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Author: **Dr. Bablu Kumar Ghosh**

sustainability

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Review

A Review on Global Emissions by E-Products Based Waste: Technical Management for Reduced Effects and Achieving Sustainable Development Goals

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Abstract: In the 21st century, a great amount of electrical and electronic waste (e-waste) has accumulated, and the unregulated nature of its disposal and recycling represents a particular hazard in a global context. For the purposes of e-waste management, there must be more emphasis on the scientific processes for recycling, reusing and remanufacturing precious materials. Resource management is related to energy management; therefore, the harvesting of costly materials from e-waste is important for both energy management and sustainable development. At present, a lack of scientific recycling of a significant amount of e-waste is a source of environmental pollution and health hazards that are having a detrimental effect on sustainable development goals. It is necessary to find a process for recovering valuable materials from e-waste with the minimum possible environmental impact. At present, it is essential to modify the process of electrical and electronic products (e-products) becoming e-waste, and the subsequent process of e-waste recycling, in order to lessen the impact in terms of pollution. E-waste scientific recycling initiatives can reduce the environmental impact of the process, which in turn can support a shift from the current linear flow of costly materials to a more sustainable circular flow. Furthermore, internal consumption loss, emissions, and heating loss from e-products are the main factors contributing to the loss of energy efficiency

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Citation: Ghosh, B.K.; Mekhilef, S.; Ahmad, S.; Ghosh, S.K. A Review on Global Emissions by E-Products Based Waste: Technical Management for Reduced Effects and Achieving Sustainable Development Goals. *Sustainability* **2022**, *14*, 4036. https://doi.org/10.3390/su14074036

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ORIGINAL ARTICLE

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Evaluation of the solar thermal storage of fluidized bed materials for hybrid solar thermo-chemical processes

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Abstract
The use of solid particles as a solar energy transport and storage medium overcomes the intermittency issues for solar energy and is advantageous for the development of a hybrid process that integrates biomass and solar thermal energy. In this study, lab-scale experimental equipment consisted of a bubbling fluidized bed (55 mm I.D. and 200 mm height) with direct irradiated solar thermal storage was designed and constructed. Sand, alumina (Al), and silica carbide (SiC) particles with 3 different particle sizes (130 μm, 250 μm, and 370 μm) were used as a solar thermal storage medium in the fluidized bed. Due to higher absorption and emissivity properties, the solar thermal efficiency of SiC was higher than those of sand and Al. As the gas velocities in the bubbling fluidized bed increased from the initial minimum fluidization velocity (Umf) to 2 Umf, the temperature differences between the upper bed and lower bed decreased from 470 to 35 °C because of vigorous solid mixing and heat transfer. Also, the increase of average particle size resulted in the decrease of solid heat storage and the increase of gas heat storage due to the differences of specific surface area and gas velocity. Therefore, the energy transported and stored according to the size of silicon carbide was the highest at 370 μm, and the receiver efficiency was 21.38%.

Keywords Solar thermal energy · Particle receiver · Energy storage · Fluidized bed · Silicon carbide

1 Introduction

Building a low-carbon society with the aim of reducing greenhouse gas emission is to be addressed urgently as one of the gravest societal issues [1]. Thermo-chemical conversion processes integrating with multiple renewable energy resources such as solar heat [2], biomass [3], and waste [4] can simultaneously solve the disadvantages of fossil fuels that cause environmental pollution and the intermittency issues of renewable energy.

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Optoelectronic properties comparison of 10 and 20 multi quantum wells $Ga_{0.952}In_{0.048}N_{0.016}As_{0.984}$/GaAs p-i-n photodetector for 1.0 μm wavelength

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ARTICLE INFO

Keywords:
Multi-quantum wells
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Quantum efficiency
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ABSTRACT

