OVER VIEW OF NANOTECHNOLOGY IN THE ENERGY SECTOR

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ABSTRACT

Worldwide energy demand is continuouslygrowing. Currently about 80 percent of primary energy demand is covered by fossil fuels. But these types of fuels are non-renewable sources, they will not be able to cover the worldwide energy consumption in the long run,in case of renewable sources they are expensive and inefficient. Due to above factors Nanotechnology can play a key role in the energy sector. In this paper we will study the possible Nano application in the energy sectors.

I. INTRODUCTION

Word Nano is derived from Greek word "dwarf" which means 10^{-9}or one-billionth. Here it refer to one – billionth of a meter or 1 nanometer (NM).

One Nanometer is equal 3 atoms. Hence Nano-technology is a science of building and using material, devices and machines at the nanometer scale, making use of unique properties that occur for structures at those small dimensions. Hence in other words we can say Nanotechnology is the technology at the sub-micron (1-100) of Nanometers.

II. NANO EFFECTS ON ENERGY SECTORS

Nanotechnologies provided the potential to enhance energy efficiency and cost saving in a number of application field energy development, particularly in the generation of renewables, through optimized materials & components.

Nano structuring or Nano materials provides new possibilities for intelligent material design. Following overview give idea of application & properties of this technology.

2.1 Chemical

- more efficient catalysts in fuel cells or for the chemical conversion of frnds through extended surface and specific catalyst design.
- More powerful batteries, accurate and super capacity through higher specific electrode surface
- Optimized membrane with higher temperature and corrosion resistance for application in polymer electrolyte fuel cells or separators in either in batteries.
- Nano porous materials for the storage of hydrogel e. g metals hybrids or metal organic compounds

2.2 Mechanical

- Improved strength of construction materials for rotor blades of wind power plants.
- Wear resistant Nano layers for drill probes gear boxes and engine components.
- Optimized separability of gas membrame for the separation and deposition of carbon dioxide for flue gas of coal fixed power plant.
- Gas tight polymer Nano composites for the reduction of hydrocarbon emission from vehicle tanks.

2.3 Optical

Optimized light absorption properties of solar cells through quantum dots and Nano layers in stack cells Anti-reflection properties for solar cells to increase energy yield of solar cell. Luminescent polymers for the production of energy – efficient organic light diodes.

2.4 Electronic

Optimized electron conductivity through carbon nanotubes and Nano structure super conductors. Electric insulators through Nano-structure fillers in components of high-voltage power lines Enhanced thermoelectric for more efficient power generation from heat throughNano-structure layer system.

2.5 Thermal

Nano-structure heat protection layers for turbine blades in gas and aircraft turbine. Improved heat conductivity of carbon nanotubes for optimized heat exchange. Optimized heat stores based on Nano porous materials (Zeolites) micro encapsulated phase-change storage.

Nano foams as super-insulation system in building insulation which arecapable of efficiently minimizing the convective heat transport even at small thickness of the insulation layer, due to Nano porous structure.hence,Nanotechnology innovation are brought to bear on each part of the value-added chain in the energy sector.

III. ENERGY SOURCES

3.1 Regenerative

Photovoltaics:- Nano-optimized cells(Polymeric, dye, quantum dot, thin film, multiple junction), active-reflective coatings

Wind energy:- Nano-competitive for lighter and stronger rotor blades, wear& corrosion protection Nano coating for bearing and power trains etc.

Geothermal:-Nano-coating and composites for corrosion protection

Bio-mass energy:- yield optimization by Nano-based precaution farming (Nano sensors,controlled released and storage of pesticides and nutrients.

Fossil fuels:-wears and corrosion protection of oil and gas drilling equipment, nanoparticles for improved oil yields

Nuclear:-Nano composites for radiation shielding and protection (Personal equipment, containeretc.),long term option for nuclear fusion reaction.

Energy Change:-heat and corrosion protection of turbine blades(e.g.ceramics or inter metallicNano-coating) for more efficient turbine power plants.

Thermos electrics:-Nanostructured compound (Interface design,Nano rods)for efficient thermos electrical power generation (e.g. usage of waste heat in automobiles or body heat for personal electronics.

Fuel cell:-Nano-optimized membranes and electrodes for efficient fuel cells(PEM) for application in automobile/mobile electronics.

Hydrogen Generation:-Nano-catalyst and new process for more efficient hydrogen generation (e.gphotoelectrical,electrolysis bio photonic)

Combustion Engines:-

Wear and corrosion protection of engine components (nanocomposites/coating, Nano-particles as fuel additive etc.)

Electrical motors:-

Nano-composites for super conducting components in electro motors(e.g. in ship engines).

3.2 Energy Distributions

Power transmission:-

High voltage transmission:-Nano fillers for electrical isolation system ,soft magnetic nanomaterials for efficient current transformation.

CNT power lines:- Super conducting cells based on carbon Nanotubes

Wireless power transmission:-

power transmission by loser microwaves or electromagnetic resonance based on Nano-optimized components.

3.3 Energy Storage

Batteries:-optimized Li-on batteries by nanostructure electrodes and flexible, ceramicseparator-foils application in mobile electronics,auto-mobiles, flexible load manage in power grids.

Super capacitors:-

Nanomaterials for electrodes (Carbon-aerogels, CNT, metal 9Oxides) and electrolytes for higher energy densities.

Chemical Energy:-

Hydrogen:-nonporous materials(organ metals,metals hydrides) for application in micro fuel cells for mobile electronics or in automobiles.

Fuel reforming/Refining:-

Nano-catalyst for optimized fuel production (oil refining,desulphurization,coalliquefaction.

Fuel Tank:-

Gas tight fuel tanks based on Nano-composites for reduction of hydro carbon emissions

Thermal Energy:-

Phase change materials:-encapsulated PCM for air conditioning of building

Adsorptive storage:-

Nano porous materials(**e.**g. zeolites) for reversible heat storage in building and heating nets.

3.4 Energy Usage

Thermal insulation:-

Nano porous focus and gels (Aerogels, polymer foam) for thermal insulation of building or in industrial processes.

Air conditioning:-intelligent management of light and heat flux in building by electro chromic windows, micro mirror arrays or IR-reflectors.

Industrial process:-

Substitution of energy intensive process based on nanotech process innovation (e.g. Nano-catalysts, self-assembling process etc

Lighting :-

Energy efficient lighting system(E.G LED,OLED)

IV. CONCLUSION

The above discussion shows that we can facing critical environmental uses as well as dwindling resources. Now the time has come to manage this situation, for which we need to produce transport, store and consume energy in view and more efficient ways.

Nanotechnologies promises to be the tool we need especially if, Research and Development shall be take place in this field, many exciting opportunities with huge market potential will emerge in the decades to come. Nanotechnology will affect the entire field of energy from usage to supply, conversion and storage will improve energy efficiency also.

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