I, Michael Fletcher, declare:

1. I am well versed in both the Japanese and English languages and have over 15 years of experience translating Japanese technical documents into English.

2. The following translation of the patent document JPH05-3079 to English is accurate and complete to the best of my knowledge.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and accurate.

Executed this 3rd day of November 2019, at Parowan, UT

Michael Fletcher

(19) Japanese Patent Office (JP)

(12) Publication of Unexamined Patent Application (A)

(11) Patent Application Disclosure
H05-3079

(43) Publication Date: January 8, 1993

(51) Int. Cl[5]		ID Number	JPO File Number	FI	Theme code (ref.)
H05B	33/14		8815-3K		
H01L	33/00	A	8934-4M		
H05B	33/26		8815-3K		

Request for Examination: Not Requested Number of Claims: 1 Total pages: 6

(21) Application No.: 1991-178679

(22) Application Date: June 24, 1991

(71) Applicant 000005016
Pioneer Corporation
1-4-1 Meguro, Meguro-ku, Tokyo

(71) Applicant 000111889
Pioneer Video Corporation
2680-banchi, Nishihanawa, Tatomi-cho, Nakakoma-gun, Yamanashi

(72) Inventor MANABE, Masamichi
c/o Pioneer Video Corporation Flagship Factory 465-banchi, Osato-cho, Kofushi, Yamanashi

(72) Inventor AMEMIYA, Kimio
c/o Pioneer Video Corporation Flagship Factory 465-banchi, Osato-cho, Kofushi, Yamanashi

(74) Agent Patent Attorney KOBASHI, Shingo (1 other)

Continued on last page

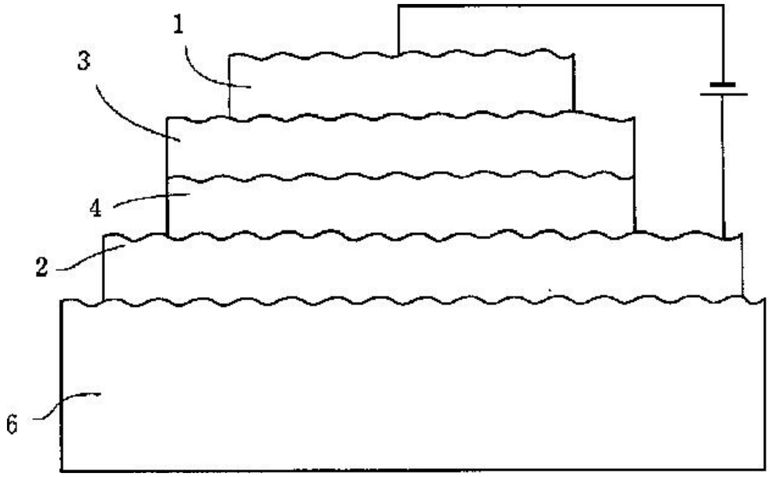
(54) TITLE OF THE INVENTION

Organic EL element

(57) ABSTRACT

PURPOSE
To reduce luminance and emission spectrum visual dependence.

CONSTITUTION
An organic EL element with a transparent electrode, organic EL layer, and metal electrode laminated in order on a transparent substrate, wherein the surface of the organic EL layer in contact with the metal electrode or the surface of the metal electrode that is in contact with the organic EL layer has been roughened.



CLAIMS

[Claim 1]

An organic EL element with a transparent electrode, organic EL layer, and metal electrode laminated in order on a transparent substrate, wherein the surface of the organic EL layer in contact with the metal electrode or the surface of the metal electrode that is in contact with the organic EL layer has been roughened.

DETAILED DESCRIPTION OF THE INVENTION

[0001]

FIELD OF INDUSTRIAL USE

The present invention is related to an organic EL element that utilizes electroluminescence (hereafter called EL) of substances caused by current injection and is prepared with an EL layer formed with a thin film of this substance and in particular where the light emitting substance is an organic compound.

[0002]

BACKGROUND TECHNOLOGY

Regarding this type of organic EL element, as shown in FIG. 3, those with a two layer structure made up respectively of organic compounds, an EL layer 3 made up of a light emitting thin film and a hole transport layer 4, mutually laminated together, and arranged between a metal cathode 1 and transparent anode 2 and those with a three layer structure as shown in FIG. 4 made up respectively of organic compounds, an electron transport layer 5, EL layer 3, and hole transport layer 4 mutually laminated together and arranged between a metal cathode 1 and transparent anode 2 are well known. Here, the hole transport layer 4 has a function of more readily injecting holes from the anode and a function of blocking electrons and the electron transport layer 5 has a function of more readily injecting electrons from the cathode and a function of blocking holes.

