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(71) Applicants:

- **OJI PAPER CO., LTD.**
Tokyo (JP)
- **Oji Tac Co., Ltd.**
Chuo-ku,
Tokyo 104-0061 (JP)

(72) Inventors:

- **Matsubayashi, Satoru**
Oji Tac Co., Ltd.
Utsunomiya-shi, Tochigi-ken (JP)
- **Fukimbara, Masahiro**
Oji Tac Co., Ltd.
Utsunomiya-shi, Tochigi-ken (JP)

(74) Representative: **Poulin, Gérard et al**

BREVALEX

**3, rue du Docteur Lancereaux
75008 Paris (FR)**

(54) **Adhesive label, release-sheet laminated adhesive label, and information reading method**

(57) An adhesive label having a printing surface where information is printed using an ink which emits fluorescence due to the irradiation of excitation light, and to which excitation light is irradiated in order to read the information, including:

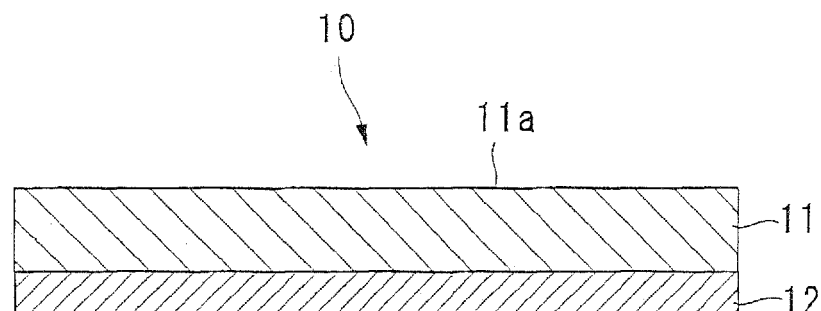
a substrate for printing in which one surface is a printing surface;

an adhesive layer which is provided on the other surface of the substrate for printing;

a first light absorbing agent which absorbs excitation light; and

a second light absorbing agent which absorbs light having a wavelength for detection in the fluorescence, is provided so that the information printed on the printing surface with a fluorescent ink can be read accurately.

FIG. 1



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Description**BACKGROUND OF THE INVENTION**

Field of the Invention

[0001] The present invention relates to an adhesive label on which information such as bar codes is printed with an ink which emits fluorescence due to the irradiation of excitation light, as well as an adhesive label where a release sheet is laminated. In addition, the present invention relates to an information reading method by which the information printed with the ink which emits fluorescence due to the irradiation of excitation light is read.

[0002] Priority is claimed on Japanese Patent Application No. 2006-119211, filed April 24, 2006, the content of which is incorporated herein by reference.

Description of the Related Art

[0003] When sorting postal matter such as postcards and sealed letters, the following method is known (refer to Patent document 1). Firstly, character information such as postal codes and addresses on postal matter is read using an image reading apparatus at the central post office. Secondly, after converting the read character information into bar codes and printing them on the postal matter, the postal matter is delivered to local post offices. Lastly, the bar codes are read at local post offices and the postal matter is automatically sorted based on the read address information.

[0004] When printing bar codes in this sorting method, an ink which emits fluorescence due to the irradiation of excitation light is used (hereinafter, the ink which emits fluorescence due to the irradiation of excitation light is referred to as a "fluorescent ink").

[0005] As a bar code reading method, a method where ultraviolet radiation is irradiated on bar codes as an excitation light and the bar codes are read due to a sensor, which detects light having a wavelength for detection in the fluorescence emitted from the bar codes, is usually adopted. In general, the peak wavelength of a fluorescence which is emitted from bar codes is selected as the wavelength for detection.

[0006] Addresses and postmarks are printed on postal matter in advance and there are cases where substances which emit fluorescence due to the irradiation of ultraviolet radiation are contained in the printing ink when ultraviolet radiation is irradiated for reading the bar codes (hereinafter, the substance which emits fluorescence due to the irradiation of ultraviolet radiation is referred to as a "fluorescent substance"). For this reason, when bar codes were printed directly on addresses, postmarks, or the like, fluorescence was emitted from the part other than bar codes at times (hereinafter, the fluorescence emitted from the part other than bar codes is referred to as "noise fluorescence"). When noise fluorescence contained light having a wavelength for detection, it was difficult to read bar codes accurately since sensors also detected light having a wavelength for detection present in the noise fluorescence.

[0007] In addition, there are also cases where fluorescent substances are contained as coloring agents in postal matter themselves and the same problem as mentioned above occurred at times in those cases, too.

[0008] Accordingly, in order not to print bar codes directly on postal matter, a method is proposed in which an adhesive label having a printing surface is pasted onto a postal matter and bar codes are printed on the printing surface of this adhesive label (refer to Patent document 2).

[Patent document 1] Japanese Unexamined Patent Application, First Publication No. Hei 08-150375

[Patent document 2] Japanese Unexamined Patent Application, First Publication No. Hei 08-337228

[0009] However, there were cases where bar codes could not be read accurately by sensors even when the bar codes were printed on the printing surface of an adhesive label as in the method described in Patent document 2.

[0010] Moreover, such problems occurred at times not only with postal matter but also with documents, articles, or packages thereof.

[0011] The present invention is made in view of the aforementioned circumstances and it is an object to provide an adhesive label where the information printed with a fluorescent ink on a printing surface is read accurately as well as a release-sheet laminated adhesive label. Additionally, an object of the present invention is to provide an information-reading method by which the information printed with the fluorescent ink on the printing surface of the adhesive label can be read accurately.

SUMMARY OF THE INVENTION

[0012] By investigating the reason bar codes could not be read accurately by the method described in Patent document 2, in which the bar codes were printed on the printing surface of an adhesive label, the present inventors discovered that it is because a part of the irradiated ultraviolet radiation transmits through the adhesive label. The present inventors further discovered that when a part of ultraviolet radiation transmits through the adhesive label, noise fluorescence is

emitted from the fluorescent substances in postal matter or from the fluorescent ink used for printing addresses or postmarks due to this transmitted ultraviolet radiation and since this noise fluorescence contains light having a wavelength for detection, bar codes could not be read accurately.

[0013] Based on this finding, the present inventors invented the adhesive label, release-sheet laminated adhesive label, and information reading method below as a result of further studies.

[0014] The present invention contains the following configurations.

