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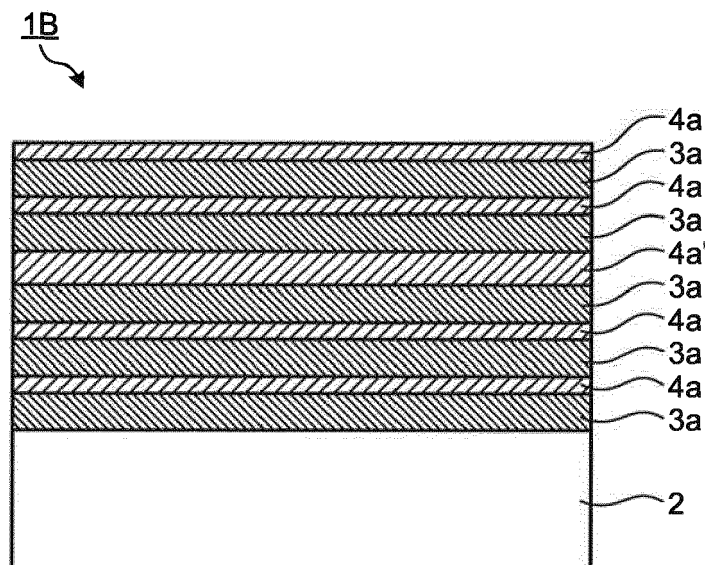
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(54) **HALOGEN LAMP**

(57) According to one embodiment, a halogen lamp (10) is provided with a bulb (2) and a multilayer film filter (1A) formed on an external surface of the bulb (2). In the multilayer film filter (1A), high refractive index films (4a)

and low refractive index films (3a) are alternately stacked. The low refractive index film (3a) is formed so that a film thickness thereof is greater than a film thickness of the high refractive index film (4a).

FIG.5



Description

FIELD

[0001] Embodiments described herein relate to a halogen lamp.

BACKGROUND

[0002] A halogen lamp, which is used for heating an object to be irradiated with radiation light, is known. Since the halogen lamp is required to have an anti-glare property for a use of heating a space or cooking, or the like, a multilayer film filter having a high visible light shielding effect is formed on an external surface of a bulb. In the multilayer film filter which transmits infrared ray and reflects visible light, high refractive index films and low refractive index films are alternately stacked in order to transmit and shield a selected wavelength band.

[0003] It is known that the multilayer film filter is formed to have a thick film thickness of the high refractive index film having a high absorption coefficient of visible light in order to improve an anti-glare level. However, in the multilayer film filter, if the film thickness of the high refractive index film is too thickened, a stress balance in each film or a boundary between adjacent films is lost and peeling or damage is caused due to heat stress when turning on light, and a phenomenon of generating pinholes is likely to be caused. If the pinholes are generated in the multilayer film filter, the pinholes are scattered as a bright point close to white when turning on the lamp, and thus an appearance of the halogen lamp is damaged.

[0004] An exemplary embodiment provides a halogen lamp which is capable of suppressing generation of the pinholes without deteriorating an anti-glare property.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005]

FIG. 1 is a schematic view illustrating a halogen lamp which exemplifies a first embodiment.

FIG. 2 is a schematic view illustrating a multilayer film filter.

FIG. 3 is a table for exemplifying a relationship of the number of pinholes and determination criteria (pinhole level) of a lamp which can be practically used. FIG. 4 is a graph for exemplifying characteristics of the pinhole level.

FIG. 5 is a schematic view illustrating a multilayer film filter which exemplifies a second embodiment. FIG. 6 is a graph for exemplifying characteristics of a pinhole level.

FIG. 7 is a schematic view illustrating a multilayer film filter which exemplifies a modification example of the second embodiment.

DETAILED DESCRIPTION

[0006] A halogen lamp according to embodiments to be described later is provided with a bulb and a multilayer film which is formed on an external surface of the bulb, in the multilayer film, high refractive index films and low refractive index films are alternately stacked, and the low refractive index film is formed so that a film thickness thereof is greater than a film thickness of the high refractive index film.

