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"Synthesis And Characterization Of Sns And Zro Thin Films By Solvothermal Method For Photovoltaic Applications".

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Abstract:

This project investigates the synthesis and characterization of tin sulfide (SnS) and zirconium oxide (ZrO2) nanomaterials with the aim of exploring their potential application in photovoltaic devices. Tin sulfide has garnered attention as a promising absorber material for thin-film solar cells due to its suitable band gap and earth-abundant constituents, while zirconium oxide nanoparticles exhibit desirable properties such as high refractive index and optical transparency, making them attractive for various optoelectronic applications.

The synthesis of SnS and ZrO2 nanoparticles is carried out using facile and scalable methods, including solvothermal, hydrothermal, or chemical precipitation routes, tailored to control the size, morphology, and crystallinity of the nanomaterials. The structural, morphological, and optical properties of the synthesized nanoparticles are characterized using techniques such as X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), energy-dispersive X-ray spectroscopy (EDS), UV-visible spectroscopy, and photoluminescence spectroscopy.

A) Rationale and Significance of the study:

Energy is an important need for the economic development of country as well as world. Today's this need of energy specially obtained from the fossil fuels and nuclear power. These sources of energy is limited and because of that they will not last forever. In the 21st century, energy demands of the globe and the carbon emissions both are on the rise. Fossil fuels are the reason for environmental problems. For overcome the above all problems we have to move towards renewable energy sources like as energy obtained from the wind, biomass , hydro these technologies are becoming cost competitive with other low –carbon technologies in electricity generation.

Many alternative energy resources can be used instead of fossil fuels and it is now believed that renewable energy technologies can meet much of the growing demand of energy at prices that are equal to or lower than those forecasted for conventional energy. By the middle of the 21st century, renewable energy resources could account for 60 % of the world's electricity market and 40 % of the market for fuels used directly. Moreover, making a transition to a renewable energy economy would provide many benefits which cannot be measured in standard economic terms. It is investigated that by 2050, global CO_2 emissions would be reduced to 75 % of their 1985 levels provided that energy efficiency and renewable resources are widely adopted [2]. It is believed now that because of the desirable environmental and safety aspects, solar energy should be utilized instead of other alternative energy resources as it can be provided in sustainable way without harming the environment. The amount of sunlight striking the Earth's atmosphere continuously is 1.75x105 TW. Considering a 60 % transmittance through the atmospheric cloud cover, an amount of energy equal to 1.05x105 TW reaches the Earth's surface continuously. If only 1 % of this quantity could be converted into electric energy with a 10 % efficiency In other words, using one ten cover the whole world. Development of the global energy production from 1860 to 2060 is forecasted that, solar cells will account for about 18% and in order to achieve this, a reduction in the production costs of solar cells is urgently required. Hence, solar energy is having capacity to fulfill the energy demand of urban civilization without harming the environment.

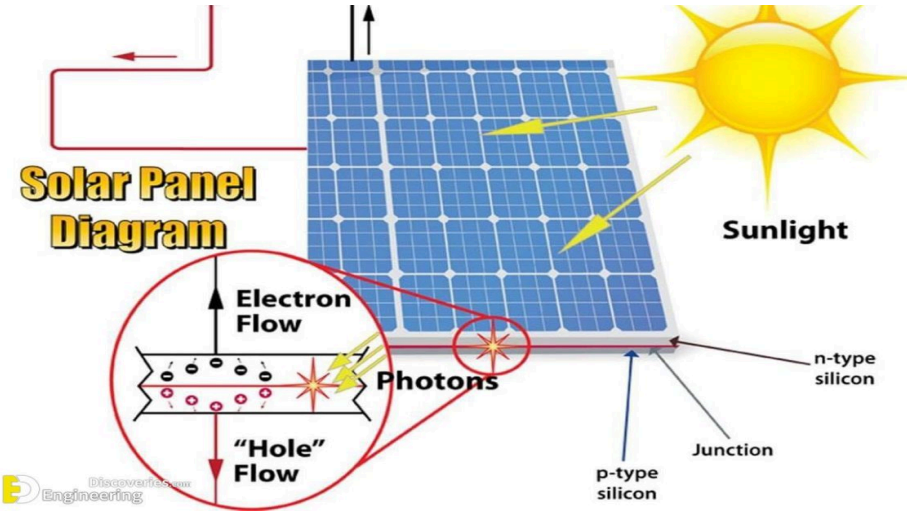
SOLAR PHOTOVOLTAIC: Solar photovoltaic (SPV) is directly convert sunlight into electricity. It moving parts, emissions or noise and all this by converting abundant sunlight without practical limitations. The relevance of solar energy specifically PV can be justified mainly with factors like scalability, environmental impact and the security of the abundant availability of the solar radiation to be utilized for PV.