[1] An adhesive label having a printing surface where information is printed using an ink which emits fluorescence due to the irradiation of excitation light, and to which excitation light is irradiated in order to read the information, and which is characterized by having a substrate for printing in which one surface is a printing surface, and an adhesive layer which is provided on the other surface of the substrate for printing and which is also characterized by containing a first light absorbing agent which absorbs the excitation light and a second light absorbing agent which absorbs light having a wavelength for detection in the fluorescence.

[2] The adhesive label according to the configuration [1] in which the first and second light absorbing agents are contained in the adhesive layer.

[3] The adhesive label according to the configuration [1] or [2] in which the total light transmittance of visible light is 50% or more.

[4] The adhesive label according to any one of the configurations [1] to [3] in which the adhesive layer has removability.

[5] A release-sheet laminated adhesive label characterized by having the adhesive label according to any one of the configurations [1] to [4] and a release sheet, which is laminated onto the adhesive layer of the adhesive label.

[6] An information reading method characterized by including pasting the adhesive label according to any one of the configurations [1] to [4] onto an adherend via the adhesive layer, printing information on the printing surface of the substrate for printing with an ink which emits fluorescence due to the irradiation of excitation light, irradiating excitation light onto the information to emit fluorescence, and reading information by detecting light having a wavelength for detection in the fluorescence.

[0015] By using the adhesive label of the present invention, the information printed on a printing surface with a fluorescent ink is read accurately.

[0016] When the first and second light absorbing agents are contained in the adhesive layer in the adhesive label of the present invention, it is readily possible to contain the first and second light absorbing agents in the adhesive layer.

[0017] When the total light transmittance of visible light of the adhesive label of the present invention is 50% or more, the adherend, onto which the adhesive label is pasted, is readily visible through the adhesive label.

[0018] When the adhesive layer of the adhesive label of the present invention has removability, the adhesive label can be released again after being pasted onto an adherend.

[0019] By using the release-sheet laminated adhesive label of the present invention, the information printed on a printing surface with a fluorescent ink is read accurately.

[0020] According to the information reading method of the present invention, the information printed on a printing surface of an adhesive label with a fluorescent ink can be read accurately.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021]

Fig. 1 is a cross-sectional diagram showing one embodiment of an adhesive label of the present invention.

Fig. 2 is a cross-sectional diagram showing one embodiment of a release-sheet laminated adhesive label of the present invention.

1: release-sheet laminated adhesive label

10: adhesive label

11: substrate for printing

11a: printing surface

12: adhesive layer

20: release sheet

DETAILED DESCRIPTION OF THE INVENTION

"Adhesive label"

[0022] One embodiment of the adhesive label of the present invention will be described.

[0023] Fig. 1 shows an adhesive label of the present embodiment. An adhesive label 10 of the present embodiment is pasted onto postal matter such as postcards and envelopes, has a printing surface 11a where bar codes, which are information, are printed with a fluorescent ink, and is irradiated with ultraviolet radiation, which is excitation light, in order to read the bar codes.

[0024] In addition, the adhesive label 10 of the present embodiment has a substrate for printing 11, one surface of which is the printing surface 11a, and an adhesive layer 12, which is provided on the other surface of the substrate for printing 11.

(Substrate for printing)

[0025] Although materials as the substrate for printing 11 may be translucent or transparent to visible light, those which are transparent are preferable since the surface of postal matter is readily visible through the adhesive label 10 when pasted on the postal matter.

[0026] Examples of the transparent substrates include glassine paper which is subjected to an intensive super calendar treatment, enamel paper where a clarifying agent is impregnated or coated, parchment paper, transparent plastic films, and translucent synthetic paper.

[0027] When the substrate for printing 11 is transparent to visible light, the total light transmittance of visible light of the substrate for printing 11 is preferably 60% or more and more preferably 80% or more since the surface of postal matter will become readily visible through the adhesive label 10. Note that the total light transmittance of visible light in the present invention is a value measured according to JIS K 7361-1 using a D65 light.

[0028] Additionally, it is preferable that the substrate for printing 11 include an ink accepting layer which contains inorganic particles such as silica, a cationic compound, and binders such as polyvinyl alcohol, on the printing surface 11a side. When the ink accepting layer is included in the printing surface 11a side of the substrate for printing 11, clear printing is achieved when printing bar codes with a fluorescent ink since ink absorbability improves and ink bleeding can also be prevented.

[0029] The average primary-particle diameter of the inorganic particles contained in the ink accepting layer is preferably 30 nm or less and more preferably 3 to 15 nm. When the average primary-particle diameter of the inorganic particles is 30 nm or less, an ink accepting layer which is highly transparent and is more excellent in printing concentration, bleeding prevention, and ink absorbability, can be achieved.

[0030] All the average particle diameters in the present invention refer to the particle diameter observed by electron microscopes (SEM and TEM) and are those derived by taking electron micrographs with a magnification of 10 to 400 thousand-fold, measuring the Martin's diameters of particles in a 5-cm square therein, and averaging them (described in "Particle Handbook" published by Asakura Publishing Co., Ltd., p52, 1991, or the like).

[0031] When inorganic particles are agglomerated particles (secondary particles) where primary particles are agglomerated, although the average secondary-particle diameter is not particularly limited, 0.05 to 1.0 μm is preferable and 0.05 to 0.5 μm is more preferable.

[0032] Specific surface area of inorganic particles measured by the BET method is preferably within the range of 100 m^2/g and approximately 1000 m^2/g and more preferably 200 to 400 m^2/g .

[0033] The BET method referred to in the present invention is one of the methods for measuring powder surface area due to a gas phase adsorption method and is a method to determine the total surface area of 1 g of sample from adsorption isotherms, that is, the specific surface area.

[0034] Examples of the materials for inorganic particles include zeolites, precipitated calcium carbonate, heavy calcium carbonate, magnesium carbonate, kaolin, talc, silica, calcium sulfate, barium sulfate, titanium oxide, zinc oxide, zinc sulfide, zinc carbonate, satin white, aluminum silicate, diatomaceous earth, calcium silicate, magnesium silicate, aluminum hydroxide, alumina, alumina hydrates, aluminosilicate, boehmite, and pseudoboehmite. Silica, alumina, alumina hydrates, and aluminosilicate are particularly preferable among them in view of their ink absorbability and silica is especially preferable. Furthermore, among various kinds of silica, gas phase method silica is preferable since transparency is further enhanced.