[0007] In the halogen lamp according to the embodiments to be described later, the film thickness of the low refractive index film is 120% to 240% of a film thickness of at least one layer of the high refractive index films.

[0008] Also, in the halogen lamp according to the embodiments to be described later, the film thickness of at least one layer of the high refractive index films is 105% to 240% of the film thickness of another high refractive index film, and the at least one layer of the high refractive index films is inserted into an arbitrary boundary in multilayer films in which the high refractive films and the low refractive films are alternately stacked.

[0009] In addition, in the halogen lamp according to the embodiments to be described later, the low refractive index films are mainly made of silicon dioxide (SiO_2), and the high refractive index films are mainly made of iron (III) oxide (Fe_2O_3).

[0010] Hereinafter, each of embodiments will be described with reference to drawings.

[0011] Moreover, the drawings are schematic or conceptual, and a dimension, a ratio, and the like of each part are not necessarily same as those in actual. Also, same numerals are given to the same configurations and operation effects in each drawing, and descriptions thereof will be omitted.

[0012] Hereinafter, a first embodiment will be described with reference to FIG. 1, FIG. 2, FIG. 3, and FIG. 4.

[0013] The halogen lamp 10 is provided with a bulb 2, a first seal portion 11, a second seal portion 12, a first outer lead 14, and a second outer lead 15 as illustrated in FIG. 1. The bulb 2 is made of a transparent and colorless material, and is formed in a cylindrical shape. As the material, for example, quartz glass having a high softening point is exemplified. The first seal portion 11 and the second seal portion 12 seal both ends of the bulb 2, and make an inside of the bulb 2 be airtight. One end of the first outer lead 14 is buried in the first seal portion 11, and the other end thereof is exposed to the outside of the first seal portion 11. One end of the second outer lead 15 is buried in the second seal portion 12, and the other end thereof is exposed to the outside of the second seal portion 12. The halogen lamp 10 is further provided with a filament which is not illustrated. The filament is disposed inside of the bulb 2. The filament is electrically connected to the first outer lead 14, and is electrically connected to the second outer lead 15. The filament generates heat and emits light by receiving a voltage being

applied through the first outer lead 14 and the second outer lead 15.

[0014] As illustrated in FIG. 2, a multilayer film filter 1A according to the embodiment is formed on a surface of the bulb 2 and provided with a plurality of low refractive index films 3a and a plurality of high refractive index films 4a. The low refractive index films 3a are mainly made of silicon dioxide (SiO_2), and the high refractive index films 4a are mainly made of iron (III) oxide (Fe_2O_3). The bulb 2 is made of, for example, quartz glass having a high softening point, and is transparent and colorless.

[0015] The multilayer film is formed in a dipping method, a vacuum evaporation method, a sputtering method, or the like, and the low refractive index films 3a and the high refractive index films 4a are alternately stacked about 10 layers. In the embodiment, odd number layers starting from a first layer directly formed on the surface of the bulb 2 are formed as the low refractive index film 3a, and even number layers starting from a second layer are formed as the high refractive index film 4a. Since SiO_2 which is a main component of the low refractive index film 3a is similar to a component of the bulb 2, by setting the low refractive index film 3a to the first layer, attachment force to a surface of the bulb 2 can be improved. In addition, since SiO_2 has excellent chemical and thermal resistance, and has a mechanical strength, there is a low possibility of causing peeling or damage even when the low refractive index film 3a is directly formed on the surface of the bulb 2 of which a temperature becomes high.

[0016] FIG. 3 exemplifies a relationship between the number of pinholes being recognized when the halogen lamp 10 is turned on and a pinhole level which is determination criteria for determining whether or not the halogen lamp 10 can be practically used. The pinhole is a hole formed on the multilayer film filter 1A, and is recognized on the surface of the bulb 2 as a bright point close to white when the halogen lamp 10 is turned on. The pinhole is checked by enlarging imaging the surface of the bulb 2 when the halogen lamp 10 is turned on at 235 V of a rated voltage for three minutes. The surface of the bulb 2 is photographed in enlargement on a half circumferential side of a circumference direction of the bulb 2 in a light emission region of one electrode part of the halogen lamp 10 through another electrode part.

