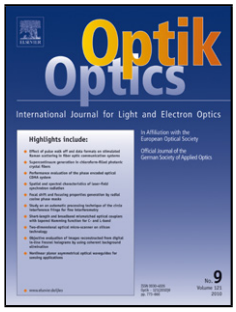

Title: novel developments in Dysprosium doped Bismuth Phosphate

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NOVEL DEVELOPMENTS IN DYSPROSIUM DOPED BISMUTH PHOSPHATE

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Abstract— Synthesis of Bismuth Phosphate is successfully carried out by hydrothermal method and its optical properties are studied. Dysprosium is doped with various concentration of 0.5, 1, 2 and 3 % and changes in its behavior are studied. The structural characterization is carried out through XRD analysis. Raman spectra are used to identify the bands corresponding to Bi and phosphate. Morphology of sample is carried out using transmission electron microscope (TEM). The band gap is studied using DRS of UV-Vis spectroscopy. The emission and excitation spectra are investigated using photoluminescence spectroscopy.

Keywords: Bismuth phosphate, dysprosium, hydrothermal, Raman spectra,

I. INTRODUCTION

The very general method of producing white light is the combination of blue LED with yellow and red emitting phosphorous. It has been reported that the oxide based inorganic host materials are the most desirable materials mainly because of its spectroscopic properties such as its increased life time, energy consumption, reproducibility and eco friendly **[1]**

As per recent reports, Bi^{3+} phosphorous **[2]** are suitable for commercial applications in light because of its tunability when excited at different wavelength **[3].** Dy^{3+} possesses monoclinic crystal structure and is suitable for the generation of long lasting phospherence. Dysprosium ions are good as yellow source, because of strong yellow luminescence, which creates the possibility of using them in yellow lasers and for generation of white light emission to be used in display systems **[4].** The luminescence properties of Dy^{3+} ions as potential candidates for laser his in some crystals **[5],** glasses **[6,7]** and gels **[8]**. Bismuth phosphate is an important inorganic phosphate that has been employed as catalysts **[9]**, radioactive separation material **[10]**, ion sensors **[11]**. Hexagonal phase, low – temperature monoclinic phase and high temperature monoclinic phase **[12, 13]** are three existing crystal structure of bismuth phosphate. It has been observed that rare earth material doping with corresponding phosphor applications in $BiPO_4$ is relatively less studied. So it is of considerable interest to prepare multi colour emitting rare earth doped phosphates for LED applications

In this work, we successfully employed hydrothermal method of synthesizing $Dy^{3+.}$ The novel properties of synthesized nano powders are characterized with XRD analysis for the determination of crystal structure and lattice parameters, surface morphologies are studied with TEM analysis, Bandgap is determined by UV – Vis Spectroscopy. Raman spectrum is obtained and results are also discussed.

2. EXPERIMENTAL

4 mmol of bismuth nitrate was dissolved in 60 ml of double distilled water and a small amount of nitric acid is added under stirring to dissolve bismuth. The mixture is kept for stirring in a magnetic stirrer at room temperature, until the bismuth nitrate was dissolved completely. Then 4 mmol of di-ammonium hydrogen phosphate is added to the solution. A white suspension was formed and the mixture was kept stirring for 3 h at a temperature of 120 ℃.

The solution is transferred into autoclave for 15 h at 200 °C. The resultant mixture is centrifuged for several times and dried in vacuum oven at 70 °C. The obtained powder is grinded and used for further characterization.

To enhance the optical properties of bismuth phosphate, Dy^{3+} is added. The experimental procedure is similar as explained above, except Dy^{3+} is added in stoichiometric ratio to Bi. Dy is taken in the molar ratio of 0.5 % , 1 %, 2 % and 3 % and denoted as Dy0.5, Dy1, Dy2, Dy3 respectively and pure $BiPO_4$ as BPO.

3. *Results and discussion*

The prepared sample is characterized with XRD, TEM, UV- VIS spectroscopy, Raman spectra and the results are discussed