METAL HYDRIDES LAMP AND FILL FOR THE SAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a metal hydrides discharge lamp. More specifically, the present invention is directed towards a discharge lamp having a chamber filled with metal, hydrogen or deuterium, and a buffer gas.

2. Description of the Prior Art

High intensity discharge lamps, such as high pressure sodium lamps and metal halide lamps, are well known. These lamps have a light transmissive, hermetically sealed, discharge chamber or tube; the chamber generally has the shape of a pillbox or slightly flatted sphere. The material inside the chamber (the "fill") includes a suitable inert buffer gas and one or more ionizable metals or metal halides.

In a typical lamp, an electric potential is developed between two electrodes in the lamp chamber, which provides energy to the fill in the chamber. In more recent years, a new type of "electrodeless" lamp has been developed, in which an external capacitive or inductive element, such as a coil, is placed in proximity to the chamber. An electromagnetic field generated by passing electricity through the external element provides energy to the fill in the chamber to promote light emission from the fill.

Various standard performance indicators are used to rate different lamps. These factors include luminous efficacy of the lamps, its rated life, lumen maintenance, chromaticity, and color rendering index (CRI). These factors are dependent upon the fill for a particular lamp, which are generally designed to optimize the efficacy and CRI. However, it is believed that these factors can be improved upon, both individually and collectively.

SUMMARY OF THE INVENTION

It is accordingly an object of the present invention to overcome the drawbacks of the prior art.

It is accordingly a further object of the present invention to provide a fill for a lamp that produces visible light from radiation emitted by metal hydrides or metal deuterides.

According to an embodiment of the invention, there is provided a fill adapted to produce light when energy is imparted thereto. The fill includes at least one metal, at least one of hydrogen and deuterium, and at least one buffer gas having a density less than or equal to 1.0×10^{19} atoms/cm^3.

According to a feature of the above embodiment, the at least one metal includes an alkaline metal, preferably at least one of magnesium, calcium, barium, and strontium.

According to another feature of the above embodiment, the at least one metal additionally includes at least one of sodium, lithium, indium, cadmium, and mercury.

According to yet another feature of the above embodiment, the at least one buffer gas is at least one noble gas, preferably at least one of xenon and argon.

According to a further feature of the above embodiment, a ratio of a pressure of the at least one of hydrogen and deuterium to a total pressure of the at least one of hydrogen and deuterium and the at least one buffer gas is between 5–20% at 25° C.

According to a still further feature of the above embodiment, the at least one metal is present in an amount sufficient to create a vapor density in the fill between 10_{14} and 10_{16} atoms/cm^3 when vaporized, preferably approximately 10_{15} atoms/cm^3.

According to another embodiment of the invention, there is provided a lamp including a sealed chamber. At least a portion of the chamber has a light transmissive surface. A fill is provided in the chamber. The fill includes at least one metal, at least one of hydrogen and deuterium, and at least one buffer gas having a density of less than or equal to $1.0\times10_{19}$ atoms/cm^3.

According to a feature of the above embodiment, at least a portion of the chamber is made of sapphire, ceramic, or quartz and a protective layer which isolates the at least one metal from the quartz.

According to another feature of the above embodiment, a device transmits energy to the fill.

According to yet another feature of the above embodiment, a power source connected to the device provides steady state power or near steady state power.

According to a further feature of the above embodiment, the device is a coil in proximity to the chamber, which generates an electromagnetic field sufficient to facilitate discharge of the fill when oscillating electricity is passed through the coil. The coil is preferably made of one of at least one of silver, copper, and aluminum.

According to a still further feature of the above embodiment, the device includes first and second electrodes mounted in the chamber.

According to yet still a further feature of the above embodiment, the at least one metal includes an alkaline metal, preferably at least one of magnesium, calcium, barium, and strontium.

According to another feature of the above embodiment, a ratio of a pressure of the at least one of hydrogen and deuterium to the total gas pressure in the chamber is between 5–20% at 25° C.

According to yet another feature of the above embodiment, the at least one metal is present in an amount sufficient to create a vapor density of between 10_{14} and 10_{16} atoms/cm^3 in the chamber when the metal is vaporized, preferably approximately 10_{15} atoms/cm^3 when the at least one metal is vaporized.

According to a further feature of the above embodiment, a total pressure in the chamber at approximately 25° C. is approximately 2.0 Torr, and a pressure of the at least one of hydrogen and deuterium is approximately 0.2 Torr.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is further described in the detailed description which follows, in reference to the noted plurality of drawings by way of non-limiting examples of preferred embodiments of the present invention, in which like reference numerals represent similar parts throughout the several views of the drawings, and wherein:

FIG. **1** is a schematic illustration of a preferred embodiment of the invention;

FIG. **2** is a schematic illustration of another embodiment of the invention;

FIG. **3** is a diagram of the lower energy states of an MgH molecule;

FIG. **4**A is a logarithmic graph of the intensity of light at various frequencies produced by the lamp. The bands at 480, 520, and 560 nm are primarily due to an MgH molecule moving from an excited state to a lower electronic state;

FIG. **4**B is a graph of the intensity of light at various frequencies around 520 nm produced by an MgH lamp;

FIG. **5** is a logarithmic graph of the intensity of light at various frequencies produced by an MgD lamp. The bands