[0035] Gas phase method silica is formed by the flame hydrolysis method and the method is also called the dry method in contrast to the wet method. Specifically, gas phase method silica is formed by combusting silicon tetrachloride together with hydrogen and oxygen.

[0036] There are also cases where silanes such as methyltrichlorosilane and trichlorosilane are used alone instead of silicon tetrachloride, or used by being mixed with silicon tetrachloride. Gas phase method silica is commercially

available as a powder having very low bulk density.

[0037] In addition, it is also preferable to use particles of silica-cationic compound agglomerates as silica since the transparency of an ink accepting layer, color developing properties of an ink, and weather resistance thereof are enhanced and ink absorbability is also improved. The term "particles of silica-cationic compound agglomerates" used here refers to those obtained by grinding the grains of silica-cationic compound agglomerates, which are obtained by mixing and agglomerating amorphous silica and cationic compounds. These particles of silica-cationic compound agglomerates are substantially formed from secondary particles, which are produced as a result of the agglomeration of primary particles.

[0038] The amorphous silica constituting the particles of silica-cationic compound agglomerates preferably has an average primary-particle diameter of 3 to 30 nm. When the average primary-particle diameter is less than 3 nm, voids between primary particles will be extremely small resulting in a considerable reduction in the capability thereof to absorb ink or the solvents in ink. On the other hand, when the average primary-particle diameter exceeds 30 nm, secondary particles will be large resulting in a possible reduction in the transparency of ink accepting layers.

[0039] Various known cationic compounds generally used in the sheet for ink jet printing can be used as the cationic compounds used in the particles of silica-cationic compound agglomerates. Examples thereof include primary amine-type cationic polymers having, as building blocks thereof, primary amine salts such as monoallylamine salts, urethane-modified allylamine salts, vinylamine salts, polyamidine-based compounds, N-vinyl acrylic amidine salts, dicyandiamide/formalin polycondensates, and dicyandiamide/polyethyleneamine polycondensates; secondary amine-type cationic polymers having, as building blocks thereof, secondary amine salts such as diallylamine salts, and ethyleneimine salts; tertiary amine-type cationic polymers having, as building blocks thereof, tertiary amine salts such as diallylmethylamine salts; quaternary ammonium-type cationic polymers having, as building blocks thereof, quaternary ammonium salts such as diallyldimethylammonium chloride, (meth)acryloyloxyethyltrimethylammonium chloride, (meth)acrylamidepropyltrimethylammonium chloride, and dimethylamine/epichlorhydrin polycondensates; aluminum compounds such as basic polyaluminum chloride, and basic polyaluminum fatty-acid; and zirconyl compounds such as zirconyl chloride, basic zirconyl chloride, and zirconyl fatty acid.

[0040] The amount of the cationic compounds added is preferably adjusted within the range of 1 to 30 mass parts relative to 100 mass parts of the amorphous silica and more preferably 5 to 20 mass parts.

[0041] As the grinding method at the time of producing particles of silica-cationic compound agglomerates, the breaking down method (method to break down aggregated materials) where a strong force is applied by mechanical means is adopted. Examples of the mechanical means include supersonic waves, high speed mill, roller mill, container-driven medium mill, medium stirring mill, jet mill, grinder, sand grinder, and homogenizer,

[0042] The average particle diameter of particles of the silica-cationic compound agglomerates is preferably 700 nm or less, more preferably 10 to 300 nm, and particularly preferably 20 to 200 nm. When the average particle diameter of particles of silica-cationic compound agglomerates exceeds 700 nm, there is a concern that transparency is considerably deteriorated and printing concentration is highly reduced. On the other hand, when the average particle diameter of particles of silica-cationic compound agglomerates is extremely small, there is a concern that sufficient ink absorption rate is not achieved.

[0043] Examples of the cationic compounds contained in the ink accepting layer include those similar to the ones used in the particles of silica-cationic compound agglomerates.

[0044] The thickness of the substrate for printing 11 is preferably 25 to 150 μm . When the thickness of the substrate for printing 11 is 25 μm or more, the adhesive label 10 will be difficult to tear and when the thickness is 150 μm or less, flexibility of the adhesive label 10 is not impaired, resulting in excellent handling properties.

(Adhesive layer)

[0045] The adhesive layer 12 in the present embodiment is a layer configured from the adhesive composition, which contains an adhesive and the first and second light absorbing agents.

<Adhesive>

[0046] Adhesives are not particularly limited and, for example, natural rubber-based adhesives, synthetic rubber-based adhesives, acrylic adhesives, urethane adhesives, silicone adhesives, or the like are used. Additionally, these adhesives may be any of a solvent type, emulsion type, and water type.

[0047] Among these adhesives, acrylic adhesives, urethane adhesives, and silicone adhesives which are solvent type are preferable from the viewpoint of transparency to visible light and compatibility with the second light absorbing agent.

[0048] In addition, since the adhesive label 10 can be readily released from postal matter after the adhesive label 10 has finished playing its role when the adhesive layer 12 has removability, it is preferable that adhesives be those having removability.

[0049] The adhesives having removability are not particularly limited as long as they have removability and examples thereof include those having removability in which adhesives are cross-linked by crosslinkers.

[0050] Other auxiliaries may be added to the adhesives where necessary. Examples of the other auxiliaries include thickening agents, pH adjusting agents, tackifiers, binders, crosslinkers, adhesive particles, antifoaming agents, anti-septic/mildewproofing agents, pigments, inorganic fillers, stabilizers, wetting agents, and moistening agents.

[0051] Additionally, in order to achieve the adhesive layer 12 having removability, it is also possible to mix non-adhesive particles in the adhesive layer 12 or to form minute irregularities on the surface in the side where the adhesive layer 12 is pasted.

<First light absorbing agent>

[0052] The first light absorbing agent in the present embodiment absorbs the ultraviolet radiation, which is irradiated in order to read the bar codes printed with a fluorescent ink on the printing surface 11a of the substrate for printing 11, and is one which is generally called an ultraviolet absorber.

[0053] Examples of the first light absorbing agents in the present embodiment include benzotriazole-based ultraviolet absorbers and benzophenone-based ultraviolet absorbers.

