PROSPECT OF NANO-ELECTRONICS MATERIAL FOR MARINE ENERGY PRODUCTION

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ABSTRACT
Multi-gap solar cells are promising techniques to achieve higher efficiency at reasonable cost. The process involves synthesis and characteristics of compound nano-wires (NW) which monolithically grown on Si and Sapphire to obtain ultra low threshold lasers and high-efficiency solar cells. Quantum dots are playing a noteworthy role in such nanostructure-based solar cells and boost the effectiveness and decrease the cost. The marine system requires high level of reliability product that can sustain vibration, dynamic and corrosive environment. Nanotechnology for marine system will provide lower cost and higher efficiency by enabling more efficient use of the spectrum directed towards marine system. This paper discuss potential explore development of nanotechnology for low-cost, reliable, and efficient novel nano-solar cells compatible for hybrid marine power system.

KEY WORDS:
Multi-gap solar cells, nano-solar cells, Quantum dots, and hybrid marine system.

1. INTRODUCTION

Nanotechnology has been regarded as an emerging technology, introducing new dimensions to science and technology with the possibility of manipulating atoms and molecules at the nanometer level ('nano' means one-billionth of a meter) [1]. Thought history of manufacturing, this new area of science is about building from bottom – up by using atoms, molecules of different material. Material properties and characteristics of atom and molecules of material that can withstand building small scale product will be studies and paddle of their arrangement will be assembled to produce Nano product. This paper discusses the material available for nanofabrication of metal–oxide–semiconductor field-effect transistor (MOSFET) gate, advantages and disadvantages of materials, new nanotechnology for the preparation of gate material, preparation of nano-material as a gate electrode for MOSFET, and potential use of nanotechnology for marine system.

2.NANOTECHNOLOGY: NEED OF PROSPECT

Malaysia is an emerging economy and a market where there is huge potential for energy producing saving technologies and equipments. Solar energy remains one of the promising answers to quest for alternative energy. Currently, there are few nano-particles based solar cells [2] such as thin-film solar cell, multi-gap solar cell, multi-junction solar cell, nano-quantum dot solar cell, and nano-electronics semiconductor MOSFET solar cell, and others. Integration of the entire hybrid of above nano-material to construct the desired material that will absorbed sun light and deliver energy efficiently is key to the future of nanotechnology. Table 1 shows the challenges that could be resolved by use of nano-solar technology.

Table 1: The challenges that could be resolved by use of nano-solar technology

Major issues	**Nano-solar cells**
Conventional energy is too expensive	Nano-solar cells technology has possibility of producing cheap power and enough for everyone
Conventional energy is too centralized	Nano-solar cells embedded in flexible plastics will be able to adjust to the shape and terrain of application
Conventional energy is polluting	Nano-energy is clean
solar energy again is too costly	Nanotechnology has possibility to produce solar energy cheaper
How will it be stored	Nanotechnology enabled super capacitors in local storage of energy.
How to reduce wastage of energy: transmission losses	Nano-superconductors will replace current transmission facilities and they will have better performance on this front.
Present day photovoltaic cells are: made up of crystalline silicon, which requires clean manufacturing free of dust and airborne microbes. Silicon is in short supply and expensive. high manufacturing costs that lead to high wattage prices	Tiny solar cells can be printed onto flexible, very thin light-retaining materials, bypassing the cost of silicon production. Thin rolls of highly efficient light-collecting plastics spread across rooftops or built into marine structure materials. Nano-cells made up of materials, several thousand times smaller than the hair, will have more light capturing capabilities than photovoltaic cells. Flexible sheets of tiny solar cells made by using nano-science applications may be used to harness the sun's energy and will ultimately provide a cheaper, more efficient source of energy.
What are further possibilities	Nano-tubes: their structure, exhibit electrical and optical properties help in the absorption of solar energy and its conversion to electrical energy. Nano-particles like QS with a polymer to make the plastic can detect energy in the infrared solar rays. This will strategically capture more solar energy. Nanotechnology also enables production of solar cell glass that will not only generate energy, but also act as windows. This also reduces overheating of the house, thereby reducing the need for cooling.