Solar photovoltaic energy are:

1. Electricity produced by solar cell than sunlight.
2. Solar energy is a locally available renewable resource. It does not need to be imported from other regions of the country or across the world. The total global energy needs for 2050 are projected to be In other words, using one ten-thousandth part of the incoming sunlight would cover the whole energy demand of mankind. Major advantages of solar photovoltaic energy are: Electricity produced by solar cells is clean and silent because they do not use fuel other solar energy is a locally available renewable resource. It does not need to be imported from other regions of the country or across the world. This reduces environmental impacts Savitribai Phule Pune University (2015) are projected to be thousandth part of the incoming sunlight would Development of the global energy production from 1860 to 2060 5 % of the global energy production in 2060 and in order to achieve this, a reduction in the production costs of solar cells is Hence, solar energy is having capacity to fulfill the energy demand of urban the field of technology and research related to the devices which is the most elegant method to produce electricity without moving parts, emissions or noise and all this by converting abundant sunlight without practical limitations. The relevance of solar energy specifically PV can be justified mainly with several source. The scalability means some major advantages of because they do not use fuel other Solar energy is a locally available renewable resource. It does not need to be imported from other

regions of the country or across the world. Unlike fuels that are mined and harvested, while using solar energy to produce electricity, there is no need to deplete or alter the resource.3

3. Solar cell systems or photovoltaic systems do not release any harmful gases or water pollution into the environment, deplete natural resources, or endanger animal or human health. It is totally a clean energy.
4. Photovoltaic systems are quiet and visually unobtrusive.
5. Small-scale solar plants can take advantage of unused space on rooftops of existing buildings.
6. Since solar cells convert light energy directly into electrical energy, there are no moving parts like turbines and generators needed in the thermal power, atomic power and wind power generation process. It needs no maintenance or very little maintenance and operates with size-independent conversion efficiency.
7. Electricity can be generated where it is needed.
8. As solar cells have a useful life in excess of twenty years, they can be considered as long-life devices.
9. A PV system can be constructed to any size based on energy requirements. Furthermore, the owner of a PV system can enlarge or move it if his or her energy requirements change. For instance, homeowners can add modules every few years as their energy usage and financial resources grow. Ranchers can use mobile trailer-mounted pumping systems to water cattle as the cattle are rotated to different fields.



Solar Panel

B) A survey of work done in the research area and the need for more research:

Solar Energy is another source of energy that is renewable, clean and abundant. Solar being the largest source of energy on the planet, has the greatest potential as a renewable source. The former is basically harnessing the heat energy and the latter is concerned with the conversion of electromagnetic energy from the sun especially, in the visible to infrared regions and its conversion to electricity. In spite of its potential, solar energy, constitutes only 1% of the total energy mix of the world. The solar photovoltaic consists of only 0.5% of the total global electricity share and solar thermal has a share of around 0.7%. The IEA has carved out a road map, if it is met, solar photovoltaic may contribute to a total of 2.2% by 2020 and a major share of 30%

by 2050 [1]. Republic of China is the leader in the use of solar thermal power and in solar photovoltaics Germany has maintained the lead. However, China has recorded a rapid growth even in the field of solar cells. The solar photovoltaics have been an exponentially growing domain of renewable energy. When solar thermal installations doubled in capacity from 2007 to 2012, the solar photovoltaic installation capacity grew ten times. This testifies the interest this domain has generated among different countries of the world. **Generations of Solar Cells:** Solar cell or photovoltaic cell is a device that converts solar energy or light into electricity. The solar cell history dates back to first experimental demonstration of photovoltaic effect given by French physicist E. Becquerel in the early 19th century.

A statement of aims and objectives:

Aim of proposed work:

To study mechanism to develop next generation solar cells result in enhancing properties like short circuit current density, open circuit voltage, fill factor, efficiency and peak power.

Objective of Investigations:

1. To synthesize of semiconductor thin film viz. SnS and ZrO.
2. To find out the maximum efficiency of the film on solar cells.
3. To perform comparative study of solar cells to verify performance of solar cell.
4. Strong motivation is to stop air pollution resulting from the consumption of fossil fuels and to maintain the ecological cycles of the bio-systems on the earth.
5. It has been popular in low-cost manufacturing processes.

