be adjusted by adding solid sodium (orange light), lithium (red light), or mercury, indium or cadmium (blue light).

Regardless of the particular metal (or combination of metals) selected, the amount of solid metal should be sufficient to create a vapor density of between $10_{14}$ and $10_{16}$ atoms/$cm^3$, and preferably approximately $10_{15}$ atoms/$cm^3$. If too little metal is used (and the resultant vapor density too low), the probability of sufficient collisions between the metal atoms and the hydrogen is too low to produce any appreciable light. If the metal density is to high, the efficacy decreases due to decreasing electron temperature (too high electron density).

In the embodiments above, hydrogen or deuterium gas is used. However, these two may be used in combination, i.e., the fill may include metal(s), a buffer gas, hydrogen and deuterium. In this case, best result are obtained using a combined pressure of the hydrogen and deuterium within 5–20% of the total pressure in chamber **1**, although other higher or slightly lower pressure may be used; preferably the total amount of hydrogen and deuterium should be at least $10_{14}$ atoms/$cm^3$.

The chamber **1** above is preferably made of $Al_2O_3$ (sapphire) to prevent degradation from the metal. However, any material that does not react with the metal can be used. For example, ceramic or ceramic coated glass or quartz, such as $Y_2O_3$, MgO, $ZrO_2$, $ThO_2$, BeO, $MgAlO_4$, $AL_6Si_2O_{13}$, $Al_{10}Y_6O_{24}$ or AlN, or a combination of these materials, may be used. A ceramic material, such as $Si_3N_4$ or BN, may also be used in conjunction with a protective layer that prevents the metal(s) in the fill from degrading the quartz; chemical vapor deposition using a gas mixture of $SiH_4$—Ar and $NH_3$ can be used to form such a protective layer.

To withstand the high temperatures generated in chamber **1**, and to provide a high surface electrical conductivity, coil **2** is preferable made of silver. However, copper protected from oxidation by encapsulation in a lamp envelope or a protective insulating layer could be used. Cooled copper or aluminum, air or water cooled either through a separate cooling system or the coil through which the coolant is passed, may also be used. A silver coating encapsulated on copper to prevent oxidation thereof is also acceptable.

A third embodiment of the present invention as utilized in a standard electrode lamp is shown in FIG. **2**. A light transmissive chamber **11** has first and second electrodes **12***a* and **12***b* therein, which are connected to a power supply **13**. Both electrodes **12***a* and **12***b* are preferably made of tungsten. The size of chamber **11** in this embodiment, which is dependent upon the input power (in this case 150W), is 65 mm between electrodes and 5 mm in diameter. The fill inside chamber **11** includes 1 mg of magnesium, 8 Torr of hydrogen gas, and 100 Torr of xenon as the buffer gas. When sufficient potential is established between electrodes **12***a* and **12***b* by power source **13**, the xenon gas will provide electrons at starting. The production of MgH and visible light is the same as discussed in the previous embodiments.

While the invention has been described with reference to several exemplary embodiments, it is understood that the words which have been used herein are words of description and illustration, rather than words of limitations. Changes may be made, within the purview of the pending claims, without effecting the scope and spirit of the invention and its aspects. While the invention has been described here with reference to particular means, materials and embodiments, the invention is not intended to be limited to the particular disclosed herein; rather, the invention extends to all functionally equivalent structures, methods and uses, such as fall within the scope of the appended claims.

By way of non-limiting example, although the preferred buffer gas for the fill is argon or xenon, any appropriate buffer gas which provides electrons, and particularly any noble gas, may be used. The ratios of hydrogen/deuterium preferably remains in the 5–20% total pressure range regardless of the buffer gas selected, although values outside this range may prove acceptable based upon the various combinations of materials in the fill provided that the molecules of metal, hydrogen, and deuterium are the source of the majority of emitted light.

In another example, power supply **3** is set to 13.56 MHZ to facilitate fill discharge in the preferred embodiment. However, any appropriate frequency which generates an electric field in chamber **1** which induces discharge may be used.

In yet another example, the present invention is not limited to electrode and electrodeless lamps. Any environment which imparts energy into the fill to facilitate the chemical reactions described herein also fall within the scope and spirit of the invention. One such example is a lamp which transmits microwave energy into the chamber.

In still yet another example, although chamber **1** and **11** are preferably completely light transmissive, the invention is not so limited; and chambers having only a portion thereof which is light transmissive may be used.

In a further example, the sizes of chambers **1** and **11** are not limited to the dimensions described herein. Any appropriate size may be used provided that the fill components are within the parameters discussed herein.

What is claimed:

**1**. A fill adapted to produce light when energy is imparted thereto, comprising:

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 $1.0\times10_{19}$ atoms/$cm^3$.

**2**. The fill of claim **1**, wherein said at least one metal includes an alkaline metal.

**3**. The fill of claim **1**, wherein said at least one metal comprises at least one of magnesium, calcium, barium, and strontium.

**4**. The fill of claim **3**, wherein said at least one metal additionally comprises at least one of sodium, lithium, indium, cadmium, and mercury.

**5**. The fill of claim **1**, wherein said at least one buffer gas comprises at least one noble gas.

**6**. The fill of claim **5**, wherein said at least one noble gas comprises at least one of xenon and argon.

**7**. The fill of claim **1**, wherein a ratio of a pressure of said at least one of hydrogen and deuterium to a total pressure of said at least one of hydrogen and deuterium and said at least one buffer gas is between 5–20% at 25° C.

**8**. The fill of claim **1**, wherein said at least one metal is present in an amount sufficient to create a vapor density in said fill between $10_{14}$ and $10_{16}$ atoms/$cm^3$ when vaporized.

**9**. The fill of claim **8**, wherein said amount of said at least one metal produces a vapor density in said fill of approximately $10_{15}$ atoms/$cm^3$ when vaporized.

**10**. A lamp, comprising:

a sealed chamber, at least a portion of said chamber having a light transmissive surface; and

a fill in said chamber, said fill comprising:

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/$cm^3$.