[0003]

For example, metal or metal such as various alloys with a small work function such as aluminum, magnesium, and indium with a thickness of roughly 1000 to 5000 angstroms can be used as the metal cathode 1. In addition, for example, a conductive material with a large work function such as Indium Tin Oxide (hereafter called ITO) or the like with a thickness of roughly 1000 to 3000 angstroms or a metal with a thickness of 800 to 1500 angstroms can be used for the anode 2.

[0004]

Aluminum quinolinol complex, in other words Al oxine chelate (hereafter called Alq_3), tetraphenyl butadiene derivative can be used as the EL layer 3. For the hole transport layer 4, compounds such as triphenyldiamine derivative N, N′-diphenyl-N, N′-bis (3methylphenyl) -1,1′-biphenyl-4,4′-diamine (hereinafter referred to as TPD) can preferably be used, as CTM (Carrier Transporting Materials) and these can be used alone or as a mixture.

[0005]

For example, oxadiazole derivatives (PBD) and the like can be used as the as the electron transport layer. In these organic EL elements, a glass substrate 6 is arranged on the outside of the transparent electrode 2 and excitons are generated from the recombining of electrons injected from the metal cathode 1 and holes injected from the transparent anode 2 onto the EL layer 3. Excitons on the EL layer near the boundary layer with the hole transport layer emit light in a radiation and deactivation process. This light is discharged externally through the transparent anode 2 and glass substrate 6 (Japanese Unexamined Patent Application S59-194393 and Japanese Unexamined Patent Application S63-295695).

[0006]
THE ISSUE(S) THAT THIS INVENTION INTENDS TO RESOLVE
However, as a result of research of the film thickness of the EL layer of a two-layer structure organic EL element and emission spectrum, luminance, and viewing angle, the inventors learned that luminance has EL layer thickness dependence and viewing angle dependence. In other words, emission spectrum and luminance of the organic EL element and glass substrate 6 as shown in FIG. 5 changes depending on the viewing angle of the viewer.

[0007]
Light emitted from one point of emission source P within the EL layer includes light from two sources, path A of light directly impinging on the substrate 6 in the drawings and path B of light reflecting off the metal electrode 1 and impinging on the substrate 6. The light from these two paths have light path difference L given by equation 1 and furthermore phase difference ηy given by equation 2 and mutually interfere (in both equations, n is the refractive index of the EL layer 3, y is the distance from the light source P to the metal electrode 1, θ is the viewing angle from normal on the display surface in the EL layer, and λ indicate respective wavelengths. Same hereinafter).

[0008]
Equation 1

$$L = 2ny\cos\theta$$

[0009]
Equation 2

$$\frac{4\pi ny\cos\theta}{\lambda} = \eta y$$

Therefore, intensity I as a result of interference can be expressed as in equation 3.
[0010]
Equation 3

$$I(y, \lambda) = \frac{1}{2}\{1 + \cos(\eta y)\}$$

[0011]
As shown in FIG. 6, the light intensity f(y) distribution in the EL layer at the boundary layer of the hole transport layer 4 decreases with increased directedness towards the metal electrode 1 and an exponential function distribution related to film thickness can be expressed as equation 4 and for EL thickness overall, can be normalized as equation 5 (in both equations d is distance from the light source to the metal electrode, ε is the light source intensity distribution parameter, and k is a constant. Same hereinafter).

[0012]
Equation 4

$$f(y)=k\ \exp(y/\varepsilon)$$

[0013]
Equation 5

$$\int_{-\infty}^{d} f(y)\,dy=1$$

[0014]
The intensity distribution F(λ) of the emission spectrum of the light source itself can be exhibited as a function of wavelength λ specific to the light source body. Therefore, the emission intensity T (λ, θ, d) of the EL element actually observed by the viewer can be given by equation 6.

[0015]
Equation 6

$$T(\lambda)=F(\lambda)\times\int_{0}^{d} f(y)\times I(y,\lambda)\,dy$$

[0016]
Here, to confirm the emission intensity T (λ, θ, d) of the EL element, an organic EL element containing an EL layer made up of Alq_3 with a film thickness d of 6000 angstroms was prepared and a test was performed regarding emission intensity of viewing angles from 0° to 75°. FIG. 7 shows emission intensity distribution relative to emission wavelength. Therefore, the emission intensity distribution was confirmed to nearly match with the emission intensity T (λ, θ, d)

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS
Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS
Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS
Sync your system to PACER to automate legal marketing.

WHAT WILL YOU BUILD? | sales@docketalarm.com | 1-866-77-FASTCASE