Criterion 3 Research Innovations & Extensions

Metric No.	3.3 Research Publications & Awards	
3.3.2	**List of Research Papers with title, author, department, name of journal and year of publication**	Front page of the papers

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Photocatalytic properties of persistent luminescent rare earth doped $SrAl_2O_4$ phosphor under solar radiation

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This paper aims to study the photocatalytic properties of strontium aluminate phosphors. The rare earth doped strontium aluminate was synthesized by combustion method. The photocatalytic property was studied by absorption of methyle orange in aqueous solution under solar radiation. Eu:Dy codoped $SrAl_2O_4$ shows better photocatalytic properties than Eu or Dy doped or Eu, Dy, Ho codoped $SrAl_2O_4$. Structural and morphological characterization was done by X-ray diffraction, SEM, EDX techniques.

Keywords: photocatalysis, strontium aluminate, combustion method, persistence luminescence.

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1. Introduction

Today, environmental pollution is major concern, especially resulting from volatile organic compounds like benzene or textile dyes, like Methylene blue, Congo red, etc.; these volatile organic compounds are known to be toxic and carcinogenic. It is required to develop photo-catalysts for the degradation of these toxic materials to reduce air pollution and to develop better wastewater cleaning process. Advanced oxidation is a process which produces reactive oxygen groups to react with different chemicals which in turn help in degradation of these chemicals. Photocatalysis is also a kind of advanced oxidation process to remove organic pollutants from water [1, 2]. When photocatalysts are dispersed in water, they absorb UV or sun light to produce electron-hole pairs which in turn generate free radicals (e.g. hydroxyl radicals OH^- and O^{2-}) that take part in secondary reactions which removes organic pollutants from water [3]. Photocatalysts are semiconductors or insulators such as Al_2O_3 [4], ZnO [5], Fe_2O_3 [6]. TiO_2 has been widely used for decolorizing of organic contaminants, dyes and phenols. The problem with TiO_2 is that it is toxic for living organisms [7, 8] like fish and other aquatic animals, as it can penetrate their skin to produce oxidative stress and impaired liver function. Hence, the search for new environmentally friendly photocatalysts is required that could be easily removed from water. It has been found that long-lasting phosphors show photocatalytic properties [9]. Rare earth doped alkaline earth aluminates are a very important class of luminescent materials due to their higher quantum efficiency and persistent luminescence [10]. They are good host materials and have wide band gaps, thus, they have been suggested for possibile application such as development of white LED'S, gamma ray dosimeter, pressure sensor, stress sensor, environmental radiation dosimetry, luminescent paint, emergency exit lamps, radiation detection [11, 12] etc. There are few papers which report persistent luminescent phosphors prepared by combustion method as photocatalytic materials.

In this paper, we have reported the synthesis of $SrAl_2O_4$ doped with Eu/Dy/Ho by combustion method and their photocatalytic properties.

2. Experimental

The combustion method involves a highly exothermic reaction between an organic fuel and metal nitrates. The reaction is initiated at low temperatures (around 610 °C) and proceeds to completion in a few minutes. The exothermic chemical reaction between the metal nitrates and fuel provides the required heat for synthesis of nano-phosphor. Research grade strontium nitrate $Sr(NO_3)_2$, aluminum nitrate $Al(NO_3)_3 \cdot 9H_2O$, europium oxide Eu_2O_3, dysprosium oxide Dy_2O_3, holmiun oxide Ho_2O_3 were used as the staring materials and urea $CO(NH_2)_2$ was used as a fuel. The Stoichiometric composition to prepare $Sr_{1-x}Al_2O_4$:Eu_x phosphor, the chemical reaction used for the combustion reaction is as follows:

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Density functional study on hybrid h-BN/graphene atomic chains

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Keywords:
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ABSTRACT

Hybrid graphene and hexagonal boron nitride (C-BN) nanostructure received much research interest due to complementary electronic properties. Graphene is zero band gap semiconductor, while hexagonal boron nitride (h-BN) is a wide band gap semiconductor. Here, we have studied the structural, electronic and mechanical properties of hybrid zigzag graphene atomic chain with boron nitride doped, and zigzag boron nitride atomic chain with carbon pairs doped. Covalent bonds are found between carbon atoms, partially ionic and covalent bonds between boron and nitrogen atoms. BN atomic chain with 6 carbon pairs-ZBNGR transformed into a metal, and GR with 14-carbon pairs-ZGRBN transformed into a semiconductor. In the distribution of density of states; p-orbital electrons are contributing. There is a zero band gap in ZBNGR, and indirect band gap in ZGRBN. Band gap of second hybrid is tuned and becomes metal by the application of strain and external electric field. Breaking energy is found to be higher for first hybrid during compression of a chain. These investigations make hybrid atomic chains significant in device applications.

