apparatus for CD in accordance with the standards is widely available as compact disc players (CD players).

To satisfy the CD standards, it is required that the reflectance is at least 70%, and with respect to the degree of modulation of the read-out signals, I_{11}/I_{top} is at least 0.6, and I_3/I_{top} is from 0.3 to 0.7.

The above-mentioned writable optical information recording media employ a laser beam in the same manner as CD. Therefore, it is strongly desired for such media to follow the same standards as the widely prevailing standards for CD.

However, conventional writable optical information recording media have a recording layer which is not present in CD, and they are designed to form pits in the recording layer and not in the substrate. Further, in some cases, a space is provided to facilitate the formation of pits in this recording layer, and the reflectance of a laser beam is low as compared with CD. Consequently, the read-out signals are naturally different from those of CD. Therefore, it has been difficult for the conventional optical information recording media to meet the above-mentioned standards for CD. Particularly, the reflectance and the degree of modulation of the read-out signals used to be too low to meet the standards. Therefore, it has been difficult to provide a writable optical information recording medium which satisfies the CD standards.

Dyes for forming a light absorption layer are known from EP-A-0 304 050.

Therefore, it is an object of the present invention to provide a writable optical information recording medium which has high reflectance and which is capable of providing read-out signals having a high degree of modulation to meet the CD standards.

The present invention provides an optical information recording medium comprising a light transmitting substrate, a light absorptive layer containing at least one light absorbing substance formed on the substrate and a light reflective layer made of a metal film formed on the light absorptive layer, wherein an optical parameter represented by $\rho = n_{abs}d_{abs}/\lambda$ wherein n_{abs} is the real part of the complex refractive index of the light absorptive layer, d_{abs} is the average thickness of the light absorptive layer and λ is the wavelength of a reading laser beam, is $0.6<\rho<1.6$. The imaginary part k_{abs} of the complex refractive index of the light absorptive layer is preferably at most 0.2.

The present invention also provides a method for recording information on an optical information recording medium, wherein the above optical information recording medium is used, and the recording is conducted by irradiating a laser beam from the substrate side of the medium.

The not prepublished EP-A-0 353 393 concerns an optical recording medium wherein $0.05 \leqq \rho \leqq 0.6$.

In the accompanying drawings:

Figure 1 is a partially cross-sectional diagrammatical perspective view illustrating an embodiment of the structure of the optical information recording medium of the present invention.

Figure 2 is a cross-sectional enlarged view, taken along the track, of a part of the optical information recording medium of Figure 1 prior to the optical recording.

Figure 3 is a cross-sectional enlarged view, taken along the track, of a part of the optical information recording medium of Figure 1 after the optical recording.

Figure 4 is a graph showing the relation between the value of $\rho = n_{abs}d_{abs}/\lambda$ wherein n_{abs} is the real part of the complex refractive index of the light absorptive layer of the optical information recording medium of the present invention, d_{abs} is the average thickness of the light absorptive layer and λ is the wavelength of the reading laser beam, and the reflectance of the reading laser beam.

Figure 5 is a graph showing the relation between the value of the imaginary part k_{abs} of the complex refractive index of the light absorptive layer of the optical information recording medium of the present invention and the reflectance of the reading laser beam.

Now, the present invention will be described in detail.

The present inventors have conducted extensive researches on optical information recording media having a light absorptive layer and a light reflective layer formed on a light transmitting substrate and as a result, have found that the optical parameter $\rho = n_{abs}d_{abs}/\lambda$ wherein wherein n_{abs} is the real part of the complex refractive index of the light absorptive layer, d_{abs} is the average thickness of the light absorptive layer (for the purpose of the present invention, the average thickness is represented by the product obtained by dividing the volume of the light absorptive layer by the area of the region on which the light absorptive layer is formed) and λ is the wavelength of the reading laser beam, is an important parameter.

From a further study, it has been found that within a range of $0.6<\rho<1.6$, it is possible to secure the standard properties prescribed in the CD standards i.e. the reflectance of at least 70%.

For example, Figure 4 is a graph showing the relation between the above-mentioned optical parameter $\rho = n_{abs}d_{abs}/\lambda$ and the reflectance of the reading laser beam irradiated from the substrate side, in a case where a polycarbonate substrate and a gold reflective layer were used, and a semiconductor laser beam having a wavelength λ of 780 nm was used as the reading laser beam. This graph can be represented by a function which is a combination of an exponential function and a periodic function, whereby the amplitude of the periodic function increases as the value ρ increases.

As is evident from this graph, the reflectance can exceed 70% at the peaks. The amplitude of this periodic function varies depending upon parameters such as the complex refractive indices of the layers constituting the optical information recording medium, their average thicknesses and the uniformity thereof. For example, if the refractive index of a layer located on the incident light side of the light absorptive layer is small, the reflectance shifts to higher in the graph. Further, this graph can be represented by an exponential function having k_{abs} and d_{abs} as parameters, whereby it has been found that the overall decrement of the reflectance in the graph increases as the imaginary part k_{abs} of the complex refractive index of the light absorptive layer increases.

From the simulation prepared by the present inventors, it has been found that so long as the light absorptive layer is homogeneous and there is no non-uniform distribution in the real part n_{abs} of the complex refractive index and in the average thickness d_{abs}, there will be no variation in the periodic cycle of the peaks in the graph.

In a case where a groove is provided on the substrate, the reflectance graph may change in a complex manner as compared with the case where no groove is provided, due to the effects of the configuration of the groove or the difference in the thickness of the light absorptive layer between the grooved portion and the land portion. Even in such a case, if the evaluation is made on the average thickness of the light absorptive layer to eliminate the effects of the interference of the groove, there will be no variation in the periodic cycle of this graph.

Under certain conditions, it is also possible to increase the reflectance at the bottoms of the graph by controlling the above-mentioned parameters. However, when the optical parameter ρ is set in the vicinity of the bottoms, it becomes difficult to increase the degree of modulation, and in some cases, the reflectance is likely to increase beyond the level prior to the recording. Thus, the optical parameter ρ is preferably set in the vicinity of the peaks.

From the results of the simulation obtained by the present inventors, it has been found that within a range of $0.6<\rho<1.6$, there are two peaks, and the peaks are always located within ranges of $0.6<\rho<1.10$ and $1.10<\rho<1.6$, and it is possible to obtain high reflectance within such ranges.

When the peak within the range of $0.6<\rho<1.10$ is to be used, ρ is preferably set within a range of from $0.61\leqq\rho\leqq1.09$, more preferably within a range of from $0.7\leqq\rho\leqq0.9$.

Likewise, when the peak within the range of from $1.10<\rho<1.6$ is to be used, ρ is preferably set within a range of $1.11\leqq\rho\leqq1.59$, more preferably within a range of from $1.25\leqq\rho\leqq1.5$.

If $0.6\geqq\rho$, the degree of modulation by recording will be smaller than the range specified by the present invention, since the amplitude of the periodic function is small. On the other hand, if $1.6\leqq\rho$, the average thickness of the light absorptive layer tends to be thick, whereby the control of the thickness of the layer will be difficult, and there will be a practical problem in the production.

Figure 5 illustrates the change in the reflectance when the imaginary part k_{abs} of the complex refractive index of the light absorptive layer is changed from a value close to 0 to 1.0 while maintaining the real part n_{abs}

of the complex refractive index at a constant level of 3.2 or 4.7, by changing the light transmittance of the light absorptive layer in an optical information recording medium wherein a gold film is used as the reflective layer, as obtained by simulation. Here, d_{abs} was set at the optimum condition within a range of $0.6<\rho<1.10$. It is evident from this graph that if k_{abs} is larger than 0.2, it becomes difficult to obtain a high reflectance at a level of at least 70%. The closer the value k_{abs} to 0, the higher the reflectance. However, if k_{abs} is too close to 0, the sensitivity will be poor. Therefore, k_{abs} is preferably at least 0.001. When the optical parameter $\rho = n_{abs}d_{abs}/\lambda$ is within a range of $0.61\leqq\rho\leqq1.09$, k_{abs} is preferably within a range of from $0.01\leqq k_{abs}\leqq0.2$. When the prescribed values other than the reflectance and the degree of modulation prescribed in the CD standards, such as the push pull value, etc., are taken into consideration, the optical parameter $\rho = n_{abs}d_{abs}/\lambda$ is preferably $0.7\leqq\rho\leqq0.9$, and at the same time k_{abs} is preferably $0.01\leqq k_{abs}\leqq0.1$.

When the optical parameter $\rho = n_{abs}d_{abs}/\lambda$ is within a range of $1.11\leqq\rho\leqq1.59$, k_{abs} is preferably $0.001\leqq k_{abs}\leqq0.2$. When the prescribed values other than the reflectance and the degree of modulation prescribed in the CD standards, such as the push pull value, etc., are taken into consideration, the optical parameter $\rho = n_{abs}d_{abs}/\lambda$ is preferably $1.25\leqq\rho\leqq1.5$, and at the same time k_{abs} is preferably $0.01\leqq k_{abs}\leqq0.08$.

Such definitions of the present invention are applicable even when other layers are provided. For example, in a case where a transparent layer such as an enhancing layer of e.g. SiO_2 or a primer layer, is provided between the substrate 2 and the light absorptive layer 3, such a transparent layer may be taken as a part of the substrate, and in a case where a layer such as an adhesive layer or a hard layer, is provided between the light absorptive layer and the light reflective layer, such an additional layer may be taken as a second light absorptive layer, and the optical parameter ρ will be $\rho = (n_1\cdot d_1+n_2\cdot d_2)/\lambda$. In a case of a plurality of layers, the optical parameter ρ will be $\rho = \Sigma(n_i\cdot d_i)/\lambda$ where i is an integer and n_i is the real part of the complex refractive index of each layer, and d_i is the average thickness of each layer. In this manner, even the case involving a plurality of layers, can be dealt with in the same way.

Likewise, a composite complex refractive index K representing the average of a plurality of k_{abs}, can be obtained by $K = \Sigma d_i\cdot k_i/\Sigma d_i$ where k_i is the imaginary part of the complex refractive index of each layer, and thus this case can be dealt with in the same manner as in the case of a single layer.

Now, specific embodiments of the present invention will be described in detail with reference to the drawings.