[0054] Benzotriazole-based ultraviolet absorbers particularly absorb the ultraviolet radiation having a wavelength of 280 to 360 nm.

[0055] Specific examples of the benzotriazole-based ultraviolet absorbers include 2-(2'-hydroxyphenyl)benzotriazole, 2-(2'-hydroxy-5'-methylphenyl)benzotriazole (for example, Cinubin P (trade name) manufactured by Ciba Specialty Chemicals K.K.), 2-(5-t-octyl-2-hydroxyphenyl)benzotriazole (for example, Chemisorb 79 (trade name) manufactured by Chemipro Kasei Kaisha, Ltd.), 2-(2'-hydroxy-5'-tert-butylphenyl)benzotriazole, 2-(2'-hydroxy-5'-tert-octylphenyl)benzotriazole, 2-(2'-hydroxy-3',5'-di-tert-butylphenyl)benzotriazole, 2-(2'-hydroxy-3-di-tert-butyl-5'-methylphenyl)-5-chlorobenzotriazole, 2-(2'-hydroxy-3',5'-di-tert-butylphenyl)-5-chlorobenzotriazole, 2-(2'-hydroxy-3',5'-di-tert-arylphenyl)benzotriazole, 2-(2'-hydroxy-3',5'-di-tert-butylphenyl)-5-tert-butylbenzotriazole, 2,2'-methylenabis[4-(1,1,3,3-tetramethylbutyl)-6-benzotriazolyl-phenol], 2,2'-methylenabis(3-methoxy-6-benzoylphenol), and 2,2'-octylidenebis[4-methyl-6-(5'-methylbenzotriazolyl)phenol].

[0056] Benzophenone-based ultraviolet absorbers particularly absorb the ultraviolet radiation having a wavelength of 300 nm or less.

[0057] Specific examples of the benzophenone-based ultraviolet absorbers include 2,4-dihydroxybenaophenone, 2-hydroxy-4-methoxybenzophenone, 2-hydroxy-4-octyloxybenzophenone, 2-hydroxy-4-dodecyloxybenzophenone, 2,2'-dihydroxy-4-methoxybenzophenone, 2,2'-hydroxy-4,4'-dimethoxybenzophenone, and 2-hydroxy-4-methoxy-5-sulfabenzophenone.

[0058] One kind of the first light absorbing agent may be used alone or two or more kinds thereof may be used concomitantly.

[0059] The content of the first light absorbing agent in the adhesive layer 12 is preferably 0.1 to 10 mass parts relative to 100 mass parts of the adhesive solid content and more preferably 1 to 7 mass parts. When the content of the first light absorbing agent is 0.1 mass parts or more relative to 100 mass parts of the adhesive solid content, more of the ultraviolet radiation irradiated for reading bar codes can be absorbed thus further preventing the ultraviolet radiation from transmitting through the adhesive label 10. In addition, when the content of the first light absorbing agent is 10 mass parts or less relative to 100 mass parts of the adhesive solid content, reductions in adherence of the adhesive layer 12 can be prevented, and this is also economical since the agent is not contained in excess.

<Second light absorbing agent >

[0060] The second light absorbing agent absorbs light having the wavelength for detection in the fluorescence (usually visible light), which is emitted due to the ultraviolet radiation irradiated in order to read bar codes. Due to this agent, light having the wavelength for detection among the noise fluorescence emitted from the parts other than the bar codes can be absorbed.

[0061] As the second light absorbing agent, coloring agents whose maximum absorption wavelength is close to the wavelength for detection can be used.

[0062] Specifically, when the wavelength for detection is within the range of 420 and 440 nm, which is in the blue region, it is preferable to use a yellowish coloring agent which absorbs light having a wavelength of 420 to 440 nm as the second light absorbing agent. Examples of the yellowish coloring agents include Kayaset Yellow 2G (trade name), which has a maximum absorption wavelength of 424 nm and half-width of absorption wavelength of 62 nm and is manufactured by Nippon Kayaku Co., Ltd.

[0063] When the wavelength for detection is within the range of 530 and 550 nm, which is in the green region, it is preferable to use a reddish coloring agent which absorbs light having a wavelength of 530 to 550 nm as the second

light absorbing agent. Examples of the reddish coloring agents include Kayaset Red B (trade name), which has a maximum absorption wavelength of 516 nm and half-width of absorption wavelength of 93 nm and is manufactured by Nippon Kayaku Co., Ltd.

[0064] When the wavelength for detection is within the range of 610 and 630 nm, which is in the red region, it is preferable to use a bluish coloring agent which absorbs light having a wavelength of 610 to 630 nm as the second light absorbing agent. Examples of the bluish coloring agents include Kayaset Blue N (trade name), which has a maximum absorption wavelength of 649 nm and half-width of absorption wavelength of 94 nm and is manufactured by Nippon Kayaku Co., Ltd., Kayaset Blue 714 (trade name), which has a maximum absorption wavelength of 639 nm and half-width of absorption wavelength of 108 nm and is manufactured by Nippon Kayaku Co., Ltd., TAP 10 (trade name), which has a maximum absorption wavelength of 604 nm and half-width of absorption wavelength of 26 nm and is manufactured by Yamada Kagaku Co., Ltd., and Daiplocoat Blue NV20 (trade name), which has a maximum absorption wavelength of 624 nm and half-width of absorption wavelength of 188 nm and is manufactured by Dainichiseika Color & Chemicals Mfg. Co., Ltd.

[0065] One kind of the second light absorbing agent may be used alone or two or more kinds thereof may be used concomitantly.

[0066] The content of the second light absorbing agent in the adhesive layer 12 is preferably 0.01 to 1.5 mass parts relative to 100 mass parts of the adhesive solid content and more preferably 0.015 to 1.0 mass parts. When the content of the second light absorbing agent is 0.01 mass parts or more relative to 100 mass parts of the adhesive solid content, more light having the wavelength for detection among the noise fluorescence can be absorbed. In addition, when the content of the second light absorbing agent is 1.5 mass parts or less relative to 100 mass parts of the adhesive solid content, the coloring of the adhesive layer 12 can be prevented and the reductions in adherence of the adhesive layer 12 can also be prevented.

