

Description

The production of chemiluminescent light by the reaction of a catalyzed hydrogen peroxide solution with a fluorescer solution is well known in the art. Blue, green and yellow chemiluminescent light has been produced depending upon the particular fluorescer employed in the fluorescer solution. Examples of these prior art chemiluminescent light-systems can be found in one or more of the following U.S. patents: Nos 3749679; 3391068; 3391069; 3974368; 3557233; 3597362; 3775336; 3888786.

One of the problems attendant the chemiluminescent light devices or systems of the prior art is that, in the dark, the commercially available systems fail to distinguish most colors when utilized as a light source. That is to say, when the chemiluminescent device or system is activated and used in the dark to identify objects, read road maps etc., the color of the object being identified or map being read is often distorted. The true color of the object being observed with the chemiluminescent light appears as a color different from its normal color in the daylight. As a result, errors in judgment or transmission of information can result.

A further disadvantage of some commercially available chemiluminescent light devices or systems is their failure to reach a light intensity required for particular uses or applications.

Accordingly, if a chemiluminescent system could be developed which exhibits white light upon activation or which exhibits a higher light intensity upon activation, a long felt need would be satisfied.

Chemiluminescent compositions have now been developed which, when activated in the presence of hydrogen peroxide and a solvent, either exhibit white light in the dark, which white light enables one to discern colors accurately, or exhibit colored light at an intensity greater than those systems now commercially available.

The present invention is directed to compositions which are intended to be reacted with or activated by hydrogen peroxide in the presence of an organic solvent which composition comprises an oxalate, a fluorescer and a soluble perylene dye, each in sufficient quantity to result in visible chemiluminescent light.

The ability of the above compositions to exhibit white light in the dark or exhibit colored light of a greater intensity is due to the presence of the soluble perylene dye. The soluble perylene dye when added, for example, to a chemiluminescent composition containing a blue fluorescer, results in a white light instead of a blue light, however various hues between blue and white and white and peach can be obtained by varying the amount of soluble perylene dye employed. The amount of soluble perylene dye employed in the compositions of the present invention therefore can range between 5×10^{-4} to 5×10^{-3} , by weight, based on the total weight of the composition, preferably 1.1×10^{-3} to $2.6 \times 10^{-3}\%$. At the lower ratios, the color obtained ranges from violet to pink; at intermediate ratios a white light with either a faint blue cast or pink cast results and at higher ratios various hues of orchid and peach form. The mole ratio of the soluble perylene dye to the specific fluorescer employed should range from about 3.45×10^{-3} to 8.15×10^{-3} to 1.

The concentrations of the oxalate and fluorescer in the compositions of the present invention are as disclosed in the art and, in particular, as disclosed in U.S. Patent No. 3749679, hereby incorporated herein by reference. Any oxalate and/or fluorescer known to be useful in the production of chemiluminescent systems or devices can be used herein. Preferred fluorescers include 9,10-diphenylanthracene, 1-chloro-9,10-bis(phenylethynyl)anthracene and 9,10-bis(phenylethynyl)anthracene while preferred oxalates include bis(2,4,5-trichloro-6-carboxypentoxyphenyl) oxalate, each in sufficient known quantity to result in visible chemiluminescent light mixtures of fluorescers may also be used.

Useful catalysts include those disclosed in U.S. Patent No. 3775336, hereby incorporated herein by reference, in the concentrations disclosed therein. A preferred catalyst is sodium salicylate.

The organic solvents useful herein include those known in the art and disclosed in the above-referenced U.S. patents. Preferred are esters, aromatic hydrocarbons and chlorinated hydrocarbons. Most preferred are dialkyl phthalates wherein the alkyl group contains 1-12 carbon atoms, inclusive. Dibutyl phthalate is exemplary.

Any perylene dye which is soluble in the solvent solution used to produce the composition of the present invention may be used therein. Suitable perylene dyes include N,N'-bis(2,5-di-t-butylphenyl)-3,4,9,10-perylenedicarboximide. This red fluorescent dye has the structural formula:

EXAMPLE 4

A solution, hereinafter called Solution D, is prepared as in Example 1A, except that 92.85 parts of dibutyl phthalate and 7.04 parts of oxalate are used. The 9,10-diphenyl-anthracene is replaced by 0.11 part of 9,10-bis(phenylethynyl)anthracene (green fluorescer). The perylene-dicarboximide concentration is 0.005 part.

When Solution B is added to Solution D (1:3), the resultant chemiluminescent light is white.

EXAMPLE 5

Use of 0.0024 part of perylene-dicarboxyimide in place of the amount employed in Example 4 results in the formation of a yellowish green chemiluminescent light.

