

FLASH LAMP AND METHOD

FIELD OF THE INVENTION

[0001] The present invention relates to flash lamps, particularly flash lamps used in photography.

BACKGROUND

[0002] Flash lamps are discharge lamps that produce highly intensive light with very short duration. Flash lamps are used extensively in a wide variety of applications, including photography. A conventional photo flash lamp includes a sealed cylindrical glass body that contains an excitable gas mixture (typically consisting of a noble gas like Xenon) and a cathode and an anode formed at both ends of the glass body. The electrode pins of the cathode and anode are joined to cylindrical shaped solderable metal pieces which are external to the glass tube.

[0003] When viewed from the ends, the surface area of the solderable metal is normally 40% less than the surface area on one end of the glass body. As the surface area is small, soldering can be difficult. This problem is compounded especially when the length of the solderable metal is short. One way to mitigate this disadvantage is to increase the length of the solderable metal. However, this will in turn increase the total length of the flash lamp which is not desirable.

[0004] Another disadvantage with conventional photo flash lamps is that with the steady reduction in length and sizes of flash lamps, it is becoming exceedingly difficult to differentiate between the anode and the cathode, which may result in incorrect polarity connections.

[0005] Therefore, the object of the invention is to provide a solution that overcomes the above disadvantages or at least provide a novel flash lamp and method.

SUMMARY OF INVENTION

[0006] According to a first aspect of the invention, a flash lamp is described comprising a tubular hollow glass body for containing an excitable gas mixture having two ends. Each end has a wall defining an opening and an electrode terminal at each end. The electrode terminal comprises an electrode pin fused to a conductive portion. The conductive portion has a solderable surface. The electrode terminal is arranged such that the conductive portion is external to the glass body and covers the wall such that a portion of the wall is uncovered, and the electrode pin extends from the conductive portion through the opening and into the glass body. The area of the solderable surface is greater than the sum of the area of the solderable surface and the area of the uncovered wall portion by 40%.

[0007] In another embodiment, the conductive portion has a thickness of less than 0.3mm.

[0008] In another embodiment, the flash lamp further comprises a solder layer over and in contact with the solderable surface.

[0009] In another embodiment, there is a gap of at least 0.01mm between the conductive portion and the wall.

[0010] In another embodiment, the electrode pin is fused to an intermediary glass member and the intermediary glass member separates the electrode pin from the wall such that the electrode pin does not contact the wall.

[0011] In another embodiment, the conductive portion comprises one of or an alloy of the following metals: copper, silver and nickel.

[0012] In another embodiment, the solder layer comprises tin.

[0013] In another embodiment, the conductive portion of the electrode terminal at one end has a different and distinguishable geometric shape from the conductive portion of the electrode terminal at the other end.

[0014] In another embodiment, the conductive portion of the electrode terminal at one end has a different and distinguishable pattern from the conductive portion of the electrode terminal at the other end.

[0015] In another embodiment, the conductive portion of the electrode terminal at one end comprises ferromagnetic material and the conductive portion of the electrode terminal at the other end comprises non-ferromagnetic material.

[0016] According to a second aspect of the invention, a method is described for assembling a flash lamp comprising the steps of fusing an electrode pin to a conductive portion to form an electrode terminal and thereafter, attaching the electrode terminal to an end of a glass body.

[0017] In another embodiment, the step of attaching the electrode terminal to an end of a glass body comprises the steps of fusing an intermediary glass member to the electrode pin and fusing the intermediary glass member to a glass wall at the end of the glass body.

[0018] In another embodiment, the method further comprises the step of coating the conductive portion with a soft solder material.

[0019] According to a third aspect of the invention, an electrode terminal for use in a flash lamp is described comprising a conductive portion fused to an electrode pin.

[0020] In another embodiment, the electrode pin extends transversely from the conductive portion.

[0021] In another embodiment, the electrode terminal is T-shaped.

[0022] The invention will now be described in detail with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The accompanying figures illustrate disclosed embodiment(s) and serve to explain principles of the disclosed embodiment(s). It is to be understood, however, that these drawings are presented for purposes of illustration only, and not for defining limits of the application.

[0024] Figure 1 is a cross-sectional view of an exemplary flash lamp.

[0025] Figure 2 is a flow chart illustrating an exemplary method for assembling a flash lamp.