Figures 1 to 3 diagrammatically illustrate an embodiment of the structure of the optical information recording medium of the present invention. In these Figures, reference numeral 1 indicates a light transmitting substrate, numeral 2 indicates a light absorptive layer formed thereon, numeral 3 indicates a light reflective layer formed thereon, and numeral 4 indicates a protective layer formed thereon.

Figure 2 diagrammatically illustrates the state prior to the recording by a laser beam, and Figure 3 diagrammatically illustrates the state after the recording.

The light transmitting substrate 1 is made of a material having high transparency with a refractive index within a range of from 1.0 to 1.8 to laser beams and is usually made of a resin having excellent impact strength. For example, a polycarbonate substrate, an acrylate resin substrate or an epoxy resin substrate can be employed. In some cases, a glass substrate or the like may be employed. To satisfy the CD standards, the thickness is preferably within a range of from 1.1 to 1.5 mm. Further, an intermediate layer such as a solvent resistant layer or an enhancing layer of e.g. SiO_2, may be formed between the substrate and the light absorptive layer. Such a substrate can be molded by any suitable molding method. However, an injection molding method is preferred.

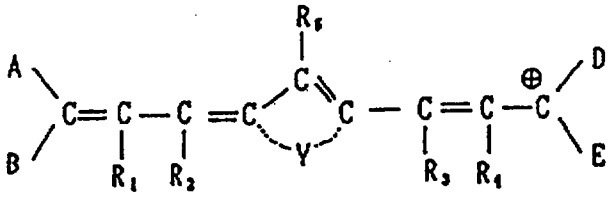
A spiral pregroove for tracking may be formed on the surface of the substrate on which the light absorptive layer is to be formed. The pitch of the groove i.e. the so-called tracking pitch, is preferably about 1.6 μm. The pregroove is usually formed by pressing a stamper at the time of the injection molding. However, it may be formed by cutting with a laser beam or by a 2P method (photo-polymer method).

The light absorbing substance to be used for the light absorptive layer 2, is preferably an organic dye, particularly a cyanine dye so that the numerical values for n_{abs} and k_{abs} can easily be set. However, any other known light absorbing substances may be employed, so long as the effects of the present invention can be obtained.

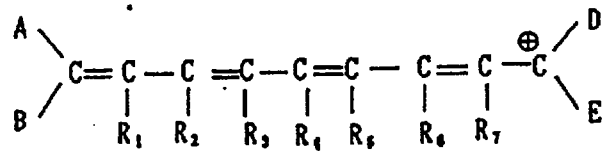
As the light absorbing organic dye, a polymethine dye, a triarylmethane dye, a pyrylium dye, a tetradehydrocholine dye, a triarylamine dye, a squarylium dye, a croconic methine dye and a mellocyanine dye may, for example, be mentioned. However, the organic dye is not limited to such specific examples.

Specifically, the following dyes may be mentioned.

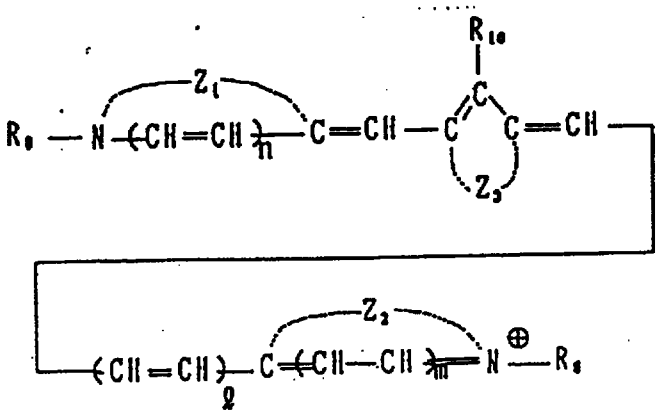
Polymethine dyes



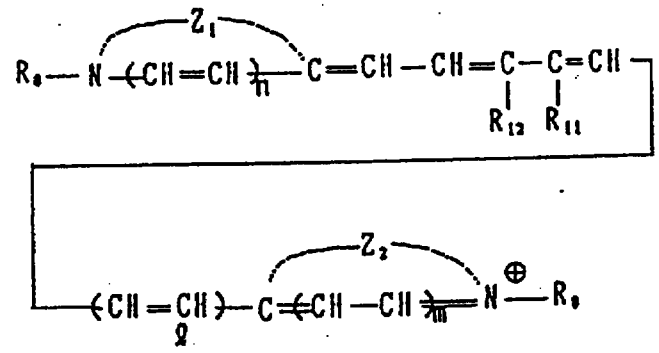
(10)



(11)



(12)

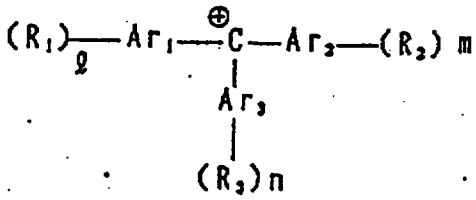


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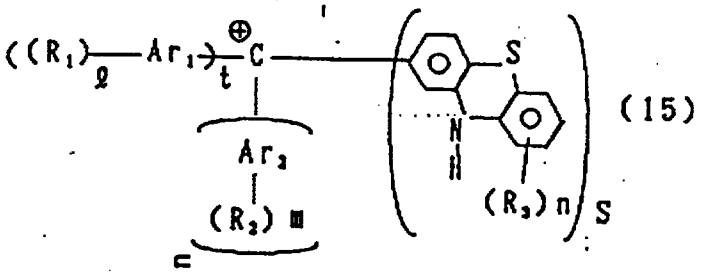
In the above chemical formulas (10) to (13), each of A, B, D and E is a substituted or unsubstituted aryl group, each of R_1, R_2, R_3, R_4, R_5, R_6 and R_7 which may be the same or different, is a hydrogen atom, a halogen atom or an alkyl group, Y is a residue having a group of atoms required to complete a 5- or 6-membered ring, each of R_8 and R_9 which may be the same or different, is a substituted or unsubstituted alkyl group, a substituted or unsubstituted aralkyl group or an alkenyl group, each of Z_1 and Z_2 is a group of atoms required to complete a substituted or unsubstituted hetero ring, Z_3 is a group of atoms required to complete a substituted or unsubstituted 5- or 6-membered ring, said 5- or 6-membered ring may be condensed with an aromatic ring, R_{10} is a hydrogen atom or a halogen atom, each of R_{11} and R_{12} is a hydrogen atom, a halogen atom, a hydroxyl

group, a carboxyl group, an alkyl group, a substituted or unsubstituted aryl group or an acyloxy group, and each of ℓ, m and n is 0 or 1.

Triarylmethane dyes



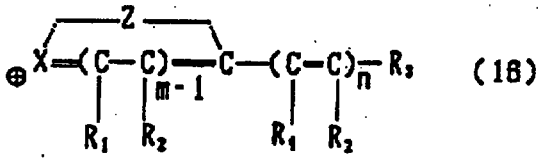
(14)



(15)

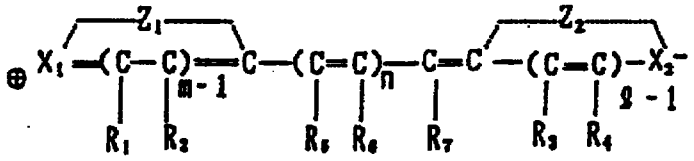
In the above chemical formulas (14) and (15), each of R_1, R_2 and R_3 which may be the same or different, is a hydrogen atom, a hydroxyl group, a halogen atom, a C_1-C_{20} alkyl group or -N(C_1-C_{10}alkyl)$_2$, each of ℓ, m and n is an integer of from 0 to 9, each of Ar_1, Ar_2 and Ar_3 which may be the same or different, is a substituted or unsubstituted aryl group, and each of s, t and u is an integer of from 0 to 3, provided that s+t+u=3.

Pyrylium dyes



(16)

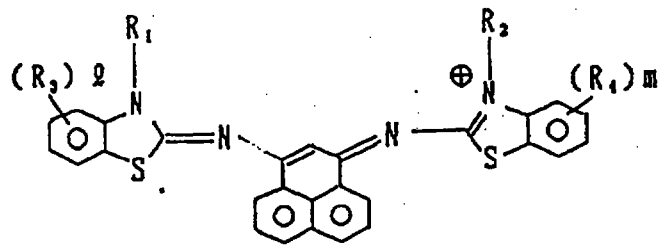
(17)



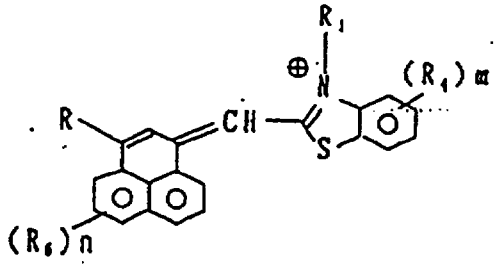
In the above chemical formulas (16) and (17), each of X, X_1 and X_2 is a sulfur atom, an oxygen atom or a selenium atom, each of Z and Z_1 is a hydrocarbon group comprising a group of atoms required to complete a substituted or unsubstituted pyrylium, thiopyrylium, selenapyrylium, benzopyrylium, benzothiopyrylium, benzoselenapyrylium, naphthopyrylium, naphthothiopyrylium or naphthoselenapyrylium, Z_2 is a hydrocarbon group comprising a group of atoms required to complete substituted or unsubstituted pyrane, thiopyrane, selenapyrane, benzopyrane, benzothiopyrane, benzoselenapyrane, naphthopyrane, naphthothiopyrane or naphthoselenapyrane, each of R_1, R_2, R_3 and R_4 is a hydrogen atom, a substituted or unsubstituted alkyl group or a substituted or unsubstituted aryl group, each of R_5, R_6 and R_7 is a hydrogen atom, a halogen atom, a sub-

stituted or unsubstituted alkyl group, a substituted or unsubstituted aryl group or a substituted or unsubstituted aralkyl group, each of m and ℓ is 1 or 2, and n is 0, 1 or 2.