[0067] As the adhesive layer 12, those which are formed by coating an adhesive composition so that the coated amount thereof after drying is 5 to 40 g/m² are preferable and those which are formed by coating an adhesive composition so that the coated amount thereof after drying is 10 to 30 g/m² are more preferable. When the adhesive layer 12 is one which is formed by coating an adhesive composition so that the coated amount thereof after drying is 5 g/m² or more, the adhesive label 10 can be reliably pasted onto postal matter. When the adhesive layer 12 is one which is formed by coating an adhesive composition so that the coated amount thereof after drying is 40 g/m² or less, there is no need to use the adhesive composition more than necessary.

(Transparency of adhesive label to visible light)

[0068] Since the surface of postal matter should be readily visible through the adhesive label 10, the adhesive label 10 preferably has high transparency to visible light. Specifically, the total light transmittance of visible light is preferably 50% or more in the adhesive label 10.

[0069] As described later, the adhesive label 10 of the present embodiment may be a release-sheet laminated adhesive label, which is made by laminating the release sheet onto the adhesive layer 12, or may be one which is made into a rolled form by pasting the adhesive layer 12 onto the printing surface 11a of the substrate for printing 11 while rolling it. When it is made into a rolled form, it is preferable to coat a release agent onto the printing surface 11a so that the adhesive layer 12 can readily be released from the printing surface 11a of the substrate for printing 11. Furthermore, among the release agents, non-silicone type release agents are preferable since they do not repel fluorescent inks.

[0070] The abovementioned adhesive label 10 is used by being pasted onto postal matter via the adhesive layer 12 and bar codes being printed on the printing surface 11a of the substrate for printing 11 with a fluorescent ink.

[0071] With this adhesive label 10, when irradiating ultraviolet radiation onto bar codes, which are printed on the printing surface 11a, in order to read them, the ultraviolet radiation which penetrated into the adhesive label 10 can be absorbed due to the first light absorbing agent in the adhesive layer 12. As a result, noise fluorescence is unlikely to be emitted since ultraviolet radiation is unlikely to transmit through the adhesive label 10 reaching postal matter.

[0072] In addition, even when the ultraviolet radiation which is not absorbed by the first light absorbing agent in the adhesive layer 12 and which has reached postal matter causes the emission of the noise fluorescence due to the fluorescent substances in the postal matter or the fluorescent ink used in prints of the postal matter, and even if the noise fluorescence contains light having the wavelength for detection, light having the wavelength for detection among the noise fluorescence can be absorbed by the second light absorbing agent in the adhesive layer 12.

[0073] Accordingly, by using the adhesive label 10, light having the wavelength for detection can selectively be detected by a sensor and bar codes can be read accurately since noise fluorescence is unlikely to be emitted, and even when it is emitted, light having the wavelength for detection among the noise fluorescence can be absorbed.

[0074] Additionally, since the first and second light absorbing agents are contained in adhesive layers, it is easy to contain the first and second light absorbing agents in the adhesive label 10.

"Release-sheet laminated adhesive label"

[0075] One embodiment of the release-sheet laminated adhesive label of the present invention is described. Fig. 2 shows the release-sheet laminated adhesive label of the present embodiment. The release-sheet laminated adhesive label 1 is one which has the abovementioned adhesive label 10 and a release sheet 20, which is laminated onto the adhesive layer 12 of the adhesive label 10.

(Release sheet)

[0076] Examples of the release sheet 20 include those having a substrate for release sheet and release-agent layer, which is provided in the substrate for release sheet in the side facing the adhesive layer 12.

[0077] Examples of the substrates for release sheet include paper such as woodfree paper and glassine paper, and plastic films such as polyethyleneterephthalate films and polypropylene films.

[0078] As the release agent constituting the release-agent layer, an addition- or condensation-type silicone-based release agent for general purpose and compounds containing a long-chain alkyl group are used. In particular, the addition-type silicone-based release agents which are highly reactive are preferably used.

[0079] Specific examples of the silicone-based release agents include BY 24-4527 and SD-7220 (product names) manufactured by Dow Corning Toray Silicone Co., Ltd., and KS-3600, KS-774, and X62-2600 (product names) manufactured by Shin-Etsu Chemical Co., Ltd. In addition, it is preferable they contain silicone resin which is an organosilicon compound having a SiO_2 unit and $(\text{CH}_3)_3\text{SiO}_{1/2}$ unit or $\text{CH}_2=\text{CH}(\text{CH}_3)\text{SiO}_{1/2}$ in the silicone-based release agents. Specific examples of the silicone resins include BY 24-843, SD-7292, and STIR-1404 (product names) manufactured by Dow Corning Toray Silicone Co., Ltd., and KS-3800 and X92-183 (product names) manufactured by Shin-Etsu Chemical Co., Ltd.

(Production method of release-sheet laminated adhesive label)

[0080] Examples of the methods to produce the release-sheet laminated adhesive label 1 include a method in which an adhesive composition in the liquid form is coated on one surface of the substrate for printing 11 and dried to form the adhesive layer 12 and the release sheet 20 is laminated onto the adhesive layer 12.

[0081] Examples of the methods to obtain adhesive compositions in the form of a liquid include a method in which the first and second light absorbing agents are dissolved or dispersed in adhesives of solvent type, emulsion-type, or water-type. When the adhesives of solvent-type are used and those which dissolve in the solvent are used as the first and second light absorbing agents, it is possible to obtain the adhesive composition in which the first and second light absorbing agents are uniformly contained in the adhesive.

[0082] As an apparatus for coating the adhesive composition in the liquid form, a comma coater, roll coater, knife coater, bar coater, air knife coater, gravure coater, curtain coater, lip coater, die coater, or the like can be used.

[0083] Drying methods may be air drying, or drying by hot air or infrared irradiation.

[0084] In addition, examples of other methods to produce the release-sheet laminated adhesive label 1 include a method in which the adhesive composition in the liquid form is coated on the release sheet 20 and dried to form the adhesive layer 12 and the substrate for printing 11 is pasted onto the adhesive layer 12.

[0085] The release-sheet laminated adhesive label 1 is used by releasing the release sheet 20 to expose the adhesive layer 12 and by being pasted onto postal matter via the exposed adhesive layer 12.

"Information reading method"

[0086] One embodiment of the information reading method of the present invention will be described. The present embodiment is an example using the abovementioned release-sheet laminated adhesive label 1.