[0017] From a photo which is photographed in enlargement, pinholes having a diameter of 0.4 mm or more are counted. A case in which seven or more pinholes are counted is set to one point, a case of five and six pinholes is set to two points, a case of three and four pinholes is set to three points, a case of one and two pinholes is set to four points, a case of zero pinholes are set to five points, and the points are defined as a pinhole level. The multilayer film filter 1A is in a level where the filter can be practically used if the pinhole level is two points or more. The multilayer film filter 1A can be practically used if the pinhole level is two points or more, but it is desirable that the pinhole level be three points or more in order to look

good in an appearance of the lamp when turning on the lamp.

[0018] As exemplified in FIG. 2 in the embodiment, all of five layers of each of the low refractive index film 3a and the high refractive index film 4a are respectively formed to have the same film thickness. A type of the multilayer film filter formed in such a manner is referred to as a comparison example hereinafter. In addition, the low refractive index film 3a is formed so that the film thickness thereof is greater than the film thickness of the high refractive index film 4a. Here, a pinhole level of a sample including the multilayer film filter 1A in which a ratio of the film thicknesses of the low refractive index film 3a with respect to the high refractive index film 4a is changed, is measured. As illustrated in FIG. 4, a plurality of samples including the multilayer film filters 1A in which the film thicknesses of the low refractive index films 3a are 118%, 120%, 137%, 141%, 200%, and 240% with respect to the film thickness of the high refractive index film 4a are prepared.

[0019] As a result of measuring the pinhole level of the plurality of samples manufactured at each film thickness ratio, as illustrated in FIG. 4, it is understood that if the film thickness of the low refractive index film 3a is 120% to 240% of the film thickness of the high refractive index film 4a, the pinhole level is two points or more, and the multilayer film filter 1A can be practically used. The pinhole level is shown as five points when the film thickness ratio is 200%, and is shown as three points when the film thickness ratios are 137% and 240%. The pinhole levels are shown as five points when the film thickness ratios are 141% and 200%. The pinhole level tends to decrease its point as the film thickness ratio is increased when the film thickness ratio is 200% or more. The multilayer film filter 1A can achieve a practical use level by making the film thickness of the low refractive index film 3a be thickened as 120% to 240% with respect to the film thickness of the high refractive index film 4a.

[0020] In addition, the type of the multilayer film filter is not limited to the comparison example exemplified in FIG. 2, and all of the five layers of the high refractive index film 4a may not be formed to have the same film thickness. The low refractive index film 3a may be formed as long as the film thickness thereof is approximately 120% to 240% greater than the film thickness of at least one layer of the high refractive index films 4a which are multiply stacked.

[0021] The halogen lamp 10 of the first embodiment is capable of providing a halogen lamp capable of suppressing generation of pinholes and improving appearance of the lamp.

[0022] Next, a second embodiment will be described with reference to FIG. 5, FIG. 6, and FIG. 7.

[0023] In a multilayer film filter 1B according to the embodiment, the low refractive index film 3a and the high refractive index film 4a are alternately stacked on the surface of the bulb 2, and an intermediate layer 4a' is inserted to an arbitrary boundary therebetween. A film

thickness of the intermediate layer 4a' is greater than the film thickness of the high refractive index film 4a. In the embodiment, the intermediate layer 4a' having a greater film thickness than the film thickness of the high refractive index film 4a is formed as, for example, a sixth layer. All of the five layers of the low refractive index films 3a have the same film thickness, and is formed so that the film thickness thereof is greater than the film thickness of the high refractive index film 4a. All of the other four layers of the high refractive index films 4a are formed to have the same film thickness, and the intermediate layer 4a' is formed so that the film thickness thereof is greater than the film thickness of the high refractive index film 4a. The intermediate layer 4a' of FIG. 5 is formed to have the greatest film thickness in the multilayer film filter 1B, but is not limited to the embodiment, and may be formed to be thinner than the film thickness of the low refractive index film 3a if the film thickness thereof is greater than another high refractive index film 4a.