Phenanthrene dyes

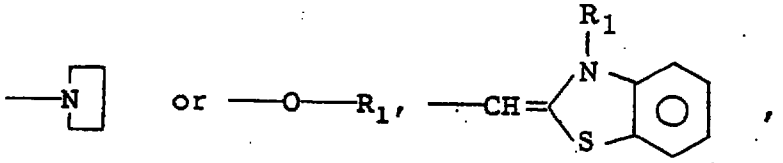


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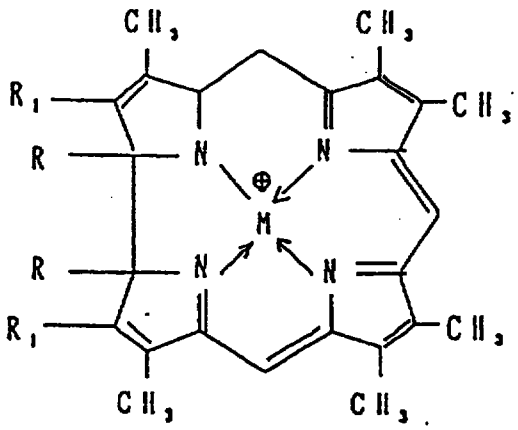
(19)

In the above chemical formulas (18) and (19), each of R_1 and R_2 is an alkyl group, each of R_3, R_4 and R_5 is a hydrogen atom, a hydroxyl group, a halogen atom, a substituted or unsubstituted alkyl, aryl, aralkyl, amino or alkoxy group, R is



and each of ℓ, m and n is an integer of from 0 to 6.

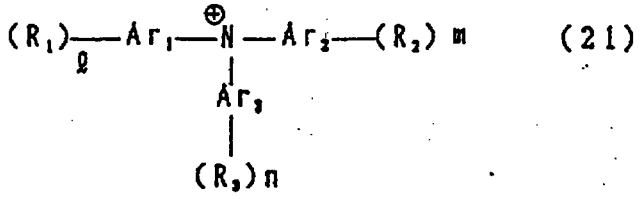
Tetrahydrocholine dyes



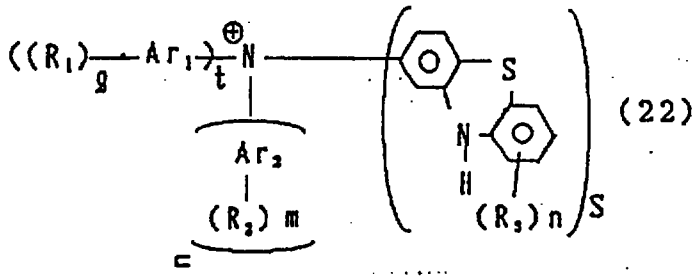
(20)

In the above chemical formula (20), R is an alkyl group or a carboxyalkyl group such as $COOC_2H_5$, R_1 is a hydrogen atom or an alkyl group, and M is H, Ni(II), Co(II) or Co(III).

Triarylamine dyes



(21)

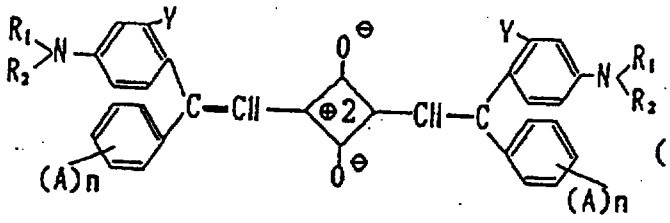


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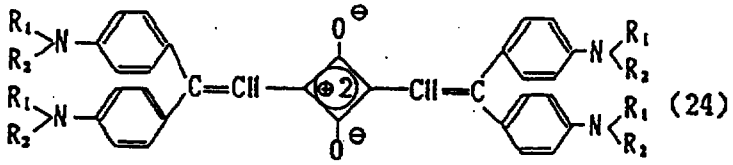
In the above chemical formulas (21) and (22), R_1 to R_3, ℓ, m, n, Ar_1 to Ar_3, s, t and u are as defined with respect to the above chemical formulas (14) and (15).

The counter ions to the dye cations of the above chemical formulas (10) to (22) may be acid anions such as a chloride ion, a bromide ion, an iodide ion, a perchloric acid ion, a benzene sulfonic acid ion, a p-toluenesulfonic acid ion, a methylsulfuric acid ion, an ethylsulfuric acid ion and a propylsulfuric acid ion.

Squarylium dyes

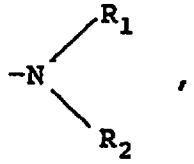


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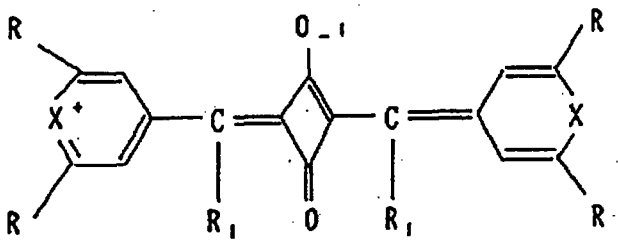
(24)

In the above chemical formulas (23) and (24), A is a hydrogen atom, a halogen atom, an alkyl group, an alkoxy group, a nitro group, a cyano group, a trifluoromethyl group or



and n is an integer of from 0 to 5, provided that when n is from 2 to 5, a plurality of A may be the same or different, Y is a hydrogen atom, an alkyl group, a halogen atom or a hydroxyl group, and each of R_1 and R_2 is an alkyl group, a substituted or unsubstituted phenyl group, a substituted or unsubstituted benzyl group or an

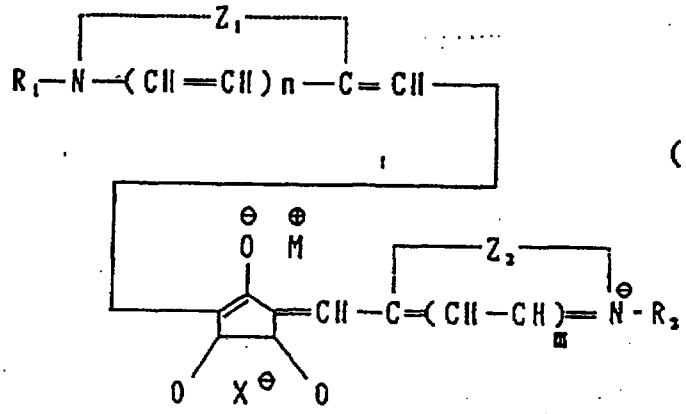
allyl group.



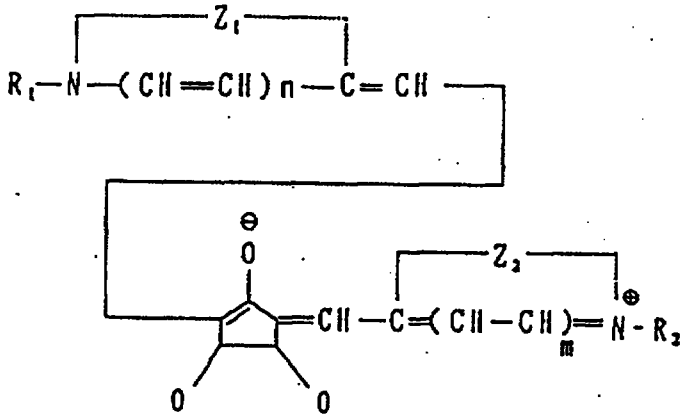
(25)

In the above chemical formula (25), X is an oxygen atom or a sulfur atom, R is an alkyl group having at least one carbon atom, and R_1 is a hydrogen atom or a methyl group.

Croconic methine dyes

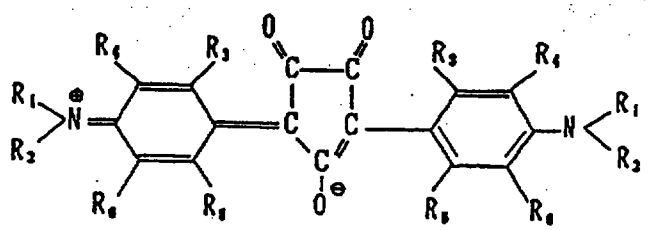


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(27)

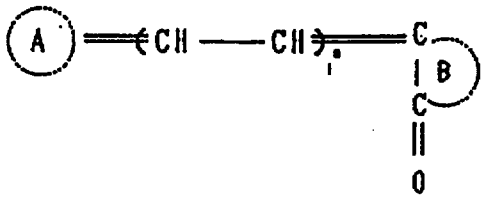
In the above chemical formulas (26) and (27), each of R_1 and R_2 is a substituted or unsubstituted alkyl group, a cyclic alkyl group, an allyl group, a substituted or unsubstituted aralkyl group or a substituted or unsubstituted aryl group, and each of Z_1 and Z_2 is a group of non-metal atoms required to complete a substituted or unsubstituted hetero ring, each of m and n is 0 or 1, M^+ is a cation, and X is an anion.



(28)

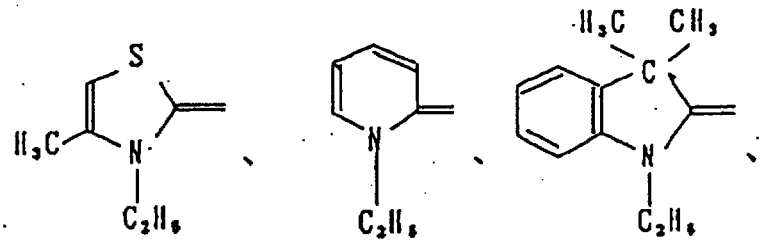
In the above chemical formula (28), each of R_1 and R_2 is an alkyl group, or R_1 and R_2 may form a ring together with the nitrogen atom, each of R_3, R_4, R_5 and R_6 is a hydrogen atom, a halogen atom, an alkyl group, an alkoxy group or a hydroxyl group, or R_1 and R_2 may bond to each other to form a benzene ring, and R_3 and R_4, and R_5 and R_6 may respectively bond to each other to form a benzene ring.