[0087] In the present embodiment, the release sheet 20 of the release-sheet laminated adhesive label 1 is firstly released to expose the adhesive layer 12 and the adhesive label 10 is pasted onto postal matter via the exposed adhesive layer 12 at the central post office. Subsequently, character information such as addresses on the postal matter which are read in advance by an image reading apparatus is converted into bar codes and the bar codes are then printed on the printing surface 11a of the substrate for printing 11 of the adhesive label 10 with a fluorescent ink. For the printing method in this case, for example, an ink jet printing method can be applied. After the printing, bar codes are read by irradiating ultraviolet radiation onto the bar codes printed on the substrate for printing 11 using a bar code reading apparatus (bar code reader) to generate fluorescence and by detecting light having the wavelength for detection in the fluorescence by a sensor.

[0088] Then, the postal matter is sorted by an automatic sorting apparatus using the address information in the read bar codes and then delivered to local post offices.

[0089] The postal matter is sorted thoroughly and delivered by reading the bar codes as described above at the local post offices, which received the postal matter.

[0090] Note that since the adhesive label 10 is not required after the sorting, it may be removed from postal matter.

[0091] With the abovementioned information reading method, light having the wavelength for detection can selectively be detected by a sensor when ultraviolet radiation is irradiated in order to read bar codes, and thus the bar codes can be read accurately since the abovementioned adhesive label 10 is used.

[0092] Note that the present invention is not limited to the abovementioned embodiment. For example, although the first and second light absorbing agents are only contained in the adhesive layer 12 in the abovementioned embodiment, the first and second light absorbing agents may be contained in any parts of an adhesive label. For example, both the first and second light absorbing agents may be only contained in the substrate for printing 11 or one of the two light absorbing agents may be contained in the adhesive layer 12 while the other may be contained in the substrate for printing 11. Additionally, both the first and second light absorbing agents may be contained in both the substrate for printing 11 and adhesive layer 12.

[0093] Moreover, in adhesive labels, an undercoat layer for filling may be provided between the substrate for printing 11 and adhesive layer 12. In this case, it is also possible to contain the first and second light absorbing agents in the undercoat layer.

[0094] In addition, although the adherends, to which the labels are pasted, are postal matter in the abovementioned embodiment, the present invention is not limited to them and the adherends may be documents, articles, or packages thereof.

[0095] Moreover, although the information printed on the printing surface 11a of the substrate for printing 11 is bar codes in the abovementioned embodiment, the information may be other than bar codes such as characters, patterns, or the like.

[0096] Additionally, although excitation light is ultraviolet radiation in the abovementioned embodiment, excitation light having a wavelength outside the ultraviolet region may be used. In that case, it is necessary to select the first light absorbing agent depending on excitation light.

[Examples]

(Example 1)

[0097] After adding 2 mass parts of a crosslinker (BXX5134 (product name) manufactured by Toyo Ink Mfg. Co., Ltd.) relative to 100 mass parts of a solvent-type acrylic adhesive (BPS-5330 (product name) manufactured by Toyo Ink Mfg. Co., Ltd.) containing a solvent (relative to 100 mass parts of the solvent-type acrylic adhesive in a wet condition), 3 mass parts of the first light absorbing agent (2-(2'-hydroxy-5'-methylphenyl)benzotriazole; Cinubin P (trade name) manufactured by Ciba Specialty Chemicals K.K.) were added relative to 100 mass parts of acrylic adhesive solid content and the mixture was sufficiently stirred. Moreover, 0.03 mass parts of an oil-soluble dye (Kayaset Blue 714 (trade name) manufactured by Nippon Kayaku Co., Ltd.) were added as the second light absorbing agent relative to 100 mass parts of acrylic adhesive solid content and the mixture was sufficiently stirred to prepare an adhesive composition (1).

[0098] Subsequently, the adhesive composition (1) was coated with a comma coater on glassine-paper type release paper (manufactured by Oji Tac Co., Ltd.) so that the coated amount thereof after drying was 15 g/m², and then was dried to form an adhesive layer. Thereafter, Dleep W 50.4 (manufactured by Oji Specialty paper Co., Ltd.), which is a substrate for printing, was pasted onto the adhesive layer to obtain a release-sheet laminated adhesive label.

(Example 2)

[0099] A release-sheet laminated adhesive label was obtained as in Example 1 except that Classico Tracing 35.5 (trade name) manufactured by Mitsubishi Paper Mills Co., Ltd. was used as the substrate for printing.

(Example 3)

[0100] A release-sheet laminated adhesive label was obtained as in Example 1 except that the adhesive composition (1) was coated so that the coated amount thereof after drying was 40 g/m².

(Example 4)

[0101] A release-sheet laminated adhesive label was obtained as in Example 1 except that an adhesive composition (2), which was prepared by adding 0.02 mass parts of an oil-soluble dye (TAP 10 (trade name) manufactured by Yamada Kagaku Co., Ltd.) as the second Light absorbing agent relative to 100 mass parts of acrylic adhesive solid content, was

used.

(Example 5)

[0102] A release-sheet laminated adhesive label was obtained as in Example 4 except that 0.1 mass parts of the oil-soluble dye (TAP 10 (trade name) manufactured by Yamada Kagaku Co., Ltd.) were added relative to 100 mass parts of acrylic adhesive solid content.

(Example 6)

[0103] A release-sheet laminated adhesive label was obtained as in Example 1 except that an adhesive composition (3), which was prepared by adding 0.6 mass parts of a pigment dispersion (Daipacoat Blue NV20 (trade name) manufactured by Dainichiseika Color & Chemicals Mfg. Co., Ltd.) as the second light absorbing agent relative to 100 mass parts of acrylic adhesive solid content, was used.

(Example 7)

[0104] After adding 4 mass parts of a crosslinker (BHS-8515 (product name) manufactured by Toyo Ink Mfg. Co., Ltd.) relative to 100 mass parts of a solvent-type acrylic adhesive (SPS-5303 (product name) manufactured by Toyo Ink Mfg. Co., Ltd.) containing a solvent, 2 mass parts of the first light absorbing agent (2-(5-t-octyl-2-hydroxyphenyl) benzotriazole; Chemisorb 79 (trade name) manufactured by Chemipro Kasei Kaisha, Ltd.) were added relative to 100 mass parts of acrylic adhesive solid content and the mixture was sufficiently stirred. Moreover, 0.05 mass parts of the oil-soluble dye (Kayaset Blue 714 (trade name) manufactured by Nippon Kayaku Co., Ltd.) were added as the second light absorbing agent relative to 100 mass parts of acrylic adhesive solid content to prepare an adhesive composition (4).

