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Fabrication of Aloe vera nanopowder by high energy ball mill process

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ABSTRACT

Since Rigvedic, Aloe vera has been utilized for vitality, wellbeing, and medicinal reasons. Aloe vera is used for wound healing, curing burns, minimizing frostbite damage, preventing skin from X-ray damage, lung cancer, digestive disorders, raising high-density lipoprotein (HDL), and decreasing blood sugar in diabetics, combating acquired immune AIDS, allergies, and stimulating the immune system. In the present investigation, aloe vera nanopowders are fabricated by high energy planetary ball milling. The synthesized Aloe vera nanoparticles are characterized using Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Analysis (EDX). Moreover, to examine the chemical structure of the nanoparticles and to measure the particle size, Fourier Transform Infrared Spectroscopy (FTIR) analysis has been performed. In addition, to determine the average size of the aloe vera nanoparticles, X-ray diffraction (XRD) on the specimen has been performed. It is interesting that the particle size of the Aloe vera powders is successfully decreased under the estimated optimal milling conditions.

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1. Introduction

Aloe vera gets its name from a combination of Arabic and Latin words: “Alloeh” in Arabic means “sparkling bitter material,” and “vera” in Latin means “truth” [1]. It is a xerophyte that grows in a rosette at the stem, with thick, beefy, pointed leaves. The leaves are encased in a gel made up of 98 % water and 0.66 % solids that arise from the parenchyma cells. In general, the plants have to tolerate lengthy periods of deficiency. Aloe vera is inhabitant to Northern Africa, although it can also be found along the Nile in the Mediterranean, India, South America, and South Africa [2]. It has no or very small stems and grows to be 80 to 100 cm tall, scattering by balance and root shoots (Fig. 1). Its a cactus-like plant having green, knife formed plump leaves, tightening, barbed, marinated and loaded up with a reasonable gooey gel as shown in Fig. 1. Aloe vera leaves have a contact angle of 96.89° and subsequently, it has huge wettability. It mostly comprises Ca (3.58 %), Mg (1.22 %), Na (3.66 %), K (4.06 %), P (0.02 %), Fe (0.1 %), Cu (0.06 %), and Zn (0.02 %) [3].

Because Aloe vera leaves contain a variety of bioactive compounds, their use has long been associated with several medical benefits. Injury mending, anticancer, cell reinforcement, immunomodulatory, and purgative are just a few of the detailed qualities. The study of plants reveals the presence of a variety of naturally dynamic mixes that can help with injuries, irritations, malignant growth, diabetes, ulcers, microbiological illnesses, skin diseases, (AIDS), liver harms, dental troubles, cardiovascular problems, hyperlipidemia, and other ailments [4]. In addition, the plant is antagonistic to maturing, purgative, cell reinforcement, and immunomodulatory activities. It also has an effect on oestrogen levels and cell digestion, as well as diuretic exercises. Anticancer, antioxidant, antibacterial, antiallergic, anti-inflammatory, hepatoprotective, antiulcer, and antidiabetic are only a few of the properties of aloe. The gel is used as a substantial component of some corrective definitions, despite its therapeutic characteristics. However, just a few papers have mentioned anthraquinones’ results, which are minor when compared to their therapeutic properties [5]. Furthermore, the cosmetic industry could not overlook Aloe vera gel’s hydrating and skin-soothing properties. Aloe vera is found in products including soaps and cleansers, sunscreens, face antiaging treatments, lotions, and tissue paper coatings in concen-

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Effect of Mixed Modifiers on Electrical Mechanism of Zinc-Phosphate Amorphous Semiconducting Glass

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Abstract.

The impact of MoO_3 and TeO_2 inclusion on electrical and dielectric mechanisms of the zinc-phosphate host glass matrix has been reported in this communication. The well-known melt quenching route has been employed to produce glass nanocomposite systems. The formation of superimposed nanocrystallites of $ZnMoO_4$, Mo_5TeO_{16} and TeO_3 within the amorphous glass matrix is established by XRD spectra. The well-known Debye-Scherrer approach has been used to estimate the typical nanocrystallite size (d_C). The semiconducting nature of glasses has been demonstrated from their DC conductivity. The small polaron hopping process causes nonlinearity in DC conductivity, which is different from AC conductivity. The modified correlated barrier-hopping (CBH) model explains the mechanism of AC conduction. The DC and AC activation energies are found to decrease with the accumulation of TeO_2 in glass matrices.

