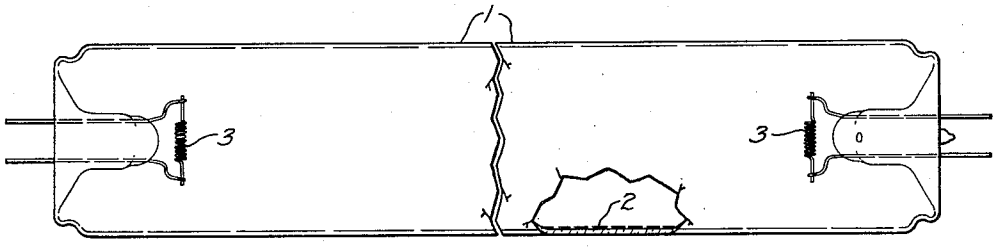
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THERMIONIC CATHODE FOR DISCHARGE DEVICES

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THERMIONIC CATHODE FOR DISCHARGE DEVICES

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This invention relates to thermionic cathodes for electric discharge devices having a gas or vapor filling, the cathodes being of the kind comprising a carrier of refractory metal supporting electron emissive material which is more active in electron emission than said metal. The carrier usually consists of tungsten. More particularly, though not exclusively, the invention relates to such cathodes for use in low pressure fluorescent electric discharge lamps and to lamps of this kind incorporating such cathodes.

Cathodes of this kind are required to provide a copious electron emission and to be resistant to ion bombardment, but these properties, which depend on the electron emissive material used, do not in general go together. Thus, for example, alkaline earth metal oxide material, which is most commonly used, is more active than, say, barium silicate but is not so resistant to ion bombardment.

The object of this invention is to provide a cathode of the kind referred to which provides a good electron emission and is, at the same time, resistant to ion bombardment.

According to the invention, in a thermionic cathode of the kind referred to the electron emissive material consists at least partly of one or more alkaline earth metal germanates.

It is to be understood that the term "alkaline earth metal" as used herein refers to the metals calcium, strontium and barium.

In cathodes for use in low pressure fluorescent electric discharge lamps, the electron emissive material preferably contains only a minor proportion of alkaline earth metal germanate, the greater part of the material consisting of one or more alkaline earth metal oxides. In such cathodes, the proportion of germanium present as germanate is preferably within the range of about 2.5% to 20% of the weight of the alkaline earth metal oxide, the optimum proportion of germanium within this range being about 7%. The alkaline earth metal germanate present preferably consists of both barium germanate and strontium germanate.

In the case of cathodes in which the electron emissive material consists of a coating on the metal carrier, and especially when the carrier is a coiled-coil helix of the known kind formed by coiling an already coiled wire, I have found that the best results are obtained by forming the alkaline earth metal germanate in situ on the carrier.

This is preferably effected by mixing finely powdered germanium or germanium oxide in the alkaline earth metal carbonate suspension usually used and then applying the suspension to the metal carrier, drying the coating thus formed, and heating the cathode, in the usual manner.

The suspending medium for the mixture of carbonate or carbonates and powdered germanium or germanium oxide may, for example, be a solution of nitrocellulose in butyl acetate. The particle size of the germanium or germanium oxide powder may conveniently lie in the range of about ½ to 5 microns, and is preferably about one micron. The carbonate constituent preferably consists of a mixture of barium and strontium carbonates in equimolecular proportions. In cathodes for use in low pressure fluorescent electric discharge lamps, the proportion of germanium or germanium oxide powder included in the mixture is suitably within the range of 2% to 15% by weight of the total carbonates, the preferred proportion being about 5% by weight of the carbonates.

The coated and dried cathode is mounted in the electric discharge device in known manner, and the cathode is subsequently heated during the processing of the device to a temperature of about 1300° C., usually by the passage of an electric current through the metal carrier. During this heating the carbonates are reduced to oxides; at the same time a reaction of part of the carbonates and/or oxides with the germanium or germanium oxide takes place to form the alkaline earth metal germanate or germanates in admixture with alkaline earth metal oxide, and a lightly sintered cathode coating is obtained. In some cases, especially with the higher proportions of germanium, some free germanium or germanium oxide may be left, but its presence is not usually disadvantageous.

I have found that low pressure fluorescent electric discharge lamps provided with cathodes in accordance with the invention, especially of the filamentary coiled-coil type, and containing the usual filling of mercury and inert ionizable gas, give reliable starting and have exceptionally long life with good lumen maintenance.

The drawing is an elevation, partly in section, of a conventional fluorescent lamp comprising an elongated glass envelope **1** with a coating **2** of fluorescent material thereon and having a pair of cathodes **3**, **3** sealed therein, and containing a quantity of mercury and a filling of inert ionizable gas. In accordance with the invention, the cathodes **3** may consist of coiled-coil filaments of tungsten having thereon a coating of alkaline earth metal oxides and alkaline earth metal germanates.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A thermionic cathode comprising a refractory metal carrier having thereon a coating of electron emissive material comprising essentially a minor proportion of alkaline earth metal germanate in admixture with a major proportion of alkaline earth metal oxide.

2. A thermionic cathode comprising a tungsten filament having thereon a coating of electron emissive material comprising essentially at least one oxide of an alkaline earth metal and a minor proportion or alkaline earth metal germanate.

3. A thermionic cathode comprising a refractory metal carrier having thereon a coating of electron emission material comprising essentially at least one oxide of an alkaline earth metal and a minor proportion of alkaline earth metal germanate containing a weight of germanium in the range of about 2.5% to 20% of the weight of the alkaline earth metal oxide.

4. A thermionic cathode comprising a refractory metal carrier having thereon a coating of electron emissive material comprising essentially at least one oxide of an alkaline earth metal and alkaline earth metal germanate containing a weight of germanium of about 7% of the weight of the alkaline earth metal oxide.

5. A fluorescent lamp comprising a sealed light-transmitting envelope having a coating of fluorescent material on the inner wall thereof, a quantity of mercury and a filling of inert gas in said envelope, filamentary electrodes in said envelope, and a coating on said electrodes comprising essentially at least one oxide of an alkaline earth metal and a minor proportion of alkaline earth metal germanate containing a weight of germanium in the range of about 2.5% to 20% of the weight of the alkaline earth metal oxide.

6. A fluorescent lamp comprising a sealed light-transmitting envelope having a coating of fluorescent material on the inner wall thereof, a quantity of mercury and a filling of inert gas in said envelope, filamentary electrodes in said envelope, and a coating on said electrodes comprising essentially at least one oxide of an alkaline earth metal and alkaline earth metal germanate containing a weight of germanium of about 7% of the weight of the alkaline earth metal oxide.

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