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CHITOSAN:EU^{3+} FUNCTIONLISED COMPOSITE: TOWARDS UV -SENSORS GLASS FIBERS

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Abstract: *Composite of inorganic (Y, Gd)BaB_9O_{16}:Eu^{3+} nano-phosphors with organic polymeric chitosan were successfully prepared in 2% acetic acid solution and applied on glass fiber using solvent evaporation technique. The surface morphology and sensor/fluorescence properties of obtained coating was studied and investigated by SEM and UV-PL. Coated glass fiber on UV irradiation exhibits very quick photo-chromic absorption response at 254nm and emission spectra generated around 612nm radiating pure and intense red color. Chitosan polymer in composite coating had no influence on emission. The formulated composite found potential basis for application in the field of textile sensor, display applications.*

Keywords: Composite, biopolymer chitosan, sensor, textile display.

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INTRODUCTION

Smart and intelligent textile materials especially glass fiber/fabric have been recently attracted much interest of researchers for their novel properties and ability to fabricate the demand based materials such as phase changing, chromic, photovoltaic materials etc.[1-3] without sacrificing favorable properties like excellent heat and chemical resistance.[4-6] Literature cited on glass fabrics/ fibers have shows that glass fiber possess fascinating transmission region in UV and IR bandwidth and composites of photochromic materials can reversibly change their colors when exposed to external radiation[2],found commercial applications in textile material and electronics display industries[7-9].

Chitosan is derived from chitin by the deacetylation of N-acetyl group. Polymeric chitosan is chemically stable; and well known as a metal chelating polymer [10, 11] used in textile coatings and finishes as binding agent [12-14]. Creates an opportunity for combination of polymeric chitosan with phosphors.

In this study, we prepared a composite of sensor inorganic phosphor (Y, Gd)BaB_9O_{16}:Eu^{3+} and chitosan in dilute acetic acid and applied on glass fibers as a coating. This composite coated fiber examined for photo-chromic performance under UV exposure.

2. Materials and Methods

2.1 Materials

The commercial chitosan $(C_8H_{13}NO_5)_n$ (98% purity) was obtained from Alfa Aesar, England. Glass fabric of Arial density 200 g m^{-2} used was supplied by Montex glass fiber India Pvt. Ltd. India. Acetic acid glacial 100% GR grade was purchased from Merck India and DD water was employed. The photo-chromic phosphor (Y, Gd)BaB_9O_{16}:Eu^{3+} was synthesized as reported J.T.Ingle et al [15].

2.2 Preparation of Chitosan/ Phosphors composite and coating on glass fabric.

The requisite amount of ingredients chitosan and (Y, Gd)BaB_9O_{16}:Eu^{3+} were calculated on the basis of stoichiometric chemistry to get maximum quantum yield (Φ), dissolved in dilute acetic acid and magnetically stirred for 30 hr at room temperature to obtain clear homogenous solution. The glass fiber was treated by immersion process in resulting solution for 30 min, and then dried in dry air for about 24 hr. A thin uniform transparent layer of composite on glass fiber deposited without altering fabric structure.

2.3 Characterizations

Surface morphology of prepared phosphors particles and composite coated glass fiber has been examined by FE-SEM (S 4800 Hitachi Model Type 2), Figure1(a) shows SEM images of nano size elongated phosphor particle with regular morphology about 500nm and Figure1(b) shows coated glass fiber with chitosan/phosphors composite. The typical diameter of glass fiber is about 10 µm. The chromatic emission under UV radiation at room temperature is recorded

on (Hitachi F- 7000 spectoflurometer) in range of 200- 650 nm, the excitation and emission spectra recorded depicts in figure 2.