Keywords. Glass nanocomposite; Almond-West formalism; Small polaron hopping; AC and DC Conductivity; Modified CBH model

1. INTRODUCTION

Recent years have seen a rise in interest in zinc-phosphate glasses due to its low UV cut-off wavelength, exceptional chemical strength, thermal constancy, and outstanding electrical conduction [1, 2]. Because of their high thermal expansion coefficient, lower melting temperature, and excellent UV transmission, phosphate glasses are of tremendous technological and scientific attention for both practical and theoretical applications [3]. When compared to Pb-based glasses, their weak chemical stability frequently limits their ability for real-world sealing applications. To improve the poor chemical stability of phosphate glasses, the controlled accumulation of oxides such as CuO, MoO_3, SnO, Sb_2O_3, and V_2O_5 [3] has already been found to be effective.

Due to the remarkable modifications in the physical and structure properties seen in $ZnO-P_2O_5$ system, the presence of ZnO into phosphate glasses is quite fascinating [4]. Better chemical stability is achieved by using ZnO such as a network modifier or former, which also results in a wider glass-forming region and lower glass transition temperatures [5]. The glass doped with TeO_2 is challenging to make at large concentrations because of the potential for quick amorphization and phase separation during cooling. As a result, different kinds of defects may occur in TeO_2-doped glass during the melt quenching procedure. To improve the tellurite glassy network's ability to create glass, metaphosphate can be added [6, 7]. As a result, after being doped with P_2O_5 as a glass making agent, MoO_3 as a network modifier, and ZnO as network stabilizer, TeO_2-doped glass can be made utilizing the quench of melt method. Electro-optical applications are made possible by the electrochromism properties and improved ionic conductivity of phosphate glass systems doped with MoO_3. Mo ions can be found inside glass network as octahedral and tetrahedral structural units because they can exist in two unique valence states, Mo^{6+} and Mo^{5+} [8, 9]. Due to the development of TeO_4 trigonal bipyramids, doping $ZnO-P_2O_5$ glasses with TeO_2 results in changing structural. To determine the most suitable glassy system for more effective applications, we have investigated the results of including both MoO_3 and TeO_2 as mixed modifiers in $ZnO-P_2O_5$ glasses in the present work. The purpose of this research is to use the melt quenching method to synthesise three quaternary glassy systems that have the chemical formula $0.60ZnO-0.10P_2O_5-0.30[((1-x)\ MoO_3-xTeO_2]$. One of the main objectives of this communication is to examine the X-ray diffraction (XRD) patterns to investigate the microstructure. In order to evaluate each sample's semiconducting nature and DC conductivity, the small polaron hopping hypothesis is applied. Almond-West formalism and the well-known Jonscher's Universal Law have both been used to analyze the conductivity of the present glassy systems.

Effect of Transition Metal Oxides on Optical and DC Conduction Mechanism of Zinc-Phosphate Amorphous Semiconducting Glass

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Abstract.

It has been investigated how the incorporation of transition metal oxides impacts on physical, electrical and optical characteristics of zinc phosphate glasses developed by the standard melt quenching method. Some nanophases ZnP_4O_{11}, $Zn_{2.5}MoVO_8$, $Zn[MoO_4]$ and MoV_2O_8 have been found to superimpose on amorphous glassy matrices. The acquired X-ray diffraction data have been used to determine the polycrystalline structure, crystallinity levels, and formed nanocrystallites's average size. UV-visible spectra of glass systems have been examined, which shows that the electronic transition is indirect. On the basis of their ultraviolet edges, the Optical Band Gap Energy and Urbach Energy have been estimated. The current glassy systems exhibit semiconducting characteristics, as evidenced by the non linear nature of DC conductivity and various activation energies at high and low temperatures. In addition, tiny polarons that hop via defect or localized sites are accountable for the DC conduction mechanism. Using Mott and Greaves variable range hopping models, DC conductivity has been explained.

