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Characterization of Luminescence of Holmium with Phosphate Compounds

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ABSTRACT

Holmium is a luminescence producing rare earth element. For the lamp industry, luminescence is produced through a chemical reaction between holmium and a phosphate compound. The reaction does not need special heating but can take place under room temperature (About 230 degrees). When carrying out the experiment, the two reactants are added in a test-tube, and the reaction takes place in a specific period of time. The observations are thus recorded. However, under different phosphate ions, holmium produces different luminescence intensity.

Keywords :Fluorescent lamp Phosphorus, room temperature , Hydrogen Phosphate

, fluorescence intensity,

I. INTRODUCTION

Luminescence can generally be referred to as the emission of light by certain materials when exposed under certain conditions such as chemical reactions or specific temperatures (1). Contrary to light; luminescence is not

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emitted from incandescent bodies such as wire under electric current or burning coal. Neon and fluorescent lamps form a perfect example in which luminescence can be produced. In the two cases, light result from temperatures below room temperatures; thus it is often called the cold-light (2). Lamp industries use rare earth elements (REE) such as Gadolinium, holmium and terbium and phosphate compounds to produce luminescence. The rare earth elements and the phosphate elements undergo chemical reactions that consequently result in light (3). Based on this, therefore, this paper will primarily focus on presenting an experiment on the characterization of luminescence in rare earth elements with phosphate compounds for lamp industry.

II. EXPERIMENTAL MATERIALS

i. Phosphors for optical and thermal measurements
ii. Fluorescent lamp Phosphors
iii. Rare-Earth elements (holmium)
iv. Hydrogen Phosphate (Other phosphate ions)

III. EXPERIMENTAL PROCEDURES

A chemical reaction is carried out under room temperatures using the following procedures and methods

i. Add 5 grams of holmium in the test-tube
ii. Add three grams of Hydrogen Phosphate
iii. Shake the test-tube for all the elements to be mixed.
iv. Allow the elements to react for two-three minutes.
v. Record the Observations.

IV. RESULTS AND DISCUSSIONS

After five minutes, luminescence is observed. The reaction between holmium and Hydrogen phosphate leads to the production of holmium (III) phosphate which is responsible for **Luminescence (4**). The reaction is shown below.

$2HPO_4 + 2Ho \longrightarrow 2HoO_4P + H_2$

HoO_4P Holmium (III) phosphate is responsible for the formation of the light

$2HPO_4 + 2Ho \longrightarrow$ Luminescence + hydrogen gas

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When **holmium is reacted with hydrogen Phosphate, holmium (III) Phosphate and hydrogen gas are produced** (5). The holmium (III) phosphate is responsible for the **luminescence** produced. In Fluorescent lamp Phosphors, the holmium (III) phosphate is responsible for producing light **(6-7)**. At the start of the experiment, all the elements are set under room temperature (8). Therefore, the reaction starts slowly before steadily increasing until the right is produced as shown in the figure below.

V. CHRACTERISTIC SAMPLE FIGURE

Rare earth elements emit different levels of light when exposed under different phosphate ions. Holmium will exhibit different levels of **luminescent intensity under different phosphate ions as shown in the table below.**

entry	phosphates	K_{SV} (M^{-1})	LOD (μM)
1	$H_2PO_4^-$	6.58×10^6	0.37
2	HPO_4^{2-}	7.04×10^6	0.40
3	PO_4^{3-}	5.02×10^6	0.39
4	HoO_4P	8.96×10^6	0.27

Figure1. Characteristics of holmium under different phosphate ions

When put under Fluorescent lamp Phosphors, holmium exhibits the highest intensity of luminescence as shown in figure three below () . When exposed under different phosphate compounds such as dihydrogen Phosphate (H_2PO_4) and Hydrogen Phosphate (HPO_4) the intensity levels decrease as shown in the figure 2 below. When holmium ions are exposed to phosphate ions, the level of fluorescence intensity is as shown below.

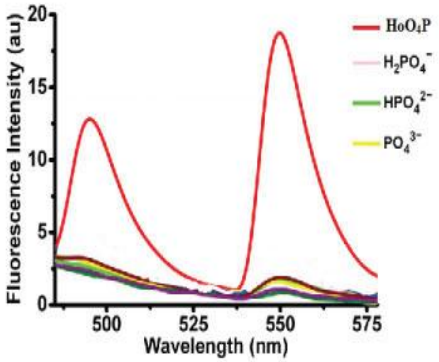

Figure2. Fluorescence intensities when holmium is exposed to different phosphate ions.

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VI. CONCLUSION

In conclusion, Holmium is a luminescence producing rare earth element. In a lamp industry, luminescence is produced through a chemical reaction between holmium and a phosphate compound. Luminescence can also be produced by exposing such as terbium(REE) in to phosphate ions. However, the luminescence intensity varies depending on the phosphate ions used. The reaction can take place under room temperature or even under lower temperatures. In a chemical reaction between holmium and hydrogen phosphate, holmium (III) phosphate is produced which is responsible for the luminescence produced.

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