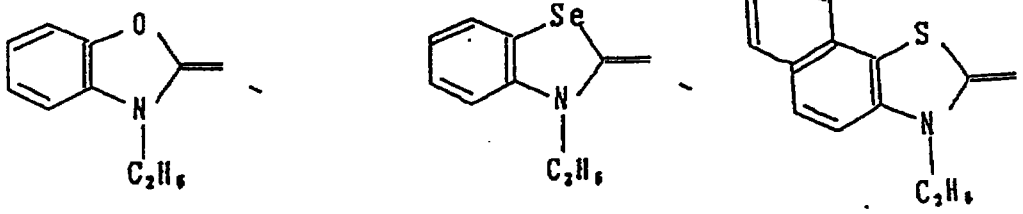
Mellocyanine dyes

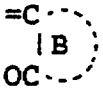


(29)

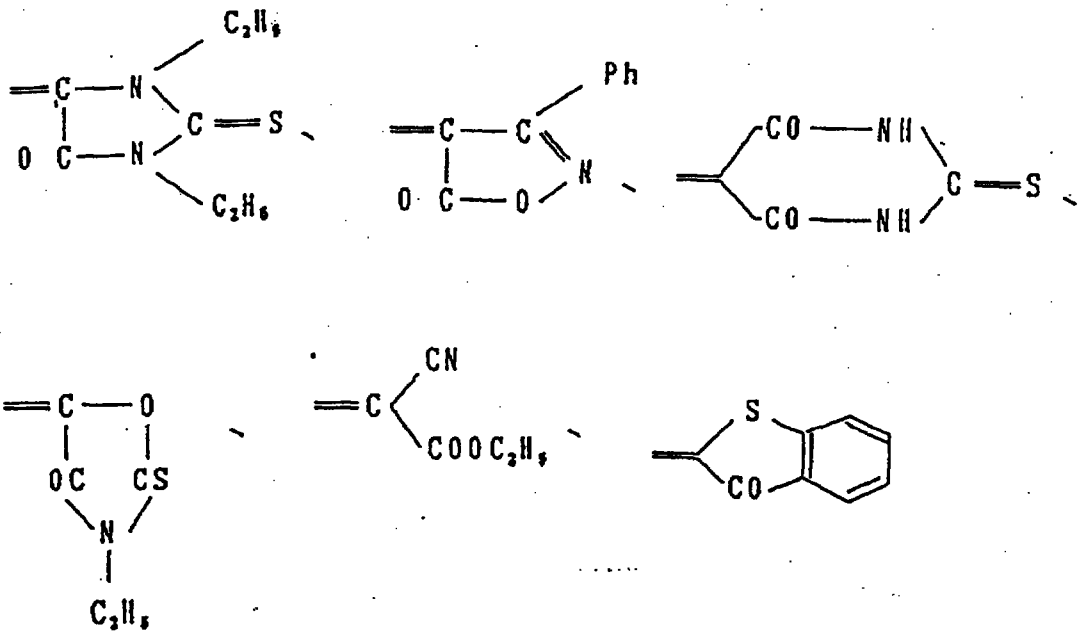
In the above chemical formula (29),  represents the following rings:





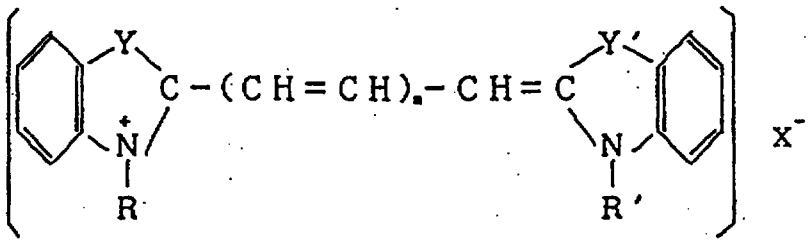


represents the following rings:



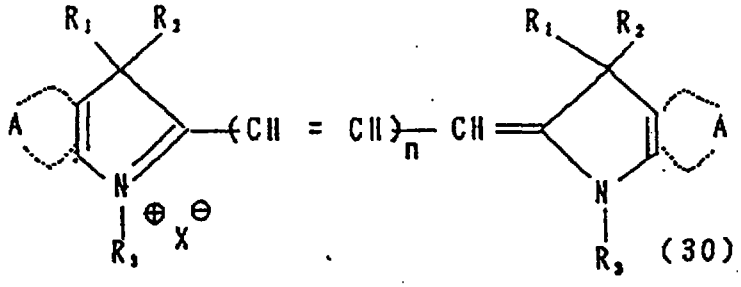
and n is 1 or 2.

A preferred cyanine dye as the material to be used for the light absorptive layer 2 of the optical information recording medium of the present invention, is represented by the following formula i.e. a dye having a structure in which the heterocyclic rings are linked by a methine chain:

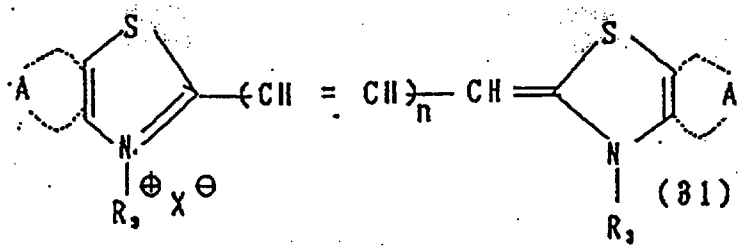


In the above chemical formula, each of Y and Y' is O, S, Se, NH, -CH=CH- or CH_3-C-CH_3, each of R and R' is an alkyl group, X is an atom or molecule capable of forming an anion such as a halogen atom, and n is 0, 1, 2 or 3.

Specifically, an indolenine-type cyanine dye and a thiazole-type cyanine dye may, for example, be mentioned. The following examples may be given.



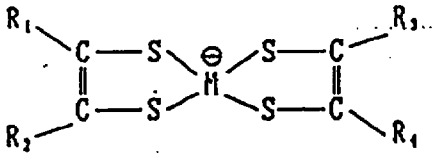
(30)



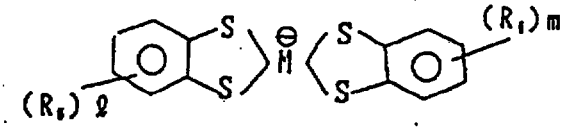
(31)

In the above chemical formulas (30) and (31), each of R_1, R_2 and R_3 which may be the same or different, is a C_1-C_6 alkyl group, X is a halogen atom, a perhalogeno acid, tetrafluoroboric acid, toluenesulfonic acid or an alkylsulfuric acid, A is a benzene ring or a naphthyl ring, which may be substituted by an alkyl group, an alkoxy group, a hydroxyl group, a carboxyl group, a halogen atom, an allyl group or an alkylcarboxyl group, and n is an integer of from 0 to 3.

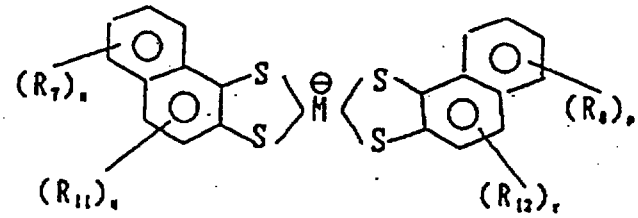
Further, an alkyl group or a halogen atom may be substituted on each carbon atoms constituting the methine chain, and X may be a metal complex anion as identified below.



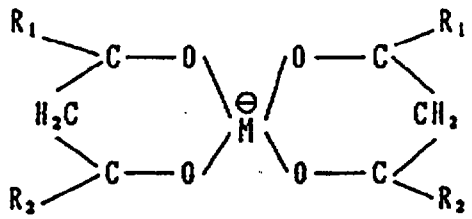
(32)



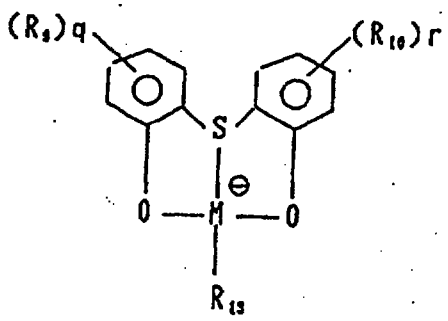
(33)



(34)



(35)

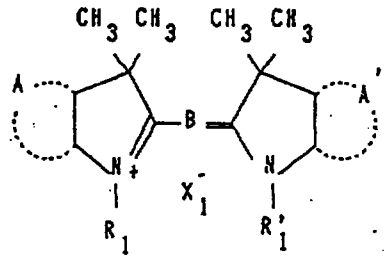


(36)

In the above chemical formulas (32) to (36), M is a transition metal such as Ni, Co, Mn, Cu, Pd or Pt, each of R_1 to R_4 which may be the same or different, is a substituted or unsubstituted alkyl, aryl or amino group, each of R_5 to R_{12} which may the same or different, is a hydrogen atom, a halogen atom or a substituted or unsubstituted alkyl, acyl, alkoxy, acyloxy, aryl, alkenyl or amino group, R_{13} is a substituted or unsubstituted amino group, each of ℓ, m, n, p, q and r is an integer of from 0 to 4, and each of u and v is an integer of from 0 to 2.

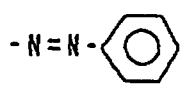
However, the present invention is by no means restricted to the above-mentioned cyanine dyes, and other cyanine dyes such as a quinoline-type cyanine dye, an oxazol-type cyanine dye, may provide the effects of the present invention, so long as they are light absorbing cyanine dyes.

The indodicarbocyanine as a further preferred cyanine dye to obtain the effects of the present invention, is represented by the following formula:



wherein each of A and A' which may be the same or different is a group of atoms forming a benzene ring, a substituted benzene ring, a naphthalene ring or a substituted naphthalene ring, B is pentamethylene (-CH=CH-CH=CH-CH=), of which each hydrogen atom may be substituted by a halogen atom, an alkyl group, an alkoxy group or a diphenylamino group, or which may have a substituted or unsubstituted cyclic side chain bridging a plurality of carbon atoms, each of R_1 and R_1' which may be the same or different is a substituted or unsubstituted alkyl, alkoxy, alkylhydroxy, aralkyl, alkenyl, alkylcarboxyl or alkylsulfonyl group, or a substituted or unsubstituted alkylcarboxyl or alkylsulfonyl group bonded to an alkali metal ion or an alkyl group, and X_1^- is an anion such as a halogen atom, perchloric acid, borofluoric acid, benzenesulfonic acid, toluenesulfonic acid, an alkylsulfonic acid, a benzenecarboxylic acid, an alkylcarboxylic acid or a trifluoromethylcarboxylic acid, provided that when R_1 and R_1' have a group bonded to an alkali metal ion, X_1^- may be not present.