[0024] In the embodiment, a ratio of the film thickness of the intermediate layer 4a' with respect to the film thickness of the high refractive index film 4a is changed, and the pinhole level is determined. As exemplified in FIG. 6, a plurality of samples including a multilayer film filters in which the film thicknesses of the intermediate layers 4a' are 105%, 115%, 130%, 160%, 200%, and 240% with respect to the film thickness of the high refractive index film 4a are prepared, and pinhole levels of the plurality of samples are measured. The multilayer film filter 1B in FIG. 6 is a multilayer film filter of the same type as the multilayer film filter of the comparison example illustrated in FIG. 2, and the intermediate layer 4a' is not provided thereto. The multilayer film filter 1B is configured with the low refractive index films 3a and the high refractive index films 4a, and the respective five layers thereof are formed to have the same film thickness as each other. In the second embodiment, the film thickness ratio of the low refractive index film 3a and the high refractive index film 4a is equal to 137% of the first embodiment, and causes the film thickness of the intermediate layer 4a' formed as the sixth layer to be changed.

[0025] As a result of measuring the pinhole level by changing the film thickness of the intermediate layer 4a' with respect to the film thickness of the high refractive index film 4a, as illustrated in FIG. 6, if the film thickness of the intermediate layer 4a' is 105% to 240% of the film thickness of the high refractive index film 4a, the pinhole level is three points or more, and the multilayer film filter can be practically used. The pinhole level is shown as five points of a peak value when the film thickness ratio of the intermediate layer 4a' is 115% and 130%, is shown as four points when the ratio is 160% and 200%, and is shown as three points when the ratio is 240%. The pinhole level tends to decrease its point as the film thickness ratio is increased when the film thickness ratio is 200% or more. The multilayer film filter 1B can achieve a practical use level by setting the film thickness ratio of the intermediate layer 4a' to the high refractive index film 4a

to 105% to 240%.

[0026] In the first embodiment, when the film thickness ratio of the low refractive index film 3a and the high refractive index film 4a is a base type of 137%, the pinhole level is three points, but the pinhole level can be improved up to five points by inserting the intermediate layer 4a' as the sixth layer. For example, when the halogen lamp 10 is used as a heater, the film thickness ratio of the low refractive index film 3a and the high refractive index film 4a is set, so that the pinhole level is decreased in accordance with a specification thereof. At this time, the multilayer film filter is capable of improving the pinhole level by inserting the thick intermediate layer 4a' thereto.

[0027] The intermediate layer 4a' is not limited to being provided as the sixth layer if the layer is inserted to an arbitrary boundary of the low refractive index films 3a. In the embodiment, it is desirable that the intermediate layer be provided as at least any one of the second layer, a fourth layer, the sixth layer, and an eighth layer. The thick intermediate layer 4a' acts as a buffer of stress being generated in each film being stacked or between adjacent films. Therefore, the intermediate layer 4a' is inserted into an arbitrary boundary in the multilayer film except a top layer, and thus generation of pinholes can be suppressed.

[0028] In addition, a modification example of the second embodiment will be described with reference to FIG. 7. As exemplified in FIG. 7, in a multilayer film filter 1C according to the modification example of the second embodiment, the high refractive index film 4a as the eighth layer of the multilayer film filter 1B of the second embodiment in FIG. 5 is substituted for the intermediate layer 4a'. That is, in the second embodiment, as exemplified in FIG. 7, the plurality of intermediate layers 4a' may be formed at an arbitrary boundary sandwiched between the low refractive index films 3a, and for example, the fourth layer and the eighth layer may be formed as the intermediate layer 4a'. In this case, the plurality of intermediate layers 4a' may be formed to have respective different film thicknesses.