[0026] Figure 3 shows cross-sectional views of some exemplary electrode terminals.

[0027] Figure 4 shows a top view from one end of the flash lamp.

[0028] Figure 5(a), (b), (c) and (d) show top views of some exemplary shapes of the conductive portion while Figure 5(e) and (f) show cross-sectional views of some exemplary shapes of the conductive portion.

[0029] Exemplary, non-limiting embodiments of the present application will now be described with references to the above-mentioned figures.

DETAILED DESCRIPTION

[0030] Referring to the drawings, Figure 1 shows a cross-sectional view of an exemplary flash lamp 100. Flash lamp 100 can have a tubular hollow glass body 101 for containing an excitable gas mixture 102, typically consisting of a noble gas like Xenon. Each end of glass body 101 has glass wall 103 and electrode terminal 104. Glass wall 103 can be annular. Electrode terminal 104 has electrode pin 105 fused to conductive portion 106. This fusing is done prior to the attachment of electrode terminal 104 to glass body 101. The configuration of electrode terminal 104 can be that electrode pin 105 extends transversely from conductive portion 106. Electrode terminal 104 can also be T-shaped. Conductive portion 106 is external to glass body 101 and does not contact glass wall 103. Electrode pin 105 extends from conductive portion 106 and into the hollow section of glass body 101.

[0031] Electrode pin 105 can be made up of refractory metal, for example, tungsten or its alloys. Conductive portion 106 can be made of any soldering materials, such as, nickel, copper, silver or alloys of any one of them. The top surface of conductive portion 106 is a solderable surface 107. Solderable surface 107 is the surface in which soldering can be performed to electrically connect flash lamp 100 to lead wires and to a power source.

[0032] Intermediary glass member 108 acts as an intermediary between electrode pin 105 and glass wall 103, such that electrode pin 105 does not contact glass wall 103. Preferably, intermediary glass member 108 does not contact conductive portion 106. This is because conductive portion 106 has a much higher thermal expansion rate than glass. Therefore, if intermediary glass member 108 was to be fused with conductive portion 106, this large disparity in the thermal expansion rate will result in stresses on intermediary glass member 108 and intermediary glass member 108 may crack. Electrode pin 105 has a thermal expansion rate much more similar to glass and therefore will not suffer from the same problem.

[0033] In another preferred embodiment, over solderable surface 107 is solder layer 109. Solder layer 109 is a layer of soft solder material. Examples of soft solder material are tin and/or its alloys. Typical alloys can be an alloy with tin and silver and copper, and an alloy with 99.3 % tin and 0.7% copper. The benefit of solder layer 109 is that a user does not need to get additional solder when soldering. Solderable surface 107 is also prone to oxidation and an oxide layer may form on solderable surface 107. This oxide layer will hamper soldering as the oxide layer will cause the solder to not stick properly to the surface. The addition of solder layer 109 to solderable surface 107 (prior to the actual soldering) will alleviate this problem as the oxide layer will form between the solderable surface 107 and solder layer 109, and the oxide layer will simply melt away during soldering.

[0034] In another preferred embodiment, there is a gap 110 between conductive portion 106 and glass wall 103. Gap 110 is preferably at least 0.01mm. The benefit of gap 110 is that it reduces the thermal stress between glass body 101 and conductive portion 106 and prevent bulging of the glass of glass wall 103 due to higher inner pressure when glass wall 103 is being fused to intermediary glass member 108.

[0035] Figure 2 shows an exemplary method for making a flash lamp. In step 201, an electrode pin is fused using techniques such as resistance welding or laser welding to a

conductive portion to form an electrode terminal. Referring to Figure 3, electrode pin 105 can be joined to the bottom surface of conductive portion 106 (Figure 3a), be embedded into conductive portion 106 (Figure 3b) or penetrate through conductive portion 106 (Figure 3c). Electrode pin 105 can also be joined to conductive portion 106 by hard soldering (or blazing) with hard solder material 111 (Figure 3d). The top surface of conductive portion 106 is a solderable surface.

[0036] In step 202, an intermediary glass member is fused to the electrode pin of the electrode terminal. The intermediary glass member can be in the form of a hollow tube and the electrode pin can be inserted into the intermediary glass member. The intermediary glass member acts as a “casing” around the electrode pin. Preferably, the intermediary glass member does not contact the conductive portion.