As the substituents A and A' of the cyanine dye represented by the foregoing formula, a substituted or unsubstituted benzene ring and a substituted or unsubstituted naphthalene ring may be mentioned. The substituents thereof include, for example, an alkyl group, an alkoxy group, a hydroxyl group, a carboxyl group, a halogen atom, an allyl group, an alkylcarboxyl group, an alkylalkoxy group, an aralkyl group, an alkylcarbonyl group, a sulfonate alkyl group bonded with a metal ion, a nitro group, an amino group, an alkylamino group, an aryl group, a phenylethylene group and the following:



-CH=CH-CN, -$NHCOCH_3$,



Further, a combination of a plurality of indolenine cyanines having such substituents may be employed. For example, substituents for the substituents A and A' of such compounds may be, for example, as shown in Table 1.

Table 1

First cyanine	Second cyanine
$-C_nH_{2n+1}(n=1,2,3,4)$	$-NO_2$
$-NO_2$	$-OC_nH_{2n+1}(n=1,2,3,4)$
$-C_nH_{2n+1}(n=1,2,3,4)$	$-OC_nH_{2n+1}(n=1,2,3,4)$
$-N(C_nH_{2n+1})(C_nH_{2n+1})$ $(n=1,2,3,4)$	$-C_nH_{2n+1}(n=1,2,3,4)$
$-N(C_nH_{2n+1})(C_nH_{2n+1})$ $(n=1,2,3,4)$	$-C_nH_{2n+1}(n=1,2,3,4)$
$-N(C_nH_{2n+1})(C_nH_{2n+1})$ $(n=1,2,3,4)$	$-OC_nH_{2n+1}(n=1,2,3,4)$

As the cyclic side chain bonding to B of the foregoing formula, a linking chain may be mentioned which is composed of carbon or other atoms forming e.g. a 4-membered, 5-membered or 6-membered ring together with a plurality of carbon atoms of the pentamethine chain by bridging e.g. the second and fourth carbon atoms, and it may have a substituent. The substituents directly attached to B or located on the above cyclic side chain, include a halogen atom, a diphenylamino group, an alkoxy group (e.g. a lower alkoxy group such as methoxy or ethoxy), and an alkyl group (e.g. a lower alkyl group such as methyl or ethyl).

The light absorptive layer may contain in addition to the above cyanine dye, other dyes, resins (e.g. a thermoplastic resin such as nitrocellulose, or a thermoplastic elastomer), liquid rubber, etc. Specifically, there may be mentioned, in addition to those mentioned in the following Examples, a thermoplastic resin such as isobutylene, a maleic anhydride copolymer, an ethylene-vinyl acetate copolymer, a carboxyvinyl polymer, a chlorinated polypropylene, a polyethylene oxide, a polyamide (nylon 6, nylon 12 or methoxymethylated polyamide), a cumarone resin, a ketone resin, a polyvinyl acetate, a polystyrene, PVA (polyvinyl alcohol) or PVE (polyvinyl ester), a cellulose derivative such as carboxymethyl cellulose, nitrocellulose, HPC (hydroxypropyl cellulose), HEC (hydroxyethyl cellulose), MC (methyl cellulose), EC (ethyl cellulose), EHEC (ethyl hydroxyethyl cellulose) or CMEC (carboxymethyl ethyl cellulose), an oligomer such as oligostyrene or methylstyrene oligomer, and an elastomer rubber such as a styrene block copolymer or a urethane-type thermoplastic elastomer.

In the case of an organic dye, this light absorptive layer 2 is formed by coating a solution of such an organic dye in a known organic solvent such as acetylacetone, methyl cellosolve or toluene, on the surface of the above substrate 1. For the coating, a vapor deposition method, a LB method or a spin coating method may, for example, be employed. Among them, a spin coating method is preferred, since it is thereby possible to readily control the thickness of the light absorptive layer 2 by adjusting the concentration or viscosity of the coating

material, or the drying rate of the solvent.

The organic solvent may be an alcohol such as methanol, ethanol, propanol, isopropyl alcohol, butanol, amyl alcohol, isoamyl alcohol, hexyl alcohol, heptanol, benzyl alcohol, cyclohexanol or furfuryl alcohol; an ether such as cellosolve, diethyl cellosolve, butyl cellosolve, methyl carbitol, carbitol, acetal, dioxane or tetrahydrofuran; a ketone such as acetone, methyl ethyl ketone, methyl isobutyl ketone, diacetone alcohol, cyclohexanone or acetophenone; an ester such as ethyl formate, butyl formate, amyl formate, methyl acetate, ethyl acetate, propyl acetate, butyl acetate, amyl acetate, phenyl acetate, methyl cellosolve acetate or cellosolve acetate; a nitrohydrocarbon such as nitromethane, nitroethane, nitropropane, nitrobutanol or nitrobenzene; a halogenated solvent such as methyl chloride, methylene chloride, chloroform, methyl bromide, bromoform, methylene iodide, ethyl chloride, ethylene chloride, ethylidene chloride, trichloroethane, trichloroethylene, propylene chloride, butyl chloride, dichlorobutane, hexachloropropylene, dichloropentane, amyl chloride, chlorobenzene, o-dichlorobenzene, trichlorobenzene, trichlorotoluene or dichlorotoluene; or other solvents such as paraldehyde, crotonaldehyde, furfural, aldol, acetonitrile, formamide, dimethylformamide, acetol, γ-valerolactone, amylphenol, sulfolane, 2-mercaptoethyl alcohol, dimethylsulfoxide, N-methylpyrrolidone or methyl carbamate. These organic solvents may be contained in the light absorptive layer.

Further, the light absorptive layer of the present invention may be formed by using a plurality of light absorbing substances.

The light reflective layer 3 is a metal film, which is formed by e.g. vapor depositing or sputtering gold, silver, copper, aluminum or an alloy thereof. Since the reflectance is required to be at least 70%, it is preferred to employ a metal film composed mainly of gold or an alloy containing gold, among them.

The protective layer 4 is formed with a resin excellent in the impact resistance similar to the light transmitting substrate 1. It is usually formed by coating an ultraviolet curable resin by spin coating, followed by irradiation with ultraviolet rays for curing. As other materials, an epoxy resin, an acrylate resin, a silicone hard coat resin, etc. may be used. In order to provide a buffering effect, it may be formed with an elastic material such as an urethane resin.

In the optical information recording medium of the present invention, a layer behind the light absorptive layer 2 relative to the light transmitting substrate 1, such as the light reflective layer 3 or the protective layer 4, is preferably made of a material having a heat distortion temperature and a hardness higher than the layer on which pits 5 are formed. By forming the layer behind the absorptive layer 2 with a hard material, the block error rate of recorded signals can effectively be reduced, whereby it is readily possible to meet the standard requirement of BLER (block error rate) being not higher than 3×10^{-2} as prescribed in the CD standards.

Further, an intermediate layer such as an oxidation resistant layer to prevent the oxidation of the reflective layer 3, may be interposed between the reflective layer 3 and the protective layer 4.

By using the optical information recording medium constructed as described above, recording is conducted by irradiating a laser beam to the light absorptive layer from the substrate side in such a manner that while rotating the optical information recording medium and tracking with a tracking guide means, for example, along the pregroove, a laser spot corresponding to the signal modulated in accordance with the CD standards, is irradiated by a pick up. The wavelength λ of the recording laser beam is preferably about 780 nm. The linear speed is preferably from 1.2 to 1.4 m/sec, and the recording power may be at a level of from 6 to 9 mW.

By conducting the recording in such a manner, the portions irradiated with the recording laser beam undergo optical changes or, in some cases, physical changes, due to the heat generation reaction of the light absorptive layer. In the following Examples, when an injection molded resin is used as the substrate and an organic dye is used for the light absorptive layer, the substrate side of the light absorptive layer may undergo a deformation.

The optical information recording medium thus recorded, may be played back by a usual CD player.

Further, the optical information recording medium of the present invention may have a ROM region formed at a portion thereof. In this manner, it is possible to preliminarily record the same data in a large quantity, and later record optional data of the user's own at the recordable region, and the recorded data can be reproduced by an ordinary CD player.

Now, the present invention will be described in further detail with reference to Examples. However, it should be understood that the present invention is by no means restricted to such specific Examples.

EXAMPLE 1

A polycarbonate substrate 1 of a disk shape having a thickness of 1.2 mm, an outer diameter of 120 mm and an inner diameter of 15 mm and having a spiral pregroove formed on its surface with a width of 0.8 μm, a depth of 0.08 μm and a pitch of 1.6 μm, was formed by injection molding.

As a cyanine dye, 0.95 g of 1,1'-dibutyl-3,3,3',3'-tetramethyl-4,5,4',5'-dibenzoindodicarbocyanine per-

chlorate (product number NK3219, manufactured by Nippon Kanko Shikiso Kenkyusho) was dissolved in 10 mℓ of an acetylacetone solvent, and the solution was coated on the above substrate 1 by spin coating to form a light absorptive layer 2 having a thickness of 250 nm. The complex refractive index of this light absorptive layer 2 was $n_{abs} = 2.7$ and $k_{abs} = 0.05$. As mentioned hereinafter, the wavelength of the reading semiconductor laser beam was $\lambda = 780$ nm, whereby $\rho = n_{abs}d_{abs}/\lambda = 0.87$.

Then, a gold film having a thickness of 60 nm was formed by vacuum deposition on the entire surface of this disk, to form a light reflective layer 3. Further, on this light reflective layer 3, an ultraviolet curable resin was spin-coated and then cured by irradiation with ultraviolet rays, to form a protective layer 4 having a thickness of 10 μm.

To the optical disk thus obtained, a semiconductor laser having a wavelength of 780 nm was irradiated at a linear speed of 1.2 m/sec with a recording power of 6.8 mW, to record EFM signals. Then, this optical disk was played back by a commercially available CD player (Aurex XR-V73, wavelength of the reading laser beam $\lambda = 780$ nm, a laser with a reading power of 0.5 mW), whereby the reflectance of the optical disk was 70.2%, I_{11}/I_{top} obtained from the eye pattern of the read-out signals was 0.9, I_3/I_{top} was 0.6, and the block error rate was 2.0×10^{-3}.

