

Advantages and Applications of Nanotechnology in Energy Sector

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ABSTRACT

Nanotechnology in energy sector is an interesting topic for research. Use of Nanotechnology in energy sector has the capability of improving life all over the world. Nanotechnology plays very interesting and important role in energy sector at different stages such as production, storage and transmission. Use of Nanotechnology in conventional and non conventional energy sources is the fascinating topic for research and development of new technologies. Nanotechnology innovations could impact different fields such as energy conservation, development in available energy sources and energy usage. This paper highlights the advantages, applications of nanotechnology in Energy sector, different nanomaterials used in energy sector and recent development of nanotechnology in Energy sector.

Keywords : Nanotechnology, nanomaterials, energy sector, conventional and non conventional energy sources.

I. INTRODUCTION

Nanotechnology is a field of research and innovation in building things, generally materials and devices at nanoscale to take advantage of enhance properties of the material that are not present in their bulk form. Properties of nanomaterials are much differs than bulk materials. The main factors behind this are Increase in surface to volume ratio and Quantum size effect. Nanotechnology has numerous applications in everyday life in all fields. Nanotechnology shows major impact on many industries such as electronics, computers, medical, transportations, defense, agriculture, textile, sports etc. Nanotechnology provides multiple approaches to energy sector. Nanomaterials and nanotechnology play a very important role in the development in traditional energy sources and of new energy in future. Energy

production faces many problems. Fossil fuels are limited and new focus is on renewable energy sources. Nanotechnology is being used in different forms in several applications to improve the efficiency of energy generation or to develop new methods to generate energy in various forms including renewable and non renewable energies. Nanotechnology is a promising solution to many problems in energy generation, energy storage and energy transfer. This paper gives a general advantages and applications of nanotechnology for sustainable energy generation, storage and transportation.

Nanotechnology in energy Generation

Nanotechnology has shown promising development in the area of solar energy. Nanotechnology can be incorporated in solar energy technology for many applications which are more eco friendly, inexpensive

and efficient. Nanomaterials incorporated in solar panel to convert solar energy to electricity, heat and steam more efficiently. Solar panels with nano materials could be cheaper to manufacture and they are easier to install. Nanomaterial coatings and nano paints being used for collection of solar energy with high efficiency. Sunlight concentrated on nano materials can produce steam with high energy efficiency. Solar steam device can be used in water purification and disinfecting instruments. In solar energy generation nanotechnology shows wide range of applications including thin films, coating, tailored electronic structure etc. Nanotechnology is improving the efficiency of fuel production from raw petroleum product through better catalysis. The use of nanoparticles in enhanced oil recovery is one of the important applications with reduction in cost of production. The amount of electricity generation by wind mills can be increased by using windmill blades made with the help of carbon nanotubes that are longer, stronger and light weighted. Other applications in wind energy include nanoparticle bearings, stronger turbine, self-cleaning coating etc. Nanotechnology is very useful in the generation of geothermal energy by reducing operating mechanism at lower temperature. The most exciting use of nanotechnology in hydrogen energy is the hydrogen storage. In hydrogen transport, use of carbon nanotubes would have increased strength, conductivity and stability at high temperature. The controlled introduction of nanoparticles in organic waste treatment can increase the production of biogas. Fuel cell technology being advanced by nanotechnology. Nanotechnology is being used to reduce the cost of catalysts used in fuel cells. Various nanoscience based technologies can be used to convert waste heat and excess pressure into usable electric power. Flexible piezoelectric nanowires woven into clothing can generate useable energy for charging electronic devices. Nano-enabled paints are self

cleaning and are used to generate electricity to power our houses.

Nanotechnology in Transmission of Energy

Electricity is produced at limited places and then distributed everywhere it is needed with the help of power lines. 'Energy transmission is the movement of energy which could be electrical or petroleum from generating site to the respective stations for use.' In traditional ways for the purpose of transmission of electrical energy cables are used and pipes are used for transmission of petroleum products. In long distance transmission energy loss occurs due to resistance of wires but wires containing carbon nano tubes / quantum wires transfer electricity with significantly reduced resistance and thus transmission losses. Conducting materials with nanomaterial coating found to be more efficient with less power loss. Electrical conductivity of quantum wire is much greater than traditional wires. Many researches are going on to find the superconducting materials made up of nanomaterials for lossless current conduction. Quantum wires are light weighted and stronger than traditional wires. Nanosensors are useful in managing smart grids. Nanomaterials play a key role in wireless power transmission systems development. Efficient heat in and out flow system based on use of nanomaterials found to be more efficient. Nanomaterial coated surfaces show numerous advantages than non-coated surfaces. Nanotechnology is also very useful in transmission of petroleum products and gases. Nano material coated pipelines show better performance than traditional pipelines in terms of wear and tear, insulation, corrosion and erosion. Nanosensors are used in gas and liquid transmission for detecting breakages and leaks. Nanocoating on metallic surfaces can help in attaining low friction and improving oxidation protection. Thus it is observed that different nanomaterials such as nanodots, nanotubes, buckyballs etc are very useful and efficient for energy transmission.

Nanotechnology in Energy storage

Nanotechnology is being favored for energy storage because of efficiency, taking up more energy and holding it longer time. Nanotechnology provides suitable material for electrodes for proper battery operation. Nanomaterials based electrodes able to tolerate high currents offering a promising solution for high energy and high power. Nanotechnology is very useful for supercapacitors mechanism. Nanomaterials are used to increase performance of batteries that can recharge significantly faster and long lasting than conventional batteries. Nanotechnology can improve capacity and safety of battery. Nanomaterials are used to make light weight fuel tank which can store more amount of hydrogen. Nanomaterials helps to manufacture high capacity batteries for portable electronic devices. Nanomaterials helps to increase the life span battery. Nanotechnology helps to store thermal energy more conveniently.

II. CONCLUSION

Nanotechnology could provide a efficiency boost needed to energy sector. Nanotechnology is a sustainable solution to many problems and drawbacks in three main parts of energy sector that are energy generation, storage and transmission. Nanotechnology increase the efficiency, performance and life span of material with reduction in maintenance cost. Nanotechnology provides a way for future research and development in energy sector.

III. REFERENCES

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