[0037] A glass body can be tubular and hollow. The glass body has a first end and a second end and each end has a glass wall with an opening. In step 203, the electrode pin with the intermediary glass member fused to it is inserted into the opening of the first end, sealing the opening. The intermediary glass member separates the electrode pin from the glass wall such that the electrode pin does not contact the glass wall. The conductive portion is external to the glass body and there is a gap between the conductive portion and the glass wall such that the conductive portion does not contact the glass wall. Preferably, this gap is at least 0.01mm.

[0038] In step 204, the intermediary glass member is fused to the glass wall of the first end.

[0039] In step 205, an excitable gas mixture is filled into the glass body.

[0040] In step 206, a second electrode pin is fused with a second conductive portion to form a second electrode terminal.

[0041] In step 207, a second intermediary glass member is fused to the second electrode pin of the second electrode terminal.

[0042] In step 208, the second electrode pin with the second intermediary glass member fused to it is inserted into the opening of the second end, sealing the opening.

[0043] In step 209, the second intermediary glass member is fused to the glass wall of the second end.

[0044] In step 210, the conductive portion is coated with soft soldering material to form a solder layer over the conductive portion. The solder layer can be formed by dipping the conductive portion into soft solder material.

[0045] In step 211, the second conductive portion is coated with soft soldering material to form a solder layer over the second conductive portion.

[0046] The fusing of the conductive portion to the electrode pin (step 201 and step 206) to form the electrode terminal first, prior to its assembly with the glass body is advantageous as a solderable surface with a large area can be achieved without increasing the overall length of the flash lamp. Figure 4 shows a top view from one end of the flash lamp. There is solderable surface 107 and exposed glass portion 112. Exposed glass portion 112 is the portion of the glass wall of which the solderable surface 107 does not cover or overlap. The glass body end area is the sum of the areas of solderable surface 107 and exposed glass portion 112. The area of the solderable surface that can be achieved is greater than 40% of the glass body end area. The benefit of a large solderable surface is that it eases the flash lamp assembly process as soldering becomes easier.

[0047] Another beneficial result of pre-joining the conductive portion to the electrode pin, prior to the assembly with the glass body, is that the thickness of the conductive portion can be reduced. In reducing the thickness of the conductive portion, the overall length of the flash lamp can be reduced without sacrificing its illumination capability. In accordance with a preferred embodiment, the uniform thickness of the conductive portion is between 0.2 mm and 0.3mm. In a conventional flash lamp, it is difficult to achieve this range of thickness of the electrode because if one was to cut or slice the electrode, one may damage the tungsten or electrode pin portion.

[0048] Because the conductive portion and its solderable surface are large, another benefit is that they can be designed so that electrode terminal of one end (the cathode) can be

distinct and distinguishable from the electrode terminal of the other end (the anode). For example, the geometric shape of the conductive portion of the cathode can have a disc-like shape while the conductive portion of the anode can have a polygonal shape. This helps to differentiate between the anode and the cathode which will help reduce incorrect polarity connections during the flash lamp assembly.

[0049] Figure 5 shows the various but non-exhaustive, shapes the conductive portion of an electrode terminal can have. From a top view perspective, the conductive portion can have a rectangle shape (Figure 5a), cross shape (Figure 5b), hexagon shape (Figure 5c) and disc shape (Figure 5d). Figure 5e and Figure 5f shows the cross-sectional view of some possible shapes the conductive portion can also have. For example, in one design for a flash lamp, a rectangle shaped conductive portion could be used for the cathode (negative) side and a cross shaped conductive portion could be used for the anode (positive) side. In so doing, the polarity of the lamp could be easily discernable by the appearance of the two conductive portions. The conductive portions and solderable surfaces can also have different patterns (i.e. such as a dot pattern or a wire mesh pattern) for polarity identification purposes. Moreover, the conductive portions and solderable surfaces can also have different colors for polarity identification purposes.

[0050] Another method for polarity identification is to use materials with different magnetic properties for the conductive portions. For example, a ferromagnetic material such as nickel can be used for the conductive portion for the cathode (negative) side while copper, a non-ferromagnetic material, can be used for the conductive portion for the anode (positive) side. The polarity can then be easily identified with a magnet.