[0029] In the embodiment, the number of layers being stacked of the multilayer film filter 1 is not limited to ten layers. The number of layers can be appropriately changed according to the type, size, usage, or the like of the halogen lamp 10.

[0030] According to the exemplary embodiment, the multilayer film filter, which is capable of suppressing generation of the pinholes and improving good appearance of the lamp, can be provided.

[0031] Moreover, an example in which the multilayer film filter 1 is used for an infrared ray lamp for heating a space and cooking is explained in the embodiment. However, the exemplary embodiment is not limited thereto. For example, the filter can be used in order to transmit or shield a selected wavelength band in accordance with a use or a function to be required in an image capturing device, a communication device, or the like.

[0032] While certain embodiments have been de-

scribed, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel embodiments described herein may be embodied in a variety of other forms, furthermore various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the inventions. The accompanying claims and there equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the invention.

Claims

1. A halogen lamp comprising:
 - a bulb; and
 - a multilayer film that is formed on an external surface of the bulb,
 - wherein, in the multilayer film, high refractive index films and low refractive index films are alternately stacked, and the low refractive index film is formed so that a film thickness thereof is greater than a film thickness of the high refractive index film.
2. The lamp according to claim 1, wherein the film thickness of the low refractive index film is 120% to 240% of a film thickness of at least one layer of the high refractive index films.
3. The lamp according to claim 1 or 2, wherein the film thickness of at least one layer of the high refractive index films is 105% to 240% of the film thickness of another high refractive index film, and the at least one layer of the high refractive index films is inserted into an arbitrary boundary in the multilayer film in which the high refractive index films and the low refractive films are alternately stacked.
4. The lamp according to any one of claims 1 to 3, wherein the low refractive index film is mainly made of silicon dioxide (SiO_2), and the high refractive index film is mainly made of iron (III) oxide (Fe_2O_3).