Keywords. Glass nanocomposite; Optical Band gap; DC Conductivity; Mott's and Greaves model.

1. Introduction

In countless technological fields, including electronics, sensors, reflecting windows, optical filters, optical switches, and electro-optic devices, glass nanocomposites are being used extensively [1,2]. Addition of transition metal ions (TMI) leads to the structural and characteristics changes of glass nano-composites have recently been identified as promising research areas in non-linear optics. Due to their potential to yield several valence states, TMI incorporation in glass networks has been one of the methods used to create incredibly cheap luminous devices [3]. Due to their inherent ability in adopting many structural forms, such as octahedral, bipyramidal and polyhedral coordination environments in different oxidation states, vanadates have drawn a significant amount of attention. They have remarkable optical and electrical properties as a result of the compositions' formation of a V_2O_5 layered structure [4]. The V^{5+} ion is bonded in a VO_4^{3-} group with the number of four O^{2-} ions in tetrahedral symmetry, as seen by the structural behaviour of V_2O_5. The vanadate glass system's structure is composed of a layered chain of VO_4 polyhedron units [4]. Transition metal oxide (TMO) such as molybdenum trioxide modifies the structure of the glass instead of acting normally as a glass-forming oxide by merging octahedral MoO_6 or tetrahedral MoO_4 structural parts along with some other glass-forming oxides, as for example phosphorus pentoxide (P_2O_5), vanadium pentoxide (V_2O_5)etc. As Mo ions have existence in both the stable Mo^{6+} (accepter level) and Mo^{5+} (donor level) valence states and form MoO_4 tetrahedral units, the addition of MoO_3 can result in more packed glassy systems [5]. MoO_3-doped glasses made of phosphate have electro-optical characteristics that are advantageous for a number of technological applications [6].

On the other hand, zinc oxide (ZnO) modifies the sensitive features of the glass while also influencing its structure and stabilizing the glass network. In view of the fact that zinc cations in glassy materials can adopt both four and

Chapter 13

Presentation of Real-Time Lab Analysis for Multiple-Area Renewable Sources-Thermal-Hydro System by Implementation of Cat Swarm Optimization

Arindita Saha, Lalit Chandra Saikia, Naladi Ram Babu, Sanjeev Kumar Bhagat, Manoja Kumar Behera, Satish Kumar Ramoji, and Biswanath Dekaraja

Abstract This work explores automatic generation control learning under traditional situation for a three-area system: Sources in area-1 are thermal–solar thermal (ST); thermal–geothermal power plant (GPP) in area-2; and thermal-hydro in area-3. The work involves various assessments in the presence of constraints such as governor rate constraint, governor dead band, and time delay. An original endeavor has been set out to execute cascade controller with amalgamation of proportional-derivative and fractional order integral-derivative (FOID), hence named as PD-FOID. The performance of PD-FOID has been compared with varied controllers like integral (I), proportional-integral (PI), and proportional-integral-derivative (PID). Various investigation express excellency of PD-FOID controller over other controller from outlook regarding lessened level of peak_overshoot (P_O), peak_undershoot (P_U), settling_time (S_T). A swarm-based meta-heuristic cat swarm optimization (CSO) algorithm is applied to acquire the controller's gains and parameters. Action in existence of redox flow battery is also examined which provides with noteworthy outcome. PD-FOID parameter values at nominal condition are appropriate for higher value of disturbance without the need for optimization.

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IMPORTANT DATES

Abstract submission begins	25 July 2022
Last date of abstract submission:	16 September 2022
Intimation of abstract acceptance:	20 September 2022
Last date submission of full-length paper:	05 November 2022
Last date Intimation of full-length paper acceptance for presentation:	20 November 2022
Early bird registration:	15-30 November 2022
Conference Sessions:	16-18 December 2022