This study proves the addition of quantum wells to the intrinsic regions of p-i-n GaInNAs/GaAs has improved the performance of optoelectronic devices. The optoelectronic properties that contribute to the device's dark current and photocurrent need to be well understood to develop photo-response at longer wavelengths. This study reports an optoelectronic properties comparison of different quantum well number for $Ga_{0.952}In_{0.048}N_{0.016}As_{0.984}$/GaAs-based dilute nitride multi-quantum wells (MQWs) p-i-n photodetector devices. From photoluminescence (PL) analysis, 20 MQWs shows a higher PL peak than 10 MQWs. The maximum quantum efficiency (QE) is found to be 80.3% for 20 MQWs and 46% for 10 MQWs, where 20 MQWs being the highest QE value ever reported for GaInNAs-based MQWs photodetector. Current versus voltage (*I–V*) measurement shows that 20 MQWs produces lower dark current than 10 MQWs. Besides, 20 QWs sample produces a higher current density (-12.43 μAcm^{-2}) than 10 MQWs (-7.52 μAcm^{-2}) under illumination. Impedance spectroscopy analysis shows that a lower dark current of 20 MQWs is due to a high intrinsic resistivity and low dielectric loss peak compared to 10 MQWs. SimWindows simulation shows good correlation with responsivity analysis and impedance analysis where at -5 V, 20 MQWs produces higher responsivity (0.65AW^{-1}) due to wider depletion region (deduce from conduction band profile) and lower intrinsic capacitance and dielectric loss (deduces from impedance analysis) than 10 MQWs (0.37AW^{-1}). At room temperature, the detectivity (D*) of the 20 MQWs photodetector (7.12×10^{10} cmHz$^{0.5}$W^{-1}) is higher than 10 MQWS photodetector (4.89×10^{10} cmHz$^{0.5}$W^{-1}). Finally, the 20 MQWs's (4.02×10^{-11} WHz$^{-0.5}$) has produces lower noise-equivalent power (NEP) than 10 MQWs (5.85×10^{-11} WHz$^{-0.5}$). This study has succesfully presenting an understanding of optoelectronic properties and simultaneously producing a sensitive photodetector with high quality, low-noise which is comparable with $\sim 10^{10}$ cmHz$^{0.5}$W^{-1} of commercial III-V alloy based near-infrared GaAs-based photodetectors.

Author: **Dr. Megat Muhammad Ikhsan Bin Megat Hasnan**

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Generation of Kelly and dip type sidebands soliton employing Topological insulator (Bi_2Te_3) as saturable absorber

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ARTICLE INFO

Keywords:
Saturable absorber
Erbium-doped fibre laser
Bismuth Selenide
Mode-locking
Multi-soliton
Bunch soliton

ABSTRACT

Conventional Kelly sidebands soliton and dip-type sidebands soliton were observed with the employment of Bi_2Te_3 as saturable absorber (SA) in Erbium-Doped Fiber Laser (EDFL). The fabricated Bi_2Te_3 possessed the following characteristics: I_{sat} 102 MW/cm^2, modulation depth 41.4%, and non-saturable absorption at 10%. The Bi_2Te3 solution was transferred to the end of the fiber ferrule by the optical deposition method. Conventional Kelly sidebands soliton was obtained with a fundamental repetition rate and pulse width of 24 MHz and 0.78 ps, respectively. The existing cavity length was extended and with the appropriate tuning of light polarization, dip-peak intensity soliton sidebands with bunched pulses were observed. The oscillation trace revealed the repetition rate of dip-peak intensity sidebands soliton was ascertained at 13.5 MHz, which was in accordance with the cavity length. There was a total of 144 pulses in a single bunch envelope under the maximum available pump power. With the appropriate tuning of light polarization, constructive and destructive interference between soliton and dispersive waves took place in EDFL resulting in the formation of peak intensity (Kelly sidebands) and dip-peak intensity on the soliton spectrum. To the best of the author's knowledge, this is the first demonstration of dip-peak intensity sidebands soliton using Bi_2Te_3.

1. Introduction

Ultrashort light sources delivered using passive mode-locking have been widely investigated for the last two decades owing to their diverse applications in micromachining [1], optical metrology [2], and medical

conventional soliton of Kelly sidebands which appeared as spikes on the soliton spectrum, was described by researchers Kelly [21] and Smith et al. [22] in the early 1990s. As the soliton was propagating in a laser cavity, dispersive waves were produced because of periodic perturbations from gain and loss processes. He stressed that the appearance of

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crystals

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Article

Mode-Locked YDFL Using Topological Insulator Bismuth Selenide Nanosheets as the Saturable Absorber

Hazlihan Haris [1], Malathy Batumalay [2], Sin Jin Tan [3], Arni Munira Markom [4], Ahmad Razif Muhammad [5], Sulaiman Wadi Harun [6], Megat Muhammad Ikhsan Megat Hasnan [1] and Ismail Saad [1,*]