The CD standards prescribed that the reflectance is at least 70%, I_{11}/I_{top} is at least 0.6, I_3/I_{top} is from 0.3 to 0.7, and the block error rate is at most 3.0×10^{-2}. The optical disk of this Example meets the standards.

EXAMPLE 2

On a polycarbonate substrate 1 molded in the same manner as in Example 1, 1.45 g of the same cyanine dye as used in Example 1 dissolved in 10 mℓ of an acetylacetone solvent, was coated by spin coating to form a light absorptive layer 2 having a thickness of 410 nm. In this case, $\rho = n_{abs}d_{abs}/\lambda = 1.42$.

In the same manner as in Example 1, a light reflective layer 3 was formed on the entire surface of this disk. Further, on this light reflective layer 3, an ultraviolet curable resin was spin-coated and cured by irradiation with ultraviolet rays to form a protective layer 4 having a thickness of 10 μm.

To the optical disk thus obtained, EFM signals were recorded in the same manner as in Example 1. Then, this optical disk was played back by the same CD player as used in Example 1, whereby the reflectance of the optical disk was 72%, I_{11}/I_{top} was 0.95, I_3/I_{top} was 0.70, and the block error rate was 1.5×10^{-2}. Thus, the optical disk of this Example also meets the CD standards like the preceding Example.

EXAMPLE 3

On a polycarbonate substrate 1 molded in the same manner as in Example 1, a solution obtained by dissolving 0.6 g of 1,1'-dipropyl-3,3,3',3'-tetramethylindodicarbocyanine perchlorate and 0.7 g of IRG003 (Nihon Kayaku K.K.) in 10 mℓ of an acetylacetone solvent, was coated by spin coating to form a light absorptive layer 2 having a thickness of 330 nm. In this case, $\rho = n_{abs}d_{abs}/\lambda = 0.85$, and $k_{abs} = 0.06$.

In the same manner as in Example 1, a light reflective layer 3 was formed on the entire surface of this disk. Further, on this light reflective layer 3, an ultraviolet curable resin was spin-coated and cured by irradiation with ultraviolet rays to form a protective layer having a thickness of 10 μm.

To the optical disk thus obtained, EFM signals were recorded in the same manner as in Example 1. Then, this optical disk was played back by the same CD player as used in Example 1, whereby the reflectance of the optical disk was 71%, I_{11}/I_{top} was 0.85, I_3/I_{top} was 0.45, and the block error rate was 1.0×10^{-2}. Thus, the optical disk of this Example also meets the CD standards like the preceding Examples.

As described in the foregoing, according to the present invention, it is possible to provide an optical information recording medium and a recording method, whereby the reflectance and the degree of modulation prescribed in the CD standards can be satisfied.

Claims

1. An optical information recording medium comprising a light transmitting substrate, a light absorptive layer containing at least one light absorbing substance formed on the substrate and a light reflective layer made of a metal film formed on the light absorptive layer, characterized in that the optical parameter represented by $\rho = n_{abs}d_{abs}/\lambda$ wherein n_{abs} is the real part of the complex refractive index of the light absorptive layer, d_{abs} is the average thickness of the light absorptive layer and λ is the wavelength of a reading laser beam, is $0.6<\rho<1.6$.

* C L M S *

chlorate (product number NK3219, manufactured by Nippon Kanko Shikiso Kenkyusho) was dissolved in 10 mℓ of an acetylacetone solvent, and the solution was coated on the above substrate 1 by spin coating to form a light absorptive layer 2 having a thickness of 250 nm. The complex refractive index of this light absorptive layer 2 was $n_{abs} = 2.7$ and $k_{abs} = 0.05$. As mentioned hereinafter, the wavelength of the reading semiconductor laser beam was $\lambda = 780$ nm, whereby $\rho = n_{abs}d_{abs}/\lambda = 0.87$.

Then, a gold film having a thickness of 60 nm was formed by vacuum deposition on the entire surface of this disk, to form a light reflective layer 3. Further, on this light reflective layer 3, an ultraviolet curable resin was spin-coated and then cured by irradiation with ultraviolet rays, to form a protective layer 4 having a thickness of 10 μm.

To the optical disk thus obtained, a semiconductor laser having a wavelength of 780 nm was irradiated at a linear speed of 1.2 m/sec with a recording power of 6.8 mW, to record EFM signals. Then, this optical disk was played back by a commercially available CD player (Aurex XR-V73, wavelength of the reading laser beam $\lambda = 780$ nm, a laser with a reading power of 0.5 mW), whereby the reflectance of the optical disk was 70.2%, I_{11}/I_{top} obtained from the eye pattern of the read-out signals was 0.9, I_3/I_{top} was 0.6, and the block error rate was 2.0×10^{-3}.

The CD standards prescribed that the reflectance is at least 70%, I_{11}/I_{top} is at least 0.6, I_3/I_{top} is from 0.3 to 0.7, and the block error rate is at most 3.0×10^{-2}. The optical disk of this Example meets the standards.

EXAMPLE 2

On a polycarbonate substrate 1 molded in the same manner as in Example 1, 1.45 g of the same cyanine dye as used in Example 1 dissolved in 10 mℓ of an acetylacetone solvent, was coated by spin coating to form a light absorptive layer 2 having a thickness of 410 nm. In this case, $\rho = n_{abs}d_{abs}/\lambda = 1.42$.

In the same manner as in Example 1, a light reflective layer 3 was formed on the entire surface of this disk. Further, on this light reflective layer 3, an ultraviolet curable resin was spin-coated and cured by irradiation with ultraviolet rays to form a protective layer 4 having a thickness of 10 μm.

To the optical disk thus obtained, EFM signals were recorded in the same manner as in Example 1. Then, this optical disk was played back by the same CD player as used in Example 1, whereby the reflectance of the optical disk was 72%, I_{11}/I_{top} was 0.95, I_3/I_{top} was 0.70, and the block error rate was 1.5×10^{-2}. Thus, the optical disk of this Example also meets the CD standards like the preceding Example.

EXAMPLE 3

On a polycarbonate substrate 1 molded in the same manner as in Example 1, a solution obtained by dissolving 0.6 g of 1,1'-dipropyl-3,3,3',3'-tetramethylindodicarbocyanine perchlorate and 0.7 g of IRG003 (Nihon Kayaku K.K.) in 10 mℓ of an acetylacetone solvent, was coated by spin coating to form a light absorptive layer 2 having a thickness of 330 nm. In this case, $\rho = n_{abs}d_{abs}/\lambda = 0.85$, and $k_{abs} = 0.06$.

In the same manner as in Example 1, a light reflective layer 3 was formed on the entire surface of this disk. Further, on this light reflective layer 3, an ultraviolet curable resin was spin-coated and cured by irradiation with ultraviolet rays to form a protective layer having a thickness of 10 μm.

To the optical disk thus obtained, EFM signals were recorded in the same manner as in Example 1. Then, this optical disk was played back by the same CD player as used in Example 1, whereby the reflectance of the optical disk was 71%, I_{11}/I_{top} was 0.85, I_3/I_{top} was 0.45, and the block error rate was 1.0×10^{-2}. Thus, the optical disk of this Example also meets the CD standards like the preceding Examples.

As described in the foregoing, according to the present invention, it is possible to provide an optical information recording medium and a recording method, whereby the reflectance and the degree of modulation prescribed in the CD standards can be satisfied.

Claims

1. An optical information recording medium comprising a light transmitting substrate, a light absorptive layer containing at least one light absorbing substance formed on the substrate and a light reflective layer made of a metal film formed on the light absorptive layer, characterized in that the optical parameter represented by $\rho = n_{abs}d_{abs}/\lambda$ wherein n_{abs} is the real part of the complex refractive index of the light absorptive layer, d_{abs} is the average thickness of the light absorptive layer and λ is the wavelength of a reading laser beam, is $0.6<\rho<1.6$.

2. The optical information recording medium according to Claim 1, wherein the imaginary part k_{abs} of the complex refractive index of the light absorptive layer is at most 0.2.

3. The optical information recording medium according to Claim 1 or 2, wherein a protective layer is formed on the light reflective layer, and the imaginary part k_{abs} of the complex refractive index of the light absorptive layer is $0.001 \leqq k_{abs} \leqq 0.2$.

4. The optical information recording medium according to Claim 1, 2 or 3, wherein the optical parameter $\rho = n_{abs}d_{abs}/\lambda$ is $0.61 \leqq \rho \leqq 1.09$, and the imaginary part k_{abs} is $0.001 \leqq k_{abs} \leqq 0.2$.

5. The optical information recording medium according to any one of the preceding Claims, wherein the optical parameter $\rho = n_{abs}d_{abs}/\lambda$ is $0.7 \leqq \rho \leqq 0.9$, and the imaginary part k_{abs} is $0.01 \leqq k_{abs} \leqq 0.1$.

6. The optical information recording medium according to any one of the preceding Claims, wherein the optical parameter $\rho = n_{abs}d_{abs}/\lambda$ is $1.11 \leqq \rho \leqq 1.59$, and the imaginary part k_{abs} is from $0.001 \leqq k_{abs} \leqq 0.2$.

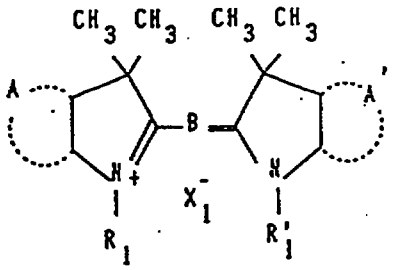
7. The optical information recording medium according to any one of the preceding Claims, wherein the optical parameter $\rho = n_{abs}d_{abs}/\lambda$ is $1.25 \leqq \rho \leqq 1.5$, and the imaginary part k_{abs} is $0.01 \leqq k_{abs} \leqq 0.08$.

8. The optical information recording medium according to any one of the preceding Claims, wherein the light transmitting substrate has a spiral groove formed on its surface on which the light absorptive layer is formed.

9. The optical information recording medium according to any one of the preceding Claims, wherein the light absorptive layer contains a cyanine dye alone or together with at least one other light absorbing substance.

