PATENT SPECIFICATION

Application Date: Feb. 23, 1942. No. 2377/42. **569,273**

Complete Specification Left: Nov. 27, 1942.

Complete Specification Accepted: May 16, 1945.

PROVISIONAL SPECIFICATION

Improvements in Luminescent Materials

We, LEONARD ANGELO LEVY and DONALD WILLOUGHBY WEST, both of 31, Shoot-up-Hill, London, N.W.2, both British subjects, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to luminescent materials and to their manufacture. Its primary object is to provide a luminescent material that has properties similar to, but not necessarily identical with, those of the well known blue-luminescing tungstates, for example magnesium tungstate; that is to say, excitability by the 2537 Å line of mercury to produce light whose dominant hue is blue or green, but which may be of low saturation.

According to one aspect of the invention a luminescent material having the said properties contains as essential elements an alkali metal an alkaline earth metal, lead, silicon, and oxygen.

According to another aspect of the invention the manufacture of luminescent material comprises heating the silicate of an alkali metal and an alkaline earth metal with lead or a compound of lead.

The preferred alkaline earth metal is barium; the preferred alkali metal is sodium; the preferred proportion of lead in the luminescent material is between 0.25 and 33%.

Two methods of manufacturing a luminescent material according to the invention will now be described by way of example.

In the first method solutions of sodium silicate and barium chloride, purified by the usual technique, are mixed together; the resulting precipitate of sodium barium silicate (probably $Na_2O:2BaO:3SiO_2$) is separated and washed thoroughly. 20 gm. of the resulting paste, containing 4 gm. of the dry silicate, are mixed with a quantity of lead carbonate which may vary between 1 and 0.1 gm. The mixture is maintained in air for about two hours at a temperature of about 750° C. It is preferable that the heating be continued until an absence of blackening when the material is exposed to hydrogen sulphide shows that there is no free lead or lead carbonate remaining.

If the amount of lead added is 1 gm., the luminescent light when the material is excited by the 2537 Å line will be slightly greenish white and not very different from that characteristic of magnesium tungstate. If the amount of lead added is 0.1 gm., the light will be blue and not very different from that characteristic of calcium tungstate.

In the second method, silica gel is mixed with the carbonates of sodium, barium, and lead, the proportions of the silica, sodium, barium, and lead being the same as in the first method. The mixture is then heated as described in the first method.

Dated the 23rd day of February, 1942.

A. F. CORNOCK,
For the Applicants,
Chartered Patent Agent.

COMPLETE SPECIFICATION

Improvements in Luminescent Materials

We, LEONARD ANGELO LEVY and DONALD WILLOUGHBY WEST, both of 31, Shoot-up-Hill, London, N.W.2, both British subjects, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

[*Price* 1/-]

This invention relates to luminescent materials of the matrix-activated type and to their manufacture. Its primary object is to provide a luminescent material that has properties similar to, but not necessarily identical with, those of the well known blue-luminescing tungstates, for example magnesium tungstate; that is to

say, excitability by the 2537 Å line of mercury to produce light whose dominant hue is blue or green, but which may be of low saturation.

According to one aspect of the invention a luminescent material of the matrix-activator type having the said properties contains as essential elements an alkali metal, an alkaline earth metal, lead, silicon, and oxygen.

According to another aspect of the invention a luminescent material of the matrix-activator type, excitable by radiation of wave-length 2537 Å to produce light whose dominant hue is blue or green, is manufactured by heating a mixture of (a) the silicate of an alkali metal, (b) the silicate of an alkaline earth metal and (c) lead or a compound of lead, or components that interact during the heating to produce a said mixture. In a said mixture two or more of the said components (a), (b), (c) may be present as a solid solution.

The preferred alkaline earth metal is barium; the preferred alkali metal is sodium; the preferred proportion of lead is between 1.5 and 20% by weight of the other components.

Two methods of manufacturing a luminescent material according to the invention will now be described by way of example.

In the first method, solutions of sodium silicate and barium chloride, purified by the usual technique, are mixed together; the resulting precipitate of sodium barium silicate is separated and washed thoroughly. 20 gm. of the resulting paste, containing 4 gm. of the dry silicate, are mixed with such a quantity of lead carbonate that the proportion of lead in the final material lies between 19.5% and 1.95% by weight of the other components. The mixture is maintained in air for about two hours at a temperature of about 750° C. It is preferable that the heating be continued until an absence of blackening when the material is exposed to hydrogen sulphide shows that there is no free lead or lead carbonate remaining.