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Abstract: Fiber lasers have long remained relevant for various applications worldwide in many industries. This paper presents a mode-locked ytterbium-doped fiber laser (YDFL) using our home-made topological insulator Bi_2Se_3 nanosheets (TI Bi_2Se_3) as the saturable absorber. The fabricated TI Bi_2Se_3 is transported to the end of the fiber ferrule using an optical deposition process, which is a key ingredient for initiating a pulsed fiber laser. With a pump power of 211.1 mW, the captured repetition rate and pulse width are 8.3 MHz and 6.2 ns, respectively. The length of the setup configuration is approximately 20 m, which corresponds to an output power measurement of 12.4 mW with a calculated pulse energy of 1.5 nJ. There are no significant Kelly sidebands, but the strong stability of the pulsed laser is defined by a high signal-to-noise ratio (SNR) of around 60.35 dB.

Keywords: mode-locked fiber laser; saturable absorber; topological insulator

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Author: **Dr. Megat Muhammad Ikhsan Bin Megat Hasnan**

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Electrical and structural comparison of (100) and (002) oriented AlN thin films deposited by RF magnetron sputtering

A. S. Bakri[1], N. Nafarizal[2,*], A. S. Abu Bakar[3], M. M. I. Megat Hasnan[4], N. A. Raship[5], W. I. Wan Omar[2], Z. Azman[1], R. A. Mohamed Ali[2], W. H. Abd Majid[3], M. K. Ahmad[2], and A. Aldalbahi[6]

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ABSTRACT

Aluminium nitride (AlN) thin film is a very attractive material to be used in electronic devices, and the most popular AlN orientations that have been reported are AlN (100) and AlN (002) planes. To the best of our knowledge, still less comparison study between AlN (100) with AlN (002) orientation based on a structural relationship with the electrical properties. For that purpose, the *c*-axis (002) and *a*-axis (100) of AlN thin films are deposited by using conventional RF magnetron sputtering. Energy-dispersive spectroscopy (EDS) analysis shows

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Autonomous Valet Parking with Asynchronous Advantage Actor-Critic Proximal Policy Optimization

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Abstract— Autonomous valet parking (AVP) is one of the main features of autonomous vehicles. Autonomous parking system is essential to reduce waiting time to search for available lot then parking, particularly in the smart city. One of the drawbacks is the inevitable control errors due to the vehicle non-linear dynamics. Hence, this brings the motivation to implement reinforcement learning into autonomous valet parking vehicles. A Proximal policy optimization with asynchronous advantage actor-critic (A3C-PPO) is proposed for autonomous valet parking. This system is simpler and can solve problems that has continuous state-action space which includes autonomous valet parking. For the agent to yield better final rewards, manual hyperparameter tuning is conducted which are mini-batch size tuning and generalized advantage estimate (GAE) factor tuning. A3C enable parallel computing and speed up the agent training.

Keywords— autonomous valet parking, deep reinforcement learning, proximal policy optimization, actor-critic

I. INTRODUCTION

Automated valet parking (AVP) system is a massive

reward. Deep reinforcement learning (DRL) combines deep learning and reinforcement learning to cater large action and state spaces. Deep reinforcement learning can train the self-driving vehicles to generate the dataset with reward. This then can be used to train the model instead of label. DRL has been applied to train the agent to conduct autonomous parking [5].

For autonomous vehicle, deep reinforcement learning approaches can be divided into two categories: value-based and actor-critic methods. The value-based method like deep Q-learning (DQN) [6] can generate a value (or Q value) for each action. In DQN, a neural network is used to approximate the Q-value function. The state is given as the input and the Q-value of all possible actions are generated as the output. DQN is suitable for discrete values (turn left, turn right, go forward, etc.). However, DQN is not suitable for continuous values, for example the degree of turning or vehicle's velocity. For continuous actions, actor-critic methods are used, e.g., Trust Region Policy Optimization (TRPO) [7]. TRPO allows non-linear function approximators (e.g., deep networks), as the previous algorithms only worked efficiently for linear approximators.

Proximal Policy Optimization (PPO) can overcome the problems of TRPO (complexity, inability to share parameters

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