[0105] The adhesive composition (4) was coated with a comma coater on glassine-paper type release paper (manufactured by Oji Tac Co., Ltd.) so that the coated amount thereof after drying was 15 g/m², and then was dried to form an adhesive layer. Thereafter, Classico Tracing 41.0 (trade name) manufactured by Mitsubishi Paper Mills Co., Ltd., which was a substrate for printing, was pasted onto the adhesive layer to obtain a release-sheet laminated adhesive label.

(Example 8)

[0106] A release-sheet laminated adhesive label was obtained as in Example 1 except that an adhesive composition (5), which was prepared by adding 0.05 mass parts of an oil-soluble dye (Kayaset Red B (trade name) manufactured by Nippon Kayaku Co., Ltd.) as the second light absorbing agent relative to 100 mass parts of acrylic adhesive solid content, was used.

(Example 9)

[0107] A release-sheet laminated adhesive label was obtained as in Example 1 except that 2.0 mass parts of the second light absorbing agent were added relative to 100 mass parts of acrylic adhesive solid content.

(Example 10)

[0108] A release-sheet laminated adhesive label was obtained as in Example 1 except that paper for labeling 35 (manufactured by Oji Specialty paper Co., Ltd.) was used as the substrate for printing.

(Example 11)

[0109] 100 mass parts of gas phase method silica (Aerosil 300 (product name) manufactured by NipponAerosil Co., Ltd., average primary-particle diameter: 7 nm, specific surface area measured by the BET method: 300 m²/g), 50 mass parts of 20 mass% aqueous solution of 50 mol% methoxycarbonyl-modified polyallylamine hydrochloride (mass average molecular weight: approximately 60 thousand), and 850 mass parts of ion-exchanged water were mixed. The obtained mixture was dispersed by a stirring device and then treated using the Nanomizer, which is a wet-type ultra-atomization device. Subsequently, 360 mass parts of 5 mass% aqueous solution of polyvinyl alcohol (PVA-245 (product name) manufactured by Kuraray Co., Ltd., degree of saponification: 88 mass%, average degree of polymerization: 4500), and a small amount of an antifoaming agent, dispersing agent, and water were added to the obtained treated liquid to obtain a coating liquid for forming an ink accepting layer having a solid concentration of 8 mass%.

[0110] Then the coating liquid for forming the ink accepting layer was coated with a wire bar onto one surface of a

translucent substrate (Dreep W (product name) manufactured by Oji Specialty paper Co., Ltd., 50.4 g/m²) so that the dry mass thereof was 10 g/m², and dried to form an ink accepting layer on the printing-surface side obtaining a substrate for printing.

[0111] An adhesive label was obtained as in Example 1 except that this substrate for printing having an ink accepting layer on the printing-surface side was used,

(Comparative Example 1)

[0112] A release-sheet laminated adhesive label was obtained as in Example 1 except that the first light absorbing agent was not added.

(Comparative Example 2)

[0113] A release-sheet laminated adhesive label was obtained as in Example 1 except that the second light absorbing agent was not added.

[0114] Maximum absorption wavelengths and half-widths of absorption wavelength in the second light absorbing agents used in each Example and Comparative Example are shown in Table 1.

[Table 1]

	Presence/ absence of first light absorbing agent	Presence/ absence of second light absorbing agent	Light absorption characteristics of second light absorbing agent		Bar code readability	
			Maximum absorption wavelength (nm)	Half-width of absorption wavelength (nm)	Evaluation	Wavelength for detection (nm)
Ex. 1	Present	Present	639	108	○	615 ± 5
Ex. 2	Present	Present	639	108	○	615 ± 5
Ex. 3	Present	Present	639	108	○	615 ± 5
Ex. 4	Present	Present	604	26	○	615 ± 5
Ex. 5	Present	Present	604	26	○	615 ± 5
Ex. 6	Present	Present	624	188	○	615 ± 5
Ex. 7	Present	Present	639	108	○	615 ± 5
Ex. 8	Present	Present	516	93	○	535 ± 5
Ex. 9	Present	Present	639	108	○	615 ± 5
Ex. 10	Present	Present	639	108	○	615 ± 5
Ex. 11	Present	Present	639	108	○	615 ± 5
Comp. Ex. 1	Absent	Present	639	108	×	615 ± 5
Comp. Ex. 2	Present	Absent	-	-	×	615 ± 5

[0115] The readability of bar codes in each of Examples and Comparative Examples was evaluated by the method below. Evaluation results are shown in Table 1.

[0116] Firstly, bar codes were printed in advance on a brown envelope (OK Kraft (product name) manufactured by Oji paper Co., Ltd., 85 g/m²), which was the adherend to which the label was pasted, with a fluorescent ink (manufactured by Video Jet Co., Ltd.), which was the same fluorescent ink as that used at the time when printing bar codes on an adhesive label.

[0117] Secondly, the release sheet was released from the release-sheet laminated adhesive label to expose the adhesive layer and the adhesive label was pasted onto the bar-code printed part on the brown envelope via the exposed adhesive layer.

[0118] Thirdly, bar codes were printed using an ink jet printer (manufactured by Video Jet Co., Ltd.) on the printing surface of the adhesive label with a fluorescent ink.

[0119] Lastly, the ultraviolet radiation having the wavelength of 300 to 400 nm was irradiated onto the bar codes printed on the adhesive label to emit fluorescence and the bar codes were read by detecting light having the wavelength for detection, which is shown in Table 1, in the emitted fluorescence by a sensor. The readability of bar codes at the time was evaluated. Evaluation criteria are as follows.

○ : Bar codes could be read accurately

×: Bar codes could not be read accurately

[0120] By using the adhesive labels provided in the release-sheet laminated adhesive labels from Examples 1 to 11 where the first and second light absorbing agents are contained in the adhesive layer, bar codes on the adherends could be read accurately using a sensor.

[0121] On the other hand, in the case where the adhesive label provided in the release-sheet laminated adhesive label from Comparative Example 1 where the first light absorbing agent was not contained although the second light absorbing agent was contained in the adhesive layer was used, bar codes could not be read using a sensor.