EXAMPLE 6-8(Comparative)

When the procedure of Example 2 is again followed except that the soluble perylenedicarboximide is replaced by the following commercially available insoluble perylene dyes 6) Red BPT, 7) Perrindo Red and 8) Indo Vat Brilliant Scarlet R, no color change or brightening effect is observed, thereby evidencing the need for a soluble dye.

EXAMPLE 9

The procedure of Example 1 is again followed except that the fluorescer is a mixture of 9,10-diphenylanthracene and 1-chloro-9,10-bis(phenylethynyl)anthracene. The result white light emits over the entire 480-540 wavelength, a feature not possessed by the blue, yellow or green chemiluminescent light of the prior art.

Claims

1. A composition intended to be reacted with hydrogen peroxide in the presence of an organic solvent to produce visible chemiluminescent light comprising a solvent solution of an oxalate and a fluorescer and further a perylene dye, characterized in that
 - a) the perylene dye is soluble in the solvent solution;
 - b) the concentration of said perylene dye is 5×10^{-4} to $5 \times 10^{-3}\%$ by weight, based on the total weight of the composition; and
 - c) the mole ratio of said perylene dye to said fluorescer ranging from 3.45×10^{-3} to 8.15×10^{-1} to 1.
2. A composition according to claim 1 wherein the perylene dye is N,N'-bis (2,5-di-t-butylphenyl)-3,4,9,10-perylenedicarboximide.
3. A composition according to claim 1 or 2, wherein said fluorescer is 9,10-diphenylanthracene.
4. A composition according to claim 1 or 2, wherein said fluorescer is 1-chloro-9,10-bis(phenylethynyl)-anthracene.
5. A composition according to claim 1, wherein said fluorescer is a mixture of 9,10-diphenylanthracene and 1-chloro-9,10-bis(phenylethynyl)anthracene.
6. A composition according to claim 1 or 2, wherein said fluorescer is 9,10-bis(phenylethynyl)anthracene.
7. A composition according to any of claims 1 or 6, wherein said oxalate is bis(2,4,5-trichloro-6-carboalkoxyphenyl)oxalate.
8. A composition according to any of claims 1 or 7 containing, in addition thereto, a basic catalyst.
9. A composition according to claim 8, wherein said catalyst is sodium salicylate.

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Claims

1. A composition intended to be reacted with hydrogen peroxide in the presence of an organic solvent to produce visible chemiluminescent light comprising a solvent solution of an oxalate and a fluorescer and further a perylene dye, characterized in that
 - a) the perylene dye is soluble in the solvent solution;
 - b) the concentration of said perylene dye is 5×10^{-4} to $5 \times 10^{-3}\%$ by weight, based on the total weight of the composition; and
 - c) the mole ratio of said perylene dye to said fluorescer ranging from 3.45×10^{-3} to 8.15×10^{-1} to 1.
2. A composition according to claim 1 wherein the perylene dye is N,N'-bis (2,5-di-t-butylphenyl)-3,4,9,10-perylenedicarboximide.
3. A composition according to claim 1 or 2, wherein said fluorescer is 9,10-diphenylanthracene.
4. A composition according to claim 1 or 2, wherein said fluorescer is 1-chloro-9,10-bis(phenylethynyl)-anthracene.
5. A composition according to claim 1, wherein said fluorescer is a mixture of 9,10-diphenylanthracene and 1-chloro-9,10-bis(phenylethynyl)anthracene.
6. A composition according to claim 1 or 2, wherein said fluorescer is 9,10-bis(phenylethynyl)anthracene.
7. A composition according to any of claims 1 or 6, wherein said oxalate is bis(2,4,5-trichloro-6-carboalkoxyphenyl)oxalate.
8. A composition according to any of claims 1 or 7 containing, in addition thereto, a basic catalyst.
9. A composition according to claim 8, wherein said catalyst is sodium salicylate.



10. A composition according to any of claims 1 to 9, wherein said solvent is an ester, an aromatic hydrocarbon or a chlorinated hydrocarbon.
11. A composition according to claim 10, wherein said solvent is a dialkyl phthalate, the alkyl group containing from 1-12 carbon atoms, inclusive.
12. A method for producing a chemiluminescent light which comprises adding to the composition of any of claims 1 to 11 a solution of hydrogen peroxide and a basic catalyst.