10. The optical information recording medium according to any one of Claims 1 to 8, wherein the light absorptive layer contains indodicarbocyanine alone or together with at least one other light absorbing substance.

11. The optical information recording medium according to any one of Claims 1 to 8, wherein the light absorbing substance in the light absorptive layer is at least one cyanine dye represented by the formula:



wherein each of A and A' which may be the same or different is a group of atoms forming a benzene ring, a substituted benzene ring, a naphthalene ring or a substituted naphthalene ring, B is pentamethylene (-CH=CH-CH=CH-CH=), of which each hydrogen atom may be substituted by a halogen atom, an alkyl group, an alkoxy group or a diphenylamino group, or which may have a substituted or unsubstituted cyclic side chain bridging a plurality of carbon atoms, each of R_1 and R_1' which may be the same or different is a substituted or unsubstituted alkyl, alkoxy, alkylhydroxy, aralkyl, alkenyl, alkylcarboxyl or alkylsulfonyl group, or a substituted or unsubstituted alkylcarboxyl or alkylsulfonyl group bonded to an alkali metal ion or an alkyl group, and X_1^- is an anion such as a halogen atom, perchloric acid, borofluoric acid, benzenesulfonic acid, toluenesulfonic acid, an alkylsulfonic acid, a benzenecarboxylic acid, an alkylcarboxylic acid or a trifluoromethylcarboxylic acid, provided that when R_1 and R_1' have a group bonded to an alkali metal ion, X_1^- may be not present.

12. The optical information recording medium according to any one of the preceding Claims, wherein the light reflective layer is made of a film of gold, silver, copper, aluminum or an alloy thereof.

13. The optical information recording medium according to any one of the preceding Claims, wherein the pro-

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tective layer is made of a photocurable resin.

14. The optical information recording medium according to any one of the preceding Claims, wherein an intermediate layer is formed between the substrate and the light absorptive layer.

15. The optical information recording medium according to any one of the preceding Claims, wherein an intermediate layer is formed between the light absorptive layer and the reflective layer.

16. The optical information recording medium according to any one of the preceding Claims, wherein an intermediate layer is formed between the reflective layer and the protective layer.

17. The optical information recording medium according to any one of the preceding Claims, wherein the light absorptive layer is made of a plurality of layers.

18. A method for recording information on an optical recording medium according to any one of the preceding Claims, wherein the recording is conducted by irradiating a laser beam from the substrate side of the medium.

19. A method for recording information on an optical information recording medium according to any one of the preceding Claims wherein the recording is conducted by deforming the substrate side of the light absorptive layer by irradiating a laser beam from the substrate side.

20. A method for producing an optical information recording medium, which comprises injection molding a resin to form a substrate, forming a light absorptive layer on the substrate, forming a thin metal film on the light absorptive layer to form a light reflective layer, and forming a photocurable resin on the light reflective layer characterized in that the light absorptive layer is formed by spin coating to satisfy the condition that an optical parameter represented by $\rho = n_{abs}d_{abs}/\lambda$ wherein n_{abs} is the real part of the complex refractive index of the light absorptive layer, d_{abs} is the average thickness of the light absorptive layer and A is the wavelength of a reading laser beam, is $0.6<\rho<1.6$.

21. The method according to Claim 20, wherein the imaginary part k_{abs} of the complex refractive index of the light absorptive layer is $0.001 \leqq k_{abs} \leqq 0.2$.

Patentansprüche

1. Optisches Informationsaufzeichnungsmaterial, umfassend ein lichtdurchlässiges Substrat, eine auf dem Substrat gebildete lichtabsorbierende Schicht, die mindestens eine lichtabsorbierende Substanz enthält, und eine auf der lichtabsorbierenden Schicht gebildete lichtreflektierende Schicht aus einem Metallfilm, dadurch gekennzeichnet, daß der optische Parameter, der durch $\rho = n_{abs}d_{abs}/\lambda$ dargestellt wird, worin n_{abs} der Realteil des komplexen Brechungsindex der lichtabsorbierenden Schicht ist, d_{abs} die durchschnittliche Dicke der lichtabsorbierenden Schicht ist und λ die Wellenlänge eines Lese-Laserstrahls ist, $0,6<\rho<1,6$ beträgt.

2. Optisches Informationsaufzeichnungsmaterial nach Anspruch 1, bei dem der Imaginärteil k_{abs} des komplexen Brechungsindex der lichtabsorbierenden Schicht höchstens 0,2 beträgt.

3. Optisches Informationsaufzeichnungsmaterial nach Anspruch 1 oder 2, bei dem eine Schutzschicht auf der lichtreflektierenden Schicht gebildet ist und der Imaginärteil k_{abs} des komplexen Brechungsindex der lichtabsorbierenden Schicht $0,001 \leqq k_{abs} \leqq 0,2$ beträgt.

4. Optisches Informationsaufzeichnungsmaterial nach Anspruch 1, 2 oder 3, bei dem der optische Parameter $\rho = n_{abs}d_{abs}/\lambda$ $0,61 \leqq \rho \leqq 1,09$ beträgt und der Imaginärteil k_{abs} $0,001 \leqq k_{abs} \leqq 0,2$ beträgt.

5. Optisches Informationsaufzeichnungsmaterial nach irgendeinem der vorangehenden Ansprüche, bei dem der optische Parameter $\rho = n_{abs}d_{abs}/\lambda$ $0,7 \leqq \rho \leqq 0,9$ beträgt und der Imaginärteil k_{abs} $0,01 \leqq k_{abs} \leqq 0,1$ beträgt.

6. Optisches Informationsaufzeichnungsmaterial nach irgendeinem der vorangehenden Ansprüche, bei dem

der optische Parameter $\rho = n_{abs}d_{abs}/\lambda$ $1,11 \leq \rho \leq 1,59$ beträgt und der Imaginärteil k_{abs} $0,001 \leq k_{abs} \leq 0,2$ beträgt.

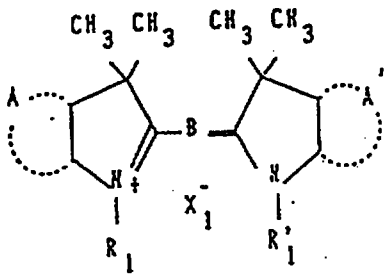
7. Optisches Informationsaufzeichnungsmaterial nach irgendeinem der vorangehenden Ansprüche, bei dem der optische Parameter $\rho = n_{abs}d_{abs}/\lambda$ $1,25 \leq \rho \leq 1,5$ beträgt und der Imaginärteil k_{abs} $0,01 \leq k_{abs} \leq 0,08$ beträgt.

8. Optisches Informationsaufzeichnungsmaterial nach irgendeinem der vorangehenden Ansprüche, bei dem das lichtdurchlässige Substrat eine spiralförmige Rille auf seiner Oberfläche, auf der die lichtabsorbierende Schicht gebildet ist, aufweist.

9. Optisches Informationsaufzeichnungsmaterial nach irgendeinem der vorangehenden Ansprüche, bei dem die lichtabsorbierende Schicht einen Cyaninfarbstoff allein oder zusammen mit mindestens einer anderen lichtabsorbierenden Substanz enthält.

10. Optisches Informationsaufzeichnungsmaterial nach irgendeinem der Ansprüche 1 bis 8, bei dem die lichtabsorbierende Schicht Indodicarbocyanin allein oder zusammen mit mindestens einer anderen lichtabsorbierenden Substanz enthält.

11. Optisches Informationsaufzeichnungsmaterial nach irgendeinem der Ansprüche 1 bis 8, bei dem die lichtabsorbierende Substanz in der lichtabsorbierenden Schicht mindestens ein Cyaninfarbstoff ist, der durch die Formel



dargestellt wird, in der jedes von A und A', die gleich oder verschieden sein können, eine Gruppe von Atomen ist, die einen Benzolring, einen substituierten Benzolring, einen Naphthalinring oder einen substituierten Naphthalinring bilden, B Pentamethylen (-CH=CH-CH=CH-CH=) ist, bei dem jedes Wasserstoffatom durch ein Halogenatom, eine Alkylgruppe, eine Alkoxygruppe oder eine Diphenylaminogruppe substituiert sein kann oder das eine substituierte oder unsubstituierte cyclische Seitenkette, die eine Mehrzahl von Kohlenstoffatomen überbrückt, aufweisen kann, jedes von R_1 und R_1', die gleich oder verschieden sein können, eine substituierte oder unsubstituierte Alkyl-, Alkoxy-, Alkylhydroxy-, Aralkyl-, Alkenyl-, Alkylcarboxyl- oder Alkylsulfonylgruppe oder eine substituierte oder unsubstitierte, an ein Alkalimetallion oder eine Alkylgruppe gebundene Alkylcarboxyl- oder Alkylsulfonylgruppe ist und X_1^- ein Anion, wie ein Halogenatom, eine Perchlorsäure, Borfluorwasserstoffsäure, Benzolsulfonsäure, Toluolsulfonsäure, eine Alkylsulfonsäure, eine Benzolcarbonsäure, eine Alkylcarbonsäure oder eine Trifluormethylcarbonsäure, ist, vorausgesetzt, daß, wenn R_1 und R_1' eine an ein Alkalimetallion gebundene Gruppe aufweisen, X_1^- nicht anwesend sein kann.

12. Optisches Informationsaufzeichnungsmaterial nach irgendeinem der vorangehenden Ansprüche, bei dem die lichtreflektierende Schicht aus einem Film aus Gold, Silber, Kupfer, Aluminium oder einer Legierung davon ist.

13. Optisches Informationsaufzeichnungsmaterial nach irgendeinem der vorangehenden Ansprüche, bei dem die Schutzschicht aus einem lichthärtbaren Harz ist.

14. Optisches Informationsaufzeichnungsmaterial nach irgendeinem der vorangehenden Ansprüche, bei dem eine Zwischenschicht zwischen dem Substrat und der lichtabsorbierenden Schicht gebildet ist.

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15. Optisches Informationsaufzeichnungsmaterial nach irgendeinem der vorangehenden Ansprüche, bei dem eine Zwischenschicht zwischen der lichtabsorbierenden Schicht und der reflektierenden Schicht gebildet ist.