[0122] In addition, also in the case where the adhesive label provided in the release-sheet laminated adhesive label from Comparative Example 2 where the second light absorbing agent was not contained although the first light absorbing agent was contained in the adhesive layer was used, bar codes could not be read using a sensor.

[0123] Additionally, visibility of the adherend, to which the adhesive label was pasted, through the adhesive label at the time the label was pasted on the adherend in each of Examples and Comparative Examples was evaluated with the method below.

Evaluation results are shown in Table 2.

[0124] Firstly, characters having an RGB of (234, 234, 234) were printed on woodfree paper with 8 fonts by the DocuColor 1250 manufactured by Fuji Xerox Co., Ltd. Secondly, the adhesive labels from each of Examples and Comparative Examples were pasted on these characters. Lastly, the visibility of the characters on the woodfree paper was evaluated by the naked-eye when the distance between the woodfree paper and the eye was approximately 30 cm. Evaluation criteria are as follows.

A: Characters printed on woodfree paper could clearly be visually recognized

B: Characters printed on woodfree paper could be visually recognized

C: Characters printed on woodfree paper slightly lacked visibility although were practically nonproblematic

D: Characters printed on woodfree paper were poor in visibility and were difficult to read

[Table 2]

	Total light transmittance of visible light (%)		Character visibility on woodfree paper
	Substrate for printing	Adhesive label	
Ex. 1	66.2	62.8	B
Ex. 2	83.3	82.6	A
Ex. 3	66.2	56.8	C
Ex. 4	66.2	63.0	B
Ex. 5	66.2	53.0	C
Ex. 6	66.2	58.5	B
Ex. 7	82.0	78.1	B
Ex. 8	66.2	61.5	B
Ex. 9	66.2	48.7	C
Ex. 10	50.5	48.6	D
Ex. 11	64.8	61.0	B
Comp. Ex. 1	66.2	63.3	B

(continued)

	Total light transmittance of visible light (%)		Character visibility on woodfree paper
	Substrate for printing	Adhesive label	
Comp. Ex. 2	66.2	64.0	B

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[0125] In addition, the total light transmittance of visible light of the substrates for printing used in each of Examples and Comparative Examples and the total light transmittance of visible light of the adhesive labels were measured according to JIS K 7361-1 using the HZ-2 manufactured by Suga Test Instruments Co., Ltd. These results are also shown in Table 2.

[0126] In Examples 1 to 9, 11, and Comparative Examples 1 and 2, where substrates for printing which had high total light transmittance of visible light were used (especially in Example 2), the total light transmittance of visible light of adhesive labels was also high and the visibility of the characters on woodfree paper was high. Moreover, in Example 11, ink absorbability and bleeding prevention at the time of printing were excellent compared to those in other Examples and Comparative Examples.

[0127] In Example 10, where the substrate for printing which had low total light transmittance of visible light was used, the total light transmittance of visible light of the adhesive label was also low and the visibility of the characters on the woodfree paper was low.

Claims

1. An adhesive label having a printing surface where information is printed using an ink which emits fluorescence due to the irradiation of excitation light, and to which excitation light is irradiated in order to read the information, the adhesive label comprising:

a substrate for printing in which one surface is a printing surface;
 an adhesive layer which is provided on the other surface of the substrate for printing;
 a first light absorbing agent which absorbs the excitation light; and
 a second light absorbing agent which absorbs light having a wavelength for detection in the fluorescence.

2. The adhesive label according to Claim 1, wherein the first and second light absorbing agents are contained in the adhesive layer.

3. The adhesive label according to Claim 1 or 2, wherein the total light transmittance of visible light is 50% or more.

4. The adhesive label according to any one of Claims 1 to 3, wherein the adhesive layer has removability.

5. A release-sheet laminated adhesive label, comprising:

the adhesive label according to any one of Claims 1 to 4, and
 a release sheet which is laminated onto the adhesive layer of the adhesive label.

6. An information reading method comprising:

pasting the adhesive label according to any one of Claims 1 to 4 onto an adherend via an adhesive layer;
 printing information on a printing surface of a substrate for printing with an ink which emits fluorescence due to the irradiation of excitation light;
 irradiating excitation light onto the information to emit fluorescence; and
 reading information by detecting light having a wavelength for detection in the fluorescence.

FIG. 1

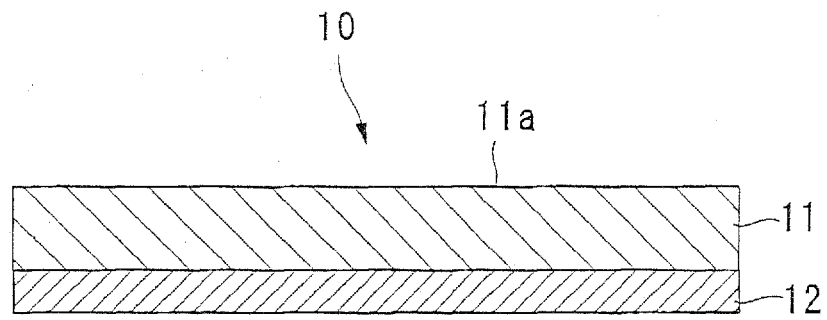
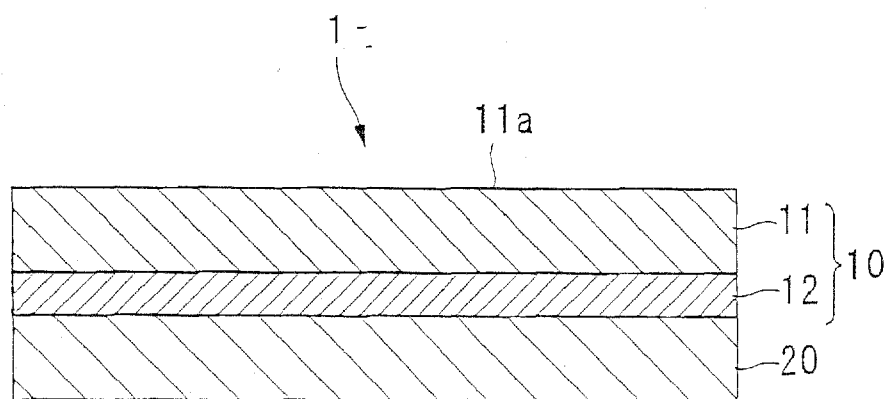


FIG. 2



REFERENCES CITED IN THE DESCRIPTION

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