FIG.1

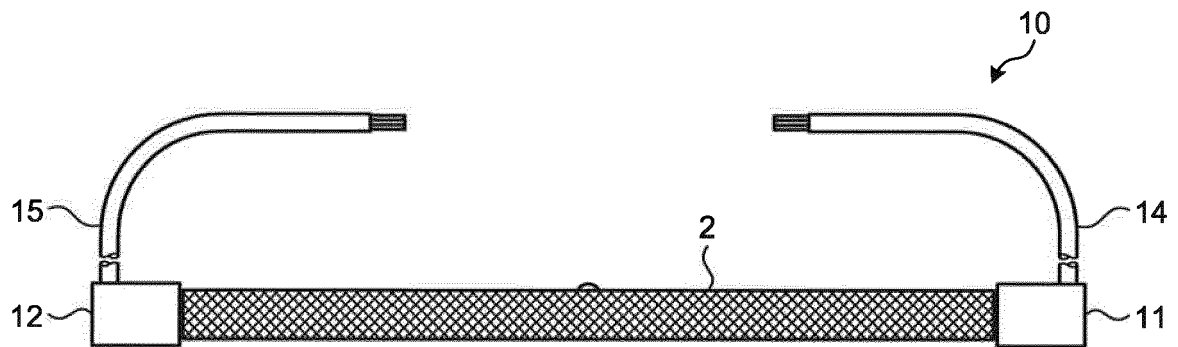


FIG.2

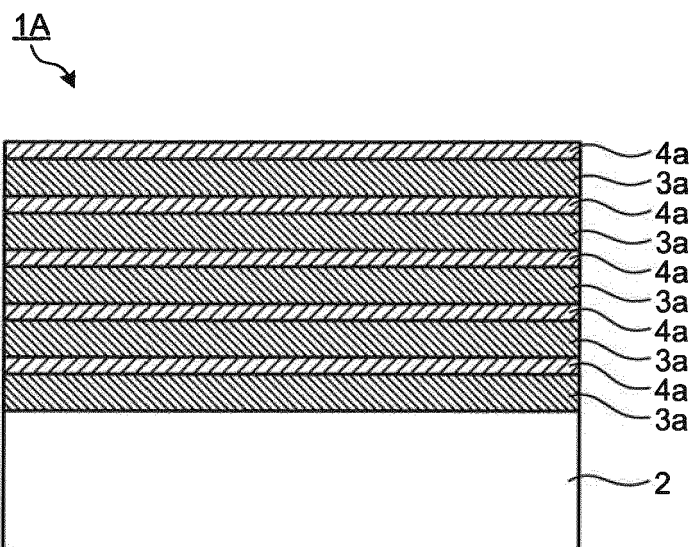


FIG.3

PINHOLE LEVEL [POINT]	NUMBER OF PINHOLES [P]
5	0
4	1 TO 2
3	3 TO 4
2	5 TO 6
1	7 OR MORE

FIG.4

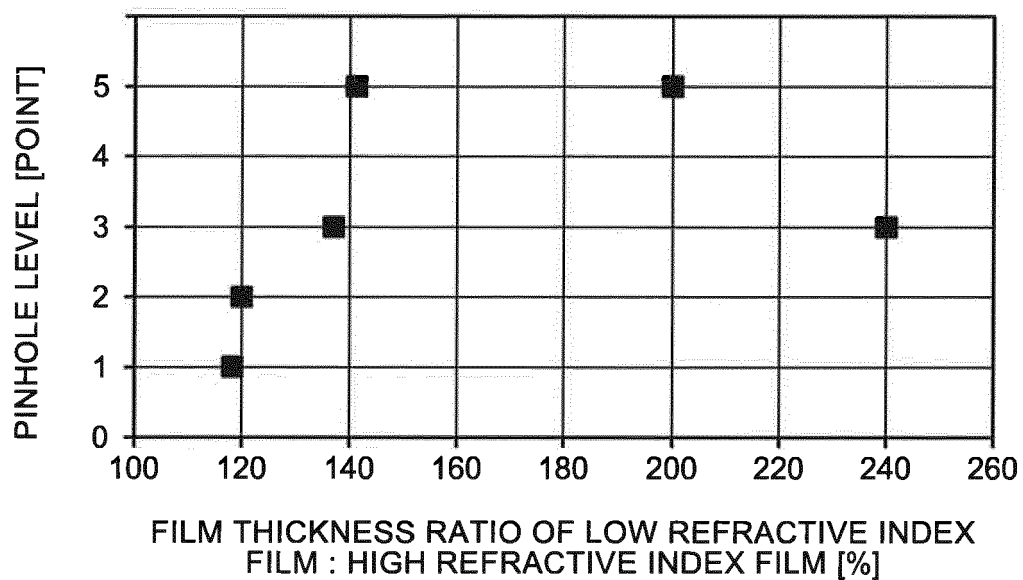


FIG.5

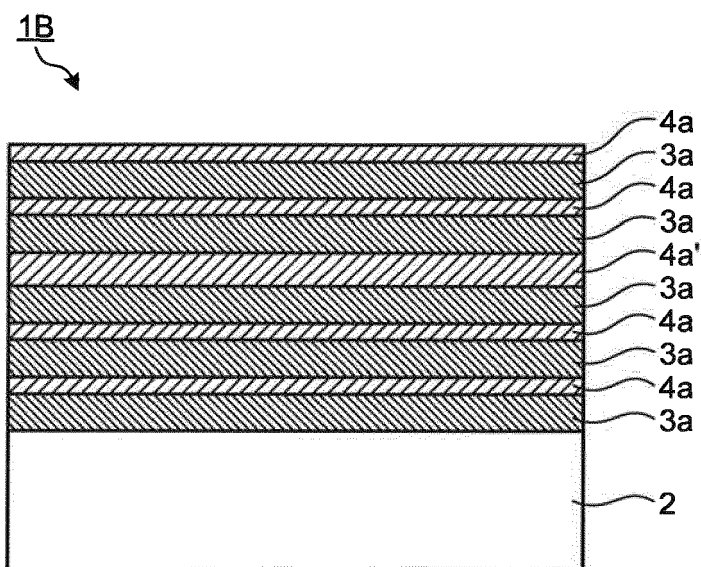


FIG.6

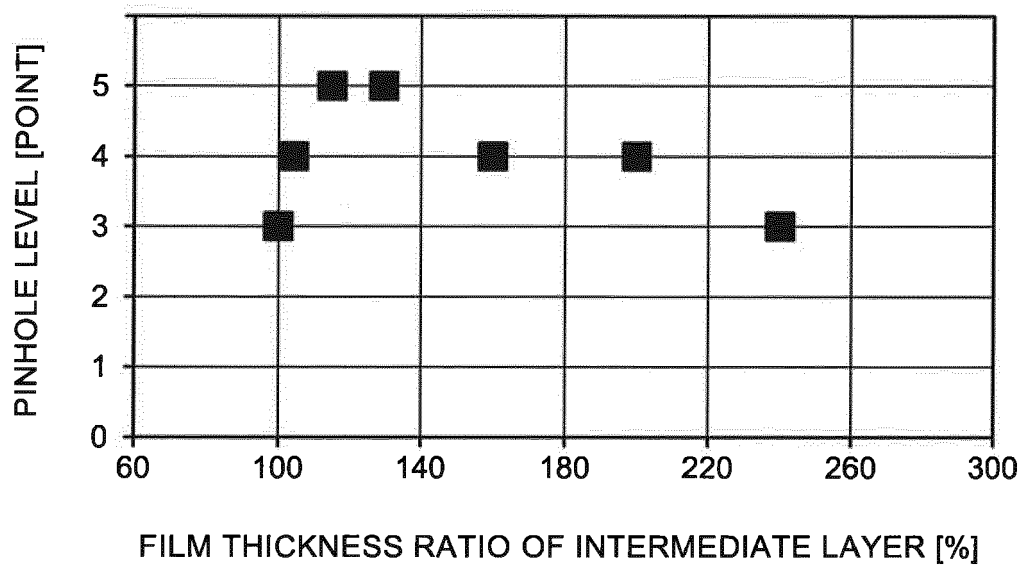