16. Optisches Informationsaufzeichnungsmaterial nach irgendeinem der vorangehenden Ansprüche, bei dem eine Zwischenschicht zwischen der reflektierenden Schicht und der Schutzschicht gebildet ist.

17. Optisches Informationsaufzeichnungsmaterial nach irgendeinem der vorangehenden Ansprüche, bei dem die lichtabsorbierende Schicht aus einer Mehrzahl von Schichten besteht.

18. Verfahren zur Aufzeichnung von Information auf einem optischen Aufzeichnungsmaterial nach irgendeinem der vorangehenden Ansprüche, in dem die Aufzeichnung durch Einstrahlen eines Laserstrahls von der Substratseite des Materials her durchgeführt wird.

19. Verfahren zur Aufzeichnung von Information auf einem optischen Informationsaufzeichnungsmaterial nach irgendeinem der vorangehenden Ansprüche, in dem die Aufzeichnung durch Verformen der Substratseite der lichtabsorbierenden Schicht durch Einstrahlen eines Laserstrahls von der Substratseite her durchgeführt wird.

20. Verfahren zur Herstellung eines optischen Informationsaufzeichnungsmaterials, umfassend das Spritzgießen eines Harzes, um ein Substrat zu bilden, das Bilden einer lichtabsorbierenden Schicht auf dem Substrat, das Bilden eines dünnen Metallfilms auf der lichtabsobierenden Schicht, um eine lichtreflektierende Schicht zu bilden, und das Bilden eines lichthärtbaren Harzes auf der lichtreflektierenden Schicht, dadurch gekennzeichnet, daß die lichtabsorbierende Schicht so durch Schleuderbeschichtung gebildet wird, daß der Bedingung genügt wird, daß ein optischer Parameter, der durch $\rho = n_{abs}d_{abs}/\lambda$ dargestellt wird, worin n_{abs} der Realteil des komplexen Brechungsindex der lichtabsorbierenden Schicht ist, d_{abs} die durchschnittliche Dicke der lichtabsorbierenden Schicht ist und λ die Wellenlänge eines Lese-Laserstrahls ist, $0,6<\rho<1,6$ beträgt.

21. Verfahren nach Anspruch 20, in dem der Imaginärteil k_{abs} des komplexen Brechungsindex der lichtabsorbierenden Schicht $0,001 \leqq k_{abs} \leqq 0,2$ beträgt.

Revendications

1. Support d'enregistrement d'informations optique comprenant un substrat phototransmetteur, une couche photo-absorbante contenant au moins une substance photo-absorbante formée sur le substrat et une couche photoréfléchissante constituée d'un film métallique formée sur la couche photo-absorbante, caractérisé en ce que le paramètre optique représenté par $\rho = n_{abs}d_{abs}/\lambda$, dans lequel n_{abs} est la partie réelle de l'indice de réfraction complexe de la couche photo-absorbante, d_{abs} est l'épaisseur moyenne de la couche photo-absorbante et λ est la longueur d'onde d'un faisceau laser de lecture, est tel que $0,6 < \rho < 1,6$.

2. Support d'enregistrement d'informations optique selon la revendication 1, dans lequel la partie imaginaire k_{abs} de l'indice de réfraction complexe de la couche photo-absorbante est au maximum de 0,2.

3. Support d'enregistrement d'informations optique selon la revendication 1 ou 2, dans lequel une couche de protection est formée sur la couche photoréfléchissante et la partie imaginaire k_{abs} de l'indice de réfraction complexe de la couche photo-absorbante est telle que $0,001 \leqq k_{abs} \leqq 0,2$.

4. Support d'enregistrement d'informations optique selon la revendication 1, 2 ou 3, dans lequel le paramètre optique $\rho = n_{abs}\, d_{abs}/\lambda$ est tel que $0,61 \leqq \rho \leqq 1,09$ et la partie imaginaire k_{abs} est telle que $0,001 \leqq k_{abs} \leqq 0,2$.

5. Support d'enregistrement d'informations optique selon l'une quelconque des revendications précédentes, dans lequel le paramètre optique $\rho = n_{abs}\, d_{abs}/\lambda$ est tel que $0,7 \leqq \rho \leqq 0,9$, et la partie imaginaire k_{abs} est telle que $0,01 \leqq k_{abs} \leqq 0,1$.

6. Support d'enregistrement d'informations optique selon l'une quelconque des revendications précédentes,

dans lequel le paramètre optique $\rho = n_{abs}\, d_{abs}/\lambda$ est tel que $1,11 \leqq \rho \leqq 1,59$ et la partie imaginaire k_{abs} est telle que $0,001 \leqq k_{abs} \leqq 0,2$.

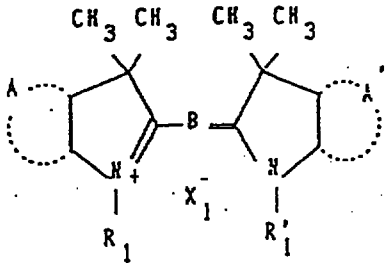
7. Support d'enregistrement d'informations optique selon l'une quelconque des revendications précédentes, dans lequel le paramètre optique $\rho = n_{abs}\, d_{abs}/\lambda$ est tel que $1,25 \leqq \rho \leqq 1,5$ et la partie imaginaire k_{abs} est telle que $0,01 \leqq k_{abs} \leqq 0,08$.

8. Support d'enregistrement d'informations optique selon l'une quelconque des revendications précédentes, dans lequel le substrat phototransmetteur a une rainure spiralée formée sur sa surface sur laquelle la couche photo-absorbante est formée.

9. Support d'enregistrement d'informations optique selon l'une quelconque des revendications précédentes, dans lequel la couche photo-absorbante contient un colorant de cyanine seul ou conjointement avec au moins une autre substance photo-absorbante.

10. Support d'enregistrement d'informations optique selon l'une quelconque des revendications 1 à 8, dans lequel la couche photo-absorbante contient de l'indodicarbocyanine seule ou conjointement avec au moins une autre substance photo-absorbante.

11. Support d'enregistrement d'informations optique selon l'une quelconque des revendications 1 à 8, dans lequel la substance photo-absorbante dans la couche photo-absorbante est au moins un colorant de cyanine représenté par la formule suivante :



dans laquelle chacun des groupes A et A', qui peuvent être identiques ou différents, constitue un groupe d'atomes formant un noyau benzènique, un noyau benzènique substitué, un noyau naphtalènique ou un noyau naphtalènique substitué, B est un groupe pentaméthylène (-CH=CH-CH=CH-CH=), dont chaque atome d'hydrogène peut être remplacé par un atome d'halogène, un groupe alkyle, un groupe alkoxy ou un groupe diphénylamino et qui peut avoir une chaîne latérale cyclique substituée ou non substituée pontant une série d'atomes de carbone, chacun des groupes R_1 et R_1', qui peuvent être identiques ou différents, est un groupe alkyle, alkoxy, alkylhydroxyle, aralkyle, alcényle, alkylcarboxyle ou alkylsulfonyle, substitué ou non substitué, ou bien un groupe alkylcarboxyle ou alkylsulfonyle, substitué ou non substitué, lié à un ion de métal alcalin ou un groupe alkyle, X_1^- est un anion tel qu'un atome d'halogène, l'acide perchlorique, l'acide borofluorique, l'acide benzènesulfonique, l'acide toluènesulfonique, un acide alkylsulfonique, un acide benzènecarboxylique, un acide alkylcarboxylique ou un acide trifluorométhylcarboxylique, pourvu que, lorsque R_1 et R_1' ont un groupe lié à un ion de métal alcalin, X_1^- puisse ne pas être présent.

12. Support d'enregistrement d'informations optique selon l'une quelconque des revendications précédentes, dans lequel la couche photo-réfléchissante est constituée d'un film d'or, d'argent, de cuivre, d'aluminium ou d'un de leurs alliages.

13. Support d'enregistrement d'informations optique selon l'une quelconque des revendications précédentes, dans lequel la couche protectrice est constituée d'une résine photodurcissable.

14. Support d'enregistrement d'informations optique selon l'une quelconque des revendications précédentes, dans lequel une couche intermédiaire est formée entre le substrat et la couche photo-absorbante.

15. Support d'enregistrement d'informations optique selon l'une quelconque des revendications précédentes,

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dans lequel une couche intermédiaire est formée entre la couche photo-absorbante et la couche réfléchissante.

16. Support d'enregistrement d'informations optique selon l'une quelconque des revendications précédentes, dans lequel une couche intermédiaire est formée entre la couche réfléchissante et la couche protectrice.

17. Support d'enregistrement d'informations optique selon l'une quelconque des revendications précédentes, dans lequel la couche photo-absorbante est constituée d'une série de couches.

18. Procédé d'enregistrement d'informations sur un support d'enregistrement optique selon l'une quelconque des revendications précédentes, dans lequel l'enregistrement est réalisé en envoyant un faisceau laser par le côté substrat du support.

19. Procédé d'enregistrement d'informations sur un support d'enregistrement d'informations optique selon l'une quelconque des revendications précédentes, dans lequel l'enregistrement est réalisé en déformant le côté substrat de la couche photo-absorbante par envoi d'un faisceau laser par le côté substrat.

20. Procédé de production d'un support d'enregistrement d'informations optique qui comprend les étapes consistant à mouler par injection une résine pour former un substrat, à former une couche photo-absorbante sur le substrat, à former un film métallique mince sur la couche photo-absorbante pour former une couche photoréfléchissante et à former une résine photodurcissable sur la couche photo-réfléchissante, caractérisé en ce que la couche photo-absorbante est formée par revêtement par centrifugation pour répondre à la condition qu'un paramètre optique représenté $\rho = n_{abs}\, d_{abs}/\lambda$, dans lequel n_{abs} est la partie réelle de l'indice de réfraction complexe de la couche photo-absorbante, d_{abs} est l'épaisseur moyenne de la couche photo-absorbante et λ est la longueur d'onde d'un faisceau laser de lecture, soit tel que $0,6 < \rho < 1,6$.

21. Procédé selon la revendication 20, dans lequel la partie imaginaire k_{abs} de l'indice de réfraction complexe de la couche photo-absorbante est telle que $0,001 \leqq k_{abs} \leqq 0,2$.