CERTIFICATION OF TRANSLATION ACCURACY

I, Michael Fletcher, declare:

1. I am well versed in both the Japanese and English languages and have over 13 years of experience translating Japanese technical documents into English.

2. The following translation of this Japanese patent document 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 31st day of October 2017, at Parowan, UT

Michael Fletcher

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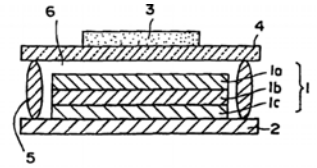
(54) Title: MULTI-COLOR LIGHT EMISSION APPARATUS AND METHOD FOR PRODUCTION THEREOF



(57) Abstract:

This invention provides a multi-color light emission apparatus wherein a transparant glass substrate (4) is disposed between an organic EL device (1) and a fluorescent layer (3) in such a manner as to arrange the fluorescent layer (3) with a gap with the organic EL device (1), and the organic EL device (1) is sealed by seal means (5) between the transparent glass substrate (4) and a support substrate (2). The invention provides also a multi-color light emission apparatus wherein a transparent insulating inorganic oxide layer (12) having a thickness of 0.01 to 200 μm is interposed between the fluorescent layer (3) and the organic EL device (1). In this way, light emission life and angle-of-field characteristics can be improved.

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The present invention provides a multi-color light emission apparatus wherein a transparent glass substrate 4 is disposed between an organic EL element 1 and a fluorescent layer 3 in such a manner as to arrange the fluorescent layer 3 with a gap with the organic EL element 1 and the organic EL element 1 is sealed by sealing means 5 between the transparent glass substrate 4 and a support substrate 2.The invention provides also a multi-color light emission apparatus wherein a transparent insulating inorganic oxide layer 12 having a thickness of 0.01 to 200 □m is disposed between the fluorescent layer 3 and the organic EL element 1.

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SPECIFICATION

Multi-color light emission apparatus and a method for producing thereof.

FIELD OF THE INVENTION

This invention relates to a multi-color light emission apparatus and a method for producing thereof. More specifically, this invention relates to a multi-color light emission apparatus suitable for use in multi-color or full-color thin-type displays and a method for producing the multi-color light emission apparatus.

BACKGROUND TECHNOLOGY

An electroluminescence element (hereinafter called "EL element") is characterized in exhibiting high visibility due to self-emission and in having excellent impact resistance because of being completely solid. At present, various EL elements using an inorganic or an organic compound as the emitting layer have been proposed and attempts have been made to put them to practical use. One of the EL elements that has been put to practical use is applied as a multi-color light emission apparatus.

Such a multi-color light emission apparatus includes an apparatus produced by arranging a color filter of three primary colors (red, green, and blue) with a white-light emitting inorganic EL element and an apparatus produced by patterning inorganic EL elements of three primary colors in order to position the EL elements of three primary colors separately on the same plane and thereby emit light (Semicond. Sci. Technol. 6 (1991) 305-323). However, there is the problem that the light emission efficiency for each color is limited to 33% of the white light at most if the white color is decomposed by the color filter of three primary colors. Further, elements that can efficiently emit white light have still not been attained at present.

On the other hand, a photolithography process is used for patterning EL elements. However, it is known that the efficiency and stability of EL elements are greatly reduced in this type of wet process.

It is common knowledge that of EL elements, organic EL elements are promising as high luminance and efficient light emitting devices. In particular, because the light emitting layer is

an organic layer, it is highly probable that various color emissions are produced by the molecular design of organic compounds. Such an organic EL element is expected to be one device which can be used in practice in a multi-color light emission apparatus.

However, these organic EL elements have the drawback that chemical factors such as external water vapor, oxygen, organic compound gas, and the like cause deterioration such as reduction in luminance accompanied by the occurrence of dark spots and the like and these devices are damaged relatively readily from physical (mechanical) factors such as heat, impact, or the like since the element structure is composed of a laminate of low molecular organic compounds.

Therefore, the method for separately disposing each of the organic EL elements, which emit light in three primary colors (RGB), on the same plane was difficult to use in a wet process or a process including heat treatment such as a photolithography process.

In order to solve such a problem, disclosed is a color EL display apparatus (see Japanese Patent Application S65-40888). This apparatus is, as shown in FIG. 8, characterized in that an EL emitting layer 1b sandwiched between a lower electrode 1c and a light transmitting upper electrode is provided on a substrate 2, the EL light which is output via the light transmitting electrode 1a is externally output from a transmitting substrate 8 via a color filter 9 provided on the transmitting substrate 8 with the color filter 9 facing the transmitting electrode 1a (Japanese Unexamined Patent Application S64-40888).

This apparatus has, however, the disadvantage that the luminance of the light of each color is reduced to one third of the EL light by the color filter. Also, because the EL element faces the color filter, the light emission life span of the EL element is invariably reduced by water vapor, oxygen, gas from organic monomers, low molecular components, and the like generated by the color filter.

To solve these problems, recently disclosed is a technique in which a fluorescent layer that absorbs light emitted from an organic EL element and emits visible fluorescent light is installed in the position (laminated or in parallel) corresponding to the emitting part of an

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