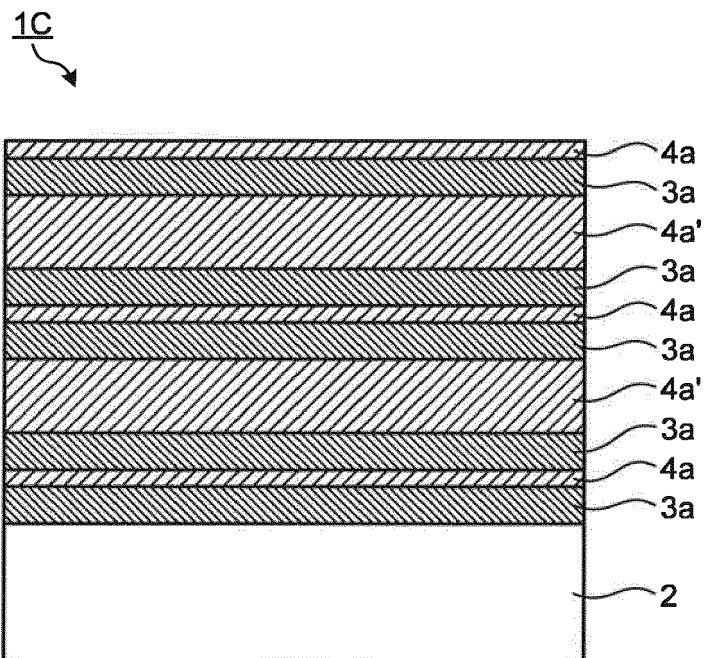


FIG.7





EUROPEAN SEARCH REPORT

Application Number
EP 17 15 8888

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Place of search Munich		Date of completion of the search 5 September 2017	Examiner Schmidt-Kärst, S
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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