1. Introduction

In the last recent years, two-dimensional (2D) materials such as graphene [[1,2]], hexagonal boron nitride [3,4], molybdenum disulfide [5,6], have been seen as a great research interest due to mechanical, structural, and electronic properties of their thin layered structures. Graphene has sp2 bonded carbon atoms which arranged in a honeycomb lattice with a zero-band gap semiconductor, because; the lower energy charge carriers behave as mass less Dirac Fermions of conduction π^* bond touches with the valence band at k-point in the Brillouin-zone [7]. Graphene nano-ribbons (GNRs) exhibit different electronic properties by defect, impurity doping [8], adsorption [9], chemical functionalization [10,11], external field [12], geometry [13], and so on. Therefore, graphene provides the methods for applications in many electronic devices, such as negative differential resistance (NDR) [14,15], rectifying behaviors [16,17], single-electron characteristics [18], gas sensors [19], spin filtering [20], field-effect transistors (FETs) [21] etc.

Similar to graphene, boron-nitride (BN) has iso-electronic structure having the same number of electrons between B–N bonds and C–C bonds. As it turns out, boron and nitrogen also form exceptionally strong sp2 bonds, leading to planar BN configurations. Graphene and hexagonal BN share very similar structural characteristics and many physical properties except the large band gap of BN. Recently, monolayer hexagonal boron nitride sheets have been fabricated in experiments [22,23], unlike graphene, hexagonal BN sheet is a wide-gap insulator. However, cutting a monolayer of BN sheet along a different size will form different type of BN nanoribbons similar to graphene nanoribbons (GNRs). The band gap of BNNRs depends on ribbon width and is very important in electronic applications. Thus, it is highly desirable to engineer the band gap of BNNRs. Few methods have been developed to tune the band gap of BNNRs, including chemical decoration [24], hydrogen-termination [25,26], by applying external electric field [27], and so on.

Recently, hybrids of 2D graphene and boron nitride (C-BN) nanostructures, in form of either in-plane hybrids or inter-planar heterolayers, have received much attention, it has confirmed that hybridized

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Density functional study on hybrid graphene/h-BN 2D sheets

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ARTICLE INFO

Keywords:
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Density of states

ABSTRACT

The structural and Electronic properties of two/three/four atomic Graphene/h-BN/BN molecules doped hybrid GR/h-BN 2D sheets are investigated without and with vacancies. The first principle density functional theory is considered for the analysis. Weaker atomic bonds are found in hybrid 2D-sheets with two vacancies, partially ionic and covalent bonds are found between boron and nitrogen atoms. The band-gap of the pristine BN sheets reduce from 4.56 eV to 3.99 eV with two vacancies, it reduces relative to increase the width of atomic sheets; and further with increasing the number of vacancies. Hybrid 2D-sheets have semiconducting nature due to p-orbitals of C atoms, a hybrid four atomic sheet with a single vacancy has a smaller band-gap 0.825 eV, and remaining hybrids have around 1.0 eV. With the application of the electric field, the shifting in the bottom of the density of states in the pristine GR-sheets is occurred, which is higher with a four atomic graphene sheet with a vacancy, it causes to enhance its electronic properties, and pristine insulating BN sheets without and with vacancy are transformed into semiconductors. The energy band-gap of hybrid sheets gradually reduces and becoming zero at 6 V/Å, i.e. hybrid semiconductors are transformed into conductors which can be applicable in the electronic devices.

1. Introduction

In the past decade, two-dimensional (2D) nanostructures such as graphene [1,2] has been studied in large-scale due to their excellent electrical, mechanical, and optical properties, and hence wide area of applications are possible [3–7]. Graphene is an allotrope of carbon, has hexagonal geometry and the C–C bond length 1.42 Å [2], *sp2* hybridization provides its high mechanical strength and high elasticity. Graphene is a zero band-gap semiconductor, its band-gap tuning through functionalization made it suitable for graphene based electronics; such as field-effect transistors (FETs), LCDs, integrated chips, electrochemical sensors, biosensors and gas sensors, etc. [8–11].