[0051] In the application, unless specified otherwise, the terms "comprising", "comprise", and grammatical variants thereof, intended to represent "open" or "inclusive" language such that they include recited elements but also permit inclusion of additional, non-explicitly recited elements.

[0052] As used herein, the term "about", in the context of concentrations of components of the formulations, typically means $\pm 5\%$ of the stated value, more typically $\pm 4\%$ of the stated value, more typically $\pm 3\%$ of the stated value, more typically, $\pm 2\%$ of the stated value, even more typically $\pm 1\%$ of the stated value, and even more typically $\pm 0.5\%$ of the stated value.

[0053] Throughout this disclosure, certain embodiments may be disclosed in a range format. The description in range format is merely for convenience and brevity and should not be construed as an inflexible limitation on the scope of the disclosed ranges. Accordingly, the description of a range should be considered to have specifically disclosed all the possible sub-ranges as well as individual numerical values within that range. For example, description of a range such as from 1 to 6 should be considered to have specifically disclosed sub-ranges such as from 1 to 3, from 1 to 4, from 1 to 5, from 2 to 4, from 2 to 6, from 3 to 6 etc., as well as individual numbers within that range, for example, 1, 2, 3, 4, 5, and 6. This applies regardless of the breadth of the range.

[0054] It will be apparent that various other modifications and adaptations of the application will be apparent to the person skilled in the art after reading the foregoing disclosure without departing from the spirit and scope of the application and it is intended that all such modifications and adaptations come within the scope of the appended claims.

Claims

1. A flash lamp comprising:
 - a tubular hollow glass body for containing a noble gas mixture having two ends, each end having a wall defining an opening;
 - an electrode terminal at each end, the electrode terminal comprising an electrode pin fused to a conductive portion, the conductive portion having a solderable surface and a thickness, the solderable surface having an area and a length;
 - an intermediary glass member fused to the electrode pin;
 - wherein the electrode terminal is arranged such that the conductive portion is external to the glass body and does not contact the wall, and the electrode pin extends from the conductive portion through the opening and into the glass body, and the intermediary glass member contacts the wall and separates the electrode pin from the wall; and
 - wherein the length of the solderable surface is substantially greater than the thickness of the conductive portion.
2. The flash lamp of claim 1 wherein the conductive portion has a thickness of less than 0.3mm.
3. The flash lamp of claims 1 or 2 further comprising a solder layer over and in contact with the solderable surface.
4. The flash lamp of any one of claims 1 to 3 wherein there is a gap of at least 0.01mm between the conductive portion and the wall.
5. The flash lamp of any one of claims 1 to 4 wherein the conductive portion comprises one of or an alloy of the following metals: copper, silver and nickel.

6. The flash lamp of any one of claims 3 to 5 wherein the solder layer comprises tin.
7. The flash lamp of any one of claims 1 to 6 wherein the conductive portion of the electrode terminal at one end has a different and distinguishable geometric shape from the conductive portion of the electrode terminal at the other end.
8. The flash lamp of any one of claims 1 to 7 wherein the conductive portion of the electrode terminal at one end has a different and distinguishable pattern from the conductive portion of the electrode terminal at the other end.
9. The flash lamp of any one of claims 1 to 8 wherein the conductive portion of the electrode terminal at one end comprises ferromagnetic material and the conductive portion of the electrode terminal at the other end comprises non-ferromagnetic material.
10. A method for assembling a flash lamp comprising the steps of:
fusing an electrode pin to a conductive portion to form an electrode terminal, the conductive portion having a solderable surface;
and thereafter, attaching the electrode terminal to an end of a glass body; wherein the step of attaching the electrode terminal to an end of a glass body comprises the steps of:
fusing an intermediary glass member to the electrode pin;
fusing the intermediary glass member to a glass wall at the end of the glass body;
and wherein the intermediary glass member separates the electrode pin from the glass wall.
11. The method of claim 10 further comprising the step of coating the solderable surface with a soft solder material.
12. The flash lamp of anyone of claims 1 to 9 wherein the electrode pin extends transversely from the conductive portion.

13. The flash lamp of anyone of claims 1 to 9 wherein the electrode terminal is T-shaped.