For most semiconductor applications, small-sized grains are a disadvantage, but the use of low concentrations and spray rates, coupled with the heat treatment after deposition of films containing small grains, can improve the stoichiometry and the crystallinity of the material. The process, as a whole, is sensitive to variables such as ambient temperature and surface measurement of the substrate, influencing the physical and electronic properties of the film. In addition, the temperature directly influences the stoichiometry (metal alloys) and deposition efficiency of the film, which in part decreases with increasing temperature. Despite these drawbacks, spray pyrolysis is an excellent method for the deposition of thin films over large geometric areas.

D) Methodologies and techniques to be used: The film technology is the most promising technology for mass production of solar cell due to the low cost solar energy conversion, low materials consumption and the possibility to obtain very small integrated solar cell module.

Characterization Techniques:

A use of thin film synthesis for the formation of solar cell can be resulted in enhancing performance of solar cells. Therefore without adequate characterization of the materials, not only reproducibility but also

valid interpretation of their result is impossible. The structural, morphological, electrical and optical properties of these film investigated using a variety of characterization techniques such as low angle XRD, Raman spectroscopy, X-ray photoelectron spectroscopy(XPS), Field emission scanning electron microscopy(FE-SEM), Hall measurement and UV-visible spectroscopy,**RF sputtering** Scanning electron microscopy(SEM), Energy-dispersive x-ray(EDX) etc.

E) The kinds of conclusions expected: The thin film single crystal SnS and ZrO were synthesis by Solvothermal method at various substrate temperatures, optical and morphological properties of these films was investigated by using various characterization techniques.

Conclusion

Hydrothermal and solvothermal techniques have been widely adopted as classic methods for the fabrication of inorganic and metal-organic nanomaterial, including oxides; Group III–V, I I –IV, and VI elements; MOFs; and transitional metals. These techniques could be utilized to synthesize organic NPs provided that the organic chemicals will not be decomposed at such high temperatures and pressures. However, methods to synthesize organic NPs are still under development and are limited by the stability of organic compounds. Additionally, organic NPs can be readily synthesized via a traditional wet chemistry method with or without the assistance of surfactants. Due to the unlimited combinations of metal ions and bridging organic ligands for MOF compounds, it would be worth exploring the MOF NP synthesis via solvothermal methods. Such research could yield very interesting discoveries in the upcoming years.

Bibliography

1. International Energy Agency. Key world energy statistics, 2015.

2. Fiddaman T, Sterman J, Jones AP, Sawin ER, Siegel LS. C-ROADS: Climate-- Rapid Overview and Decision-Support Simulator: 2008.

3. Energy and Climate Change: World Energy Outlook Special Report, 2015.

4. Manzano-Agugliaro F, Alcayde A, Montoya FG, Zapata-Sierra A, Gil C. Scientific production of renewable energies worldwide: an overview. Renewable and Sustainable Energy Reviews. 2013 Feb 28;18:134-43.

5. S. Bose, A. K. Barua, J. Phys.D: Appl. Phys. 32, 213 (1999).

6. H. Kim, C. M. Gilmore, Appl. Phys. Lett. 76, 259 (2000).

7. G. Feng, D. Li, B. L. Yao, Vacuum 68, 363 (2003).

8. A. Moustaghfir, E. Tomasella, S. B. Amor, M. Jacquet, J. Cellier, T. Sauvage, Surf. Coat. Structural, optical and electrical properties of hydrogenated nanocrystalline silicon (nc-Si:H) films deposited by hot wire chemical vapor deposition (HW-CVD).

9. N. A. Bakr, A. M. Funde Journal of Physics and Chemistry of Solids (Accepted 2010)

10. V. S. Waman, M. M. Kamble, R. R. Hawaldar, V. G. Sathe, S. W. Gosavi, S. R. Jadkar Synthesis of hydrogenated nanocrystalline silicon films by hot wire chemical vapor deposition method: Influence of filament-to-substrate distance on the material properties.

11. V. S. Waman, M. M. Kamble, Pramod M. R., A. M. Funde Thin Solid Films (communicated), N. A. Bakr, R. R. Hawaldar, D. P. Amalnerkar, V. G. Sathe, S. W. Gosavi, S. R. Jadkar.

12. Influence of hydrogen dilution on structural and optical properties of nanocrystalline silicon films obtained by HW-CVD method V. S. Waman, M. M. Kamble, Pramod M. R., A. M. Funde Current Applied Physics (communicated) , N. A. Bakr, R. R. Hawaldar, D.