If the amount of lead added is about 1 gm., the luminescent light when the material is excited by the 2537Å line will be a near white and not very different from that characteristic of magnesium tungstate, but the hue will be rather greener and less blue. If the amount of lead added about is 0.1 gm., the light will be blue and not very different from that characteristic of calcium tungstate.

In the second method, silica gel is mixed with the carbonates of sodium, barium, and lead, in such proportions that the ratio $Na_2O : BaO : SiO_2$ lies between 1:2:3 and 1:2:4, and the proportion of lead in the final material lies between 19.5% and 1.95% of the other components. The mixture is then heated as described in the first method.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A luminescent material of the matrix-activator type excitable by radiation of wave-length 2537 Å to produce light whose dominant hue is blue or green and whose essential elements are an alkali metal, an alkaline earth metal, lead, silicon and oxygen.

2. A luminescent material of the matrix-activator type, excitable by radiation of wave length 2537 Å to produce light whose dominant hue is blue or green, manufactured by heating a mixture of (a) the silicate of an alkali metal, (b) the silicate of an alkaline earth metal, and (c) lead or a compound of lead, or components that react during the heating to produce a said mixture.

3. A luminescent material according to Claim 1 or 2 wherein the said alkali metal is sodium, wherein the said alkaline earth metal is barium, and wherein the proportion of lead lies between 20% and 1.5% by weight of the other components.

4. The manufacture of a luminescent material according to Claims 2 and 3 that is conducted substantially by one of the two methods hereinbefore described by way of example.

Dated the 25th day of November, 1942.
For the Applicants,
A. F. CORNOCK,
Chartered Patent Agent.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1945.

say, excitability by the 2537 Å line of mercury to produce light whose dominant hue is blue or green, but which may be of low saturation.

According to one aspect of the invention a luminescent material of the matrix-activator type having the said properties contains as essential elements an alkali metal, an alkaline earth metal, lead, silicon, and oxygen.

According to another aspect of the invention a luminescent material of the matrix-activator type, excitable by radiation of wave-length 2537 Å to produce light whose dominant hue is blue or green, is manufactured by heating a mixture of (a) the silicate of an alkali metal, (b) the silicate of an alkaline earth metal and (c) lead or a compound of lead, or components that interact during the heating to produce a said mixture. In a said mixture two or more of the said components (a), (b), (c) may be present as a solid solution.

The preferred alkaline earth metal is barium; the preferred alkali metal is sodium; the preferred proportion of lead is between 1.5 and 20% by weight of the other components.

Two methods of manufacturing a luminescent material according to the invention will now be described by way of example.

In the first method, solutions of sodium silicate and barium chloride, purified by the usual technique, are mixed together; the resulting precipitate of sodium barium silicate is separated and washed thoroughly. 20 gm. of the resulting paste, containing 4 gm. of the dry silicate, are mixed with such a quantity of lead carbonate that the proportion of lead in the final material lies between 19.5% and 1.95% by weight of the other components. The mixture is maintained in air for about two hours at a temperature of about 750° C. It is preferable that the heating be continued until an absence of blackening when the material is exposed to hydrogen sulphide shows that there is no free lead or lead carbonate remaining.

If the amount of lead added is about 1 gm., the luminescent light when the material is excited by the 2537Å line will be a near white and not very different from that characteristic of magnesium tungstate, but the hue will be rather greener and less blue. If the amount of lead added about is 0.1 gm., the light will be blue and not very different from that characteristic of calcium tungstate.

In the second method, silica gel is mixed with the carbonates of sodium, barium, and lead, in such proportions that the ratio $Na_2O : BaO : SiO_2$ lies between 1:2:3 and 1:2:4, and the proportion of lead in the final material lies between 19.5% and 1.95% of the other components. The mixture is then heated as described in the first method.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A luminescent material of the matrix-activator type excitable by radiation of wave-length 2537 Å to produce light whose dominant hue is blue or green and whose essential elements are an alkali metal, an alkaline earth metal, lead, silicon and oxygen.

2. A luminescent material of the matrix-activator type, excitable by radiation of wave length 2537 Å to produce light whose dominant hue is blue or green, manufactured by heating a mixture of (a) the silicate of an alkali metal, (b) the silicate of an alkaline earth metal, and (c) lead or a compound of lead, or components that react during the heating to produce a said mixture.

3. A luminescent material according to Claim 1 or 2 wherein the said alkali metal is sodium, wherein the said alkaline earth metal is barium, and wherein the proportion of lead lies between 20% and 1.5% by weight of the other components.

4. The manufacture of a luminescent material according to Claims 2 and 3 that is conducted substantially by one of the two methods hereinbefore described by way of example.

Dated the 25th day of November, 1942.

For the Applicants,
A. F. CORNOCK,
Chartered Patent Agent.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1945.