10 Revendications

1. Composition destinée à réagir avec du peroxyde d'hydrogène en présence d'un solvant organique, pour produire une lumière de chimioluminescence visible, comprenant une solution d'un oxalate et d'un agent fluorescent et en outre d'un colorant dérivé de pérylène dans un solvant, caractérisée en ce que :
 - a) le colorant dérivé de pérylène est soluble dans la solution à base de solvant ;
 - b) la concentration du colorant dérivé de pérylène est de 5×10^{-4} à 5×10^{-3} % en poids par rapport au poids total de la composition ; et
 - c) le rapport molaire du colorant dérivé de pérylène à l'agent fluorescent, est de $3,45 \times 10^{-3}$ à $8,15 \times 10^{-1}$ pour 1.
2. Composition selon la revendication 1, dans laquelle le colorant dérivé de pérylène, est le N,N'-bis(2,5-di-t-butylphényl)-3,4,9,10-pérylènedicarboximide.
3. Composition selon la revendication 1 ou 2, dans laquelle l'agent fluorescent est le 9,10-diphénylanthracène.
4. Composition selon la revendication 1 ou 2, dans laquelle l'agent fluorescent est le 1-chloro-9,10-bis(phényléthynyl) anthracène.
5. Composition selon la revendication 1, dans laquelle l'agent fluorescent consiste en un mélange de 9,10-diphénylanthracène et de 1-chloro-9,10-bis(phényléthynyl) anthracène.
6. Composition selon la revendication 1 ou 2, dans laquelle l'agent fluorescent est le 9,10-bis(phényléthynyl) anthracène.
7. Composition selon l'une quelconque des revendications 1 à 6, dans laquelle l'oxalate est un oxalate de bis(2,4,5-trichloro-6-carboalkoxyphényle).
8. Composition selon l'une quelconque des revendications 1 à 7, contenant en outre un catalyseur basique.
9. Composition selon la revendication 8, dans laquelle le catalyseur est le salicylate de sodium.
10. Composition selon l'une quelconque des revendications 1 à 9, dans laquelle le solvant est un ester, un hydrocarbure aromatique ou un hydrocarbure chloré.
11. Composition selon la revendication 10, dans laquelle le solvant est un phtalate de dialkyle, le groupe alkyle contenant de 1 à 12 atomes de carbone inclus.
12. Procédé de production d'une lumière de chimioluminescence, selon lequel on ajoute dans la composition définie dans l'une quelconque des revendications 1 à 11, une solution de peroxyde d'hydrogène et d'un catalyseur basique.

Patentansprüche

1. Zusammensetzung, die mit Wasserstoffperoxid in Anwesenheit eines organischen Lösungsmittels umgesetzt werden soll, um sichtbares Chemilumineszenz-Licht zu erzeugen, umfassend eine Lösungsmittel-Lösung von einem Oxalat und einem Leuchtstoff und ferner einen Perylenfarbstoff,



dadurch gekennzeichnet, daß

- a) der Perylenfarbstoff in der Lösungsmittel-Lösung löslich ist;
- b) die Konzentration des Perylenfarbstoffes 5×10^{-4} bis 5×10^{-3} Gew.-%, bezogen auf das Gesamtgewicht der Zusammensetzung, beträgt; und
- c) das Molverhältnis des Perylenfarbstoffes zu dem Leuchtstoff im Bereich von $3,45 \times 10^{-3}$ bis $8,15 \times 10^{-1}$ zu 1 beträgt.

2. Zusammensetzung gemäß Anspruch 1, wobei der Perylenfarbstoff N,N'-Bis-(2,5-di-t-butylphenyl)-3,4,9,10-perylendicarboximid ist.

3. Zusammensetzung gemäß Anspruch 1 oder 2, wobei der Leuchtstoff 9,10-Diphenylanthracen ist.

4. Zusammensetzung gemäß Anspruch 1 oder 2, wobei der Leuchtstoff 1-Chlor-9,10-bis(phenylethynyl)-anthracen ist.

5. Zusammensetzung gemäß Anspruch 1, wobei der Leuchtstoff ein Gemisch von 9,10-Diphenylanthracen und 1-Chlor-9,10-bis(phenylethynyl)anthracen ist.

6. Zusammensetzung gemäß Anspruch 1 oder 2, wobei der Leuchtstoff 9,10-Bis(phenylethynyl)anthracen ist.

7. Zusammensetzung gemäß einem der Ansprüche 1 oder 6, wobei das Oxalat Bis(2,4,5-trichlor-6-carboalkoxyphenyl)oxalat ist.

8. Zusammensetzung gemäß einem der Ansprüche 1 oder 7, enthaltend zusätzlich einen basischen Katalysator.

9. Zusammensetzung gemäß Anspruch 8, wobei der Katalysator Natriumsalicylat ist.

10. Zusammensetzung gemäß einem der Ansprüche 1 bis 9, wobei das Lösungsmittel ein Ester, ein aromatischer Kohlenwasserstoff oder ein chlorierter Kohlenwasserstoff ist.

11. Zusammensetzung gemäß Anspruch 10, wobei das Lösungsmittel ein Dialkylphthalat ist, wobei die Alkylgruppe 1 bis einschließlich 12 Kohlenstoffatome enthält.

12. Verfahren zur Erzeugung eines Chemiluminiszenz-Lichts, umfassend die Zugabe einer Lösung von Wasserstoffperoxid und einem basischen Katalysator zu der Zusammensetzung gemäß einem der Ansprüche 1 bis 11.