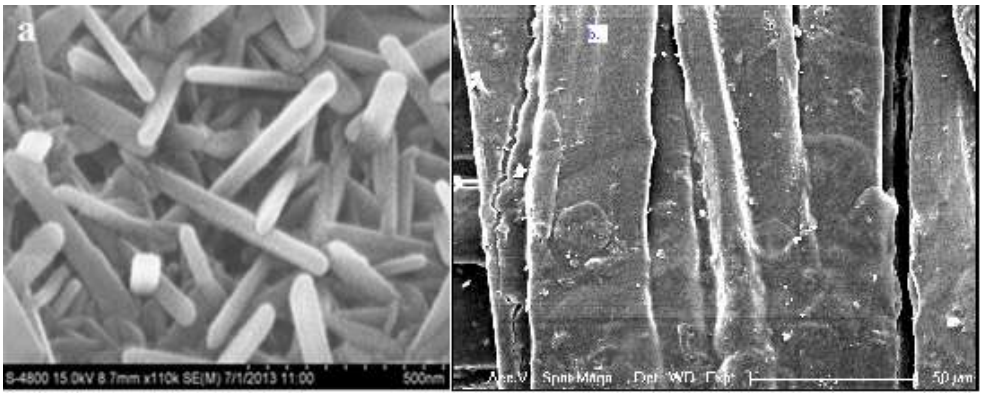

Figure1.FEM photograph of (a) Phosphor (b) Composite coated glass fiber.

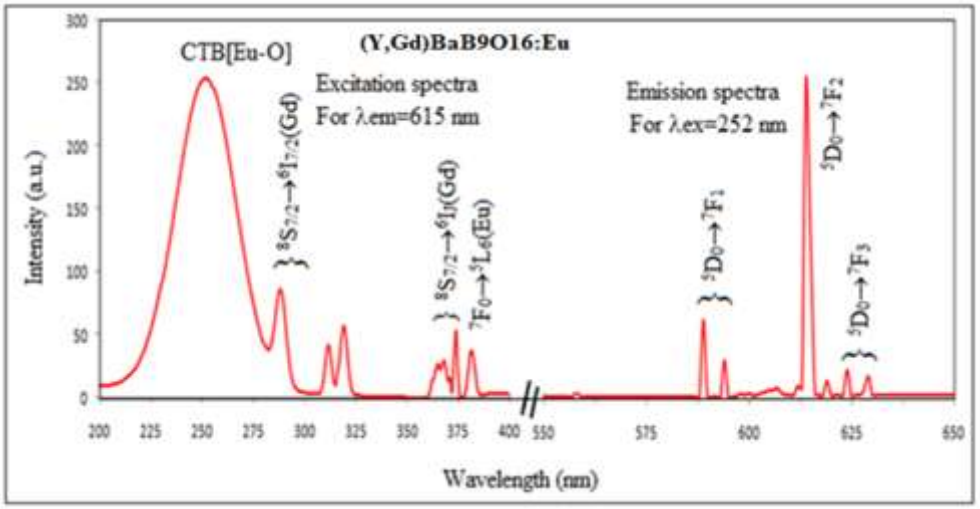

Figure 2.UVPL (Excitation and Emission) spectra of chitosan /(Y,Gd)BaB_9O_{16}:Eu^{3+} composite coated glass fibers.

RESULTS AND DISCUSSIONS

UV-vis spectrophotmetry is useful approach for investigating photo-chromic materials. The photo-chromic material absorbs light of certain wavelength and without much change in its structure emit at other wavelength. The inorganic phosphors containing a rare earth ion as activator center are well known for color emission [16]; shows the prepared composite of inorganic phosphor Eu^{3+} ion absorbed the UV radiation at 225-300nm and produce the line emission in red color at 612nm.

CONCLUSION

Composite of photo-chromic inorganic phosphor of (Y, Gd)BaB_9O_{16}:Eu^{3+} and organic linear polymer chitosan, have been successfully prepared and characterized. The composite was applied on surface of glass fiber as coating. The chitosan in composite played a major role as binder for metal ions by producing transparent thin coating without interfering in emission. UV induced pure and intense red color emission of composite coating of glass fiber open the new possibilities for functional photosensitive color producing finish, for coloration application especially for glass fiber substrate for sensor, display purpose in the field of smart and intelligent textiles.

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