Band-gap engineering is also possible by means of external electric fields [12–14]. In the transverse direction of zigzag graphene nanoribbons (ZGNRs), when an electric field is applied, the system behaves as a half-metallic material [15,16]. Such behavior can be achieved even in the absence of an external electric field in few systems as inserted ZGNRs in zig-zag h-BN nano-ribbons (ZBNNRs) [17–22].

Since B–N bonds and C–C bonds have the same number of electrons, boron nitride (BN) materials are expected to form similar covalent structures to the carbon allotropes. In recent years, the properties of hexagonal boron nitride (h-BN) have been studied in detail, both theoretically and experimentally [23–26]. Hexagonal BN is similar to graphene, it has different electronic properties; graphene is a zero-gap semimetal [27,28] and h-BN shows insulating characteristics [23]. High purity h-BN crystals were synthesized at high and atmospheric pressure [25,26]. h-BN emits light in the deep ultraviolet region, which has a large potential application such as information storage technology, environmental protection, and medical treatment [25]. The band-gap of BN can be effectively modulated by chemical decoration and defects [29–31].

Electronic properties of armchair boron nitride nanoribbon strongly depend on the strain and the conductance steps such as position and width [32]. Doping patterns in zigzag BN-C nanoribbons and graphene nanoribbons [33] have a huge influence on the electronic properties; therefore BN-C nanoribbon would have potential applications in

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Original research article

Study of Photoluminescence,Thermoluminescence, and Afterglow properties of Dy^{3+} doped $Ba_2ZnSi_2O_7$ phosphor

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ARTICLE INFO

Keywords:
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ABSTRACT

Barium Zinc Silicate $Ba_2ZnSi_2O_7$ (BZS) phosphor doped with Dysprosium (Dy^{3+}) was prepared at 1200 °C in the air by a solid-state reaction method. The prepared phosphor shows an efficient blue and yellow emission centered around 480 nm and 580 nm, respectively under UV excitation, which is believed due to incorporation of Dy^{3+} ion. The optimum concentration for Dy^{3+} ion is at 2 mol% and concentration quenching is attributed to exchange interaction. The CIE diagram is drawn for the whole series of phosphor samples prepared and it confirms that emission color had, indeed, tuned with the incorporation of Dy^{3+} ion in the BZS samples. The afterglow properties and Thermoluminescence (TL) have also been studied. TL curve confirms the presence of at least four traps in the phosphor material. The present results suggest BZS:Dy^{3+}phosphor is a promising one for display and dosimetry application.

1. Introduction

The light-emitting diode (LED) is the best choice at the moment among the most energy efficient devices to produce light. Presently phosphor converted LEDs receives much attention, so there is a considerable amount of research involved in search of new phosphor materials for better white light emission. Inorganic phosphors are widely studied materials for this purpose. These inorganic phosphors are available in various forms such as aluminate, silicate, phosphate, etc. [1–3]. Doping plays a very important role for the enhancement of luminescent properties of the inorganic phosphor. The rare-earth elements are used extensively for this purpose because of their intrinsic properties which are due to their unpaired 4f electrons. It enhances their chemical, optical and electronic characteristics. Due to this unique electronic configuration, rare earth doped inorganic phosphor produces a wide emission, which covers the range from ultraviolet to near infra-red region. Hence, rare-earth doped materials are always preferred as potential candidates for making multicolor light-emitting devices [4]. Among the rare-earth ions, Dy^{3+} is the center of attraction due to its white light emission property. In general, Dy^{3+} phosphor gives two strong emission peaks in blue and yellow regions. Near-white light emission can be achieved by altering the ratio of the intensity of yellow to blue. Thus, Dy^{3+} activated phosphor materials have drawn much attention, because of their applications as promising single-phase white emitting phosphors[5]. These phosphors always contain some intrinsic defects and incorporation of impurity may create new defects. These defects play an especially important role in the

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माध्यमिक स्तर के शिक्षकों की शिक्षण के प्रति शिक्षकीय प्रभावशीलता का अध्ययन

डॉ0 ज्योति प्रकाश कन्नौजे*
श्रीमती उर्मिला यादव**

शोध सारांश

प्रस्तुत अध्ययन का उद्देश्य दुर्ग जिले के माध्यमिक स्तर के शिक्षकों की शिक्षण के प्रति शिक्षकीय प्रभावशीलता का अध्ययन करना है। अध्ययन में शासकीय विद्यालय के शिक्षक (100) एवं निजी विद्यालय के शिक्षक (100) शिक्षकों का चयन किया गया है। इस प्रकार कुल 200 शिक्षकों का चयन यादृच्छिक न्यादर्श द्वारा किया गया है। इस अध्ययन में शिक्षकीय प्रभावशीलता मापन हेतु डॉ. प्रमोद कुमार एवं डॉ. डी.एन.मुथा द्वारा निर्मित मापनी का उपयोग किया गया। इस अध्ययन में पाया कि शासकीय एवं निजी विद्यालय के शिक्षकों की शिक्षण के प्रति शिक्षकीय प्रभावशीलता में अन्तर नहीं है।

Keywords : शिक्षकीय प्रभावशीलता

प्रस्तावना

शिक्षा जीवन पर्यन्त चलने वाली प्रक्रिया है। व्यक्ति औपचारिक एवं अनौपचारिक साधनों से शिक्षा प्राप्त करता है। शिक्षा व्यक्ति की प्रकृति प्रदत्त शक्तियों का विकास करती है। शिक्षा के इस योगदान के कारण ही समाज में उसे महत्वपूर्ण स्थान प्राप्त हुआ है। समाज के बदलते स्वरूप के कारण जीवन के प्रत्येक क्षेत्र में अनेक संभावनाएँ और समस्याएँ जन्म ले रही हैं। इन संभावनाओं और समस्याओं की खोज तथा समाधान शैक्षिक अनुसंधानों के द्वारा ही संभव है।

वर्तमान समय में शिक्षक व शिक्षण दोनों ही महत्वपूर्ण हैं। शिक्षक राष्ट्र एवं भावी पीढ़ी का निर्माता होता है। शिक्षक का पद हमेशा समाज एवं शैक्षिक क्रियाओं में अत्यंत महत्वपूर्ण होता है। आधुनिक शिक्षा में शिक्षक के समक्ष चुनौती रहती है कि वह तेजी से बदलते परिवेश के अनुसार शिक्षण अधिगम प्रदान करे, जिससे वह नवाचारिक प्रयासों द्वारा कक्षा शिक्षण की रोचकता को बनाकर रख सके। शिक्षक और विद्यार्थी दोनों हमेशा कुछ नया करने के लिए उत्सुक रहते हैं। ऐसे में शिक्षकों को नये–नये प्रयास करने चाहिए। शिक्षक को अपने शिक्षण के प्रति प्रतिबद्ध होना चाहिए।

अध्यापक प्रभावशीलता की अवधारणा

अध्यापक प्रभावशीलता अधिक भ्रामक प्रत्यय है। प्रभावशीलता एक सापेक्षिक प्रत्यय है। अध्यापक प्रभावशीलता से तात्पर्य शिक्षण कौशल व्यावसायिक योग्यताओं तथा शिक्षण उद्देश्यों को प्राप्त करने से है। इसको समझाने के लिए दो शब्दों को समझना आवश्यक है– अध्यापक एवं प्रभावशीलता।

रविन्द्रनाथ टैगोर ने अध्यापक को निम्न प्रकार से परिभाषित किया है– अध्यापक एक जलते हुए दीपक के समान है। एक जलता हुआ दीपक दूसरे दीपक को जला सकता है। छात्रों में अपेक्षित योग्यता होती है उनका संचालन करना अध्यापक का कर्तव्य होता है। एक अध्ययनशील व्यक्ति ही दूसरे को अध्ययन के लिए प्रोत्साहित कर सकता है एक अध्यापक जीवन पर्यन्त छात्र रहता है।

प्रभावशीलता एक सापेक्षित प्रत्यय है यह किसी मापदण्डों की ओर संकेत करता है। डी.डी. रेयान ने प्रभावशीलता के लिए तीन मानदण्डों का उल्लेख किया है –

1. योग्यता मापदण्ड
2. प्रक्रिया मापदण्ड
3. परिणाम मापदण्ड

वर्तमान समय में विश्व में बदलते परिप्रेक्ष्य एवं संक्रमण के दौर में मूल्य विहीनता को देखते हुए शिक्षण के क्षेत्र में शिक्षकों की शिक्षण के प्रति शिक्षकीय प्रभावशीलता के मध्य परस्पर संबंध आज ज्वलंत चर्चा का विषय है।

शिक्षकीय प्रभावशीलता का अर्थ

शिक्षकीय प्रभावशीलता का संबंध उस शिक्षण प्रभाव से लिया जाता है, जिसके द्वारा एक शिक्षक अपने विद्यार्थी पर प्रभाव डालता है। जिस प्रभाव के कारण बालक के व्यक्तित्व का

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