The selection of nano material depends on the thermodynamic stability, electronics properties and process stability. Adapting nanotechnology for marine application requires reliability in terms of vibration, water tightness, corrosion/ antifouling resistance/ anticathode, size, and of course, storage. Figure 1 shows the Prospect of nanotechnology.

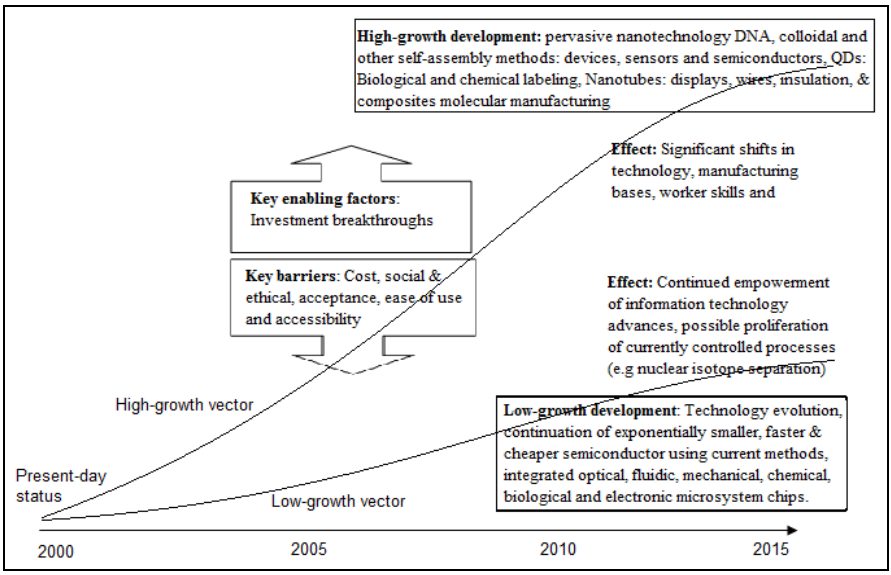

Figure1: Prospect of Nanotechnology

3. MATERIALS FOR NANOFABRICATION OF MOSFET GATE

New material that could compete with silicon oxide for MOSFET based nano-electronic for energy production will require having high-*k* material and Polysilicon metal gate. The summary of candidate material and *k*-values are shown in Table 2.

Table 2: The summary of candidate material and *k*-values

Metal oxide	***k*-value**	**Average *k*-value**	
AlO	9-11.5	10.5	
BaO	31-37	15.5	
CeO	18-28	21.5	1-10 nm
HfO	20-22	21	
CaO	25-30	27.5	
TaO	25-45	35	
TiO	Sep-90	49.5	

There are metal under considerations are Silicon oxide, Silicon nitrite, Oxynitrides, Aluminium oxide, Tantalum pentoxide, Hafnium oxide, Zirconium oxide and Barium strontium titanate (BST).

4. ADVANTAGES AND DISADVANTAGES OF MATERIALS

ADVANTAGES	DISADVANTAGES
New nanotechnology for the preparation of material gate & Use of metal gate allow possibility to make material thick and reduce gate leakage	Polysilicon has disadvantaged of formation of depleting layer and resistivity
Tin,ta,nb has high work function and sufficient high melting point (>>1000 degree cel.)- they are good for n-MOS	High k material subject gate to high temperature, therefore there is need for annealing, hydrogen pasivation is and optoipn
Co,re,ni and ru because of high melting point characteristics. Ru and pt are good for pmos but cannot survive hydrogen pasivation as they are thermodynamically unstable.	High k oxide material takes care of leakage problem that arise from scaling down silicon oxide to say 1.5nm.fro the later.
High metal metalik alloy & Tin is mid gap metal gate candidate, it is stable, high melting point, compatibility with polysilicon. Strain silicon is good to increase speed of performance of devices.	Replacing silicon oxide gate with high dielectric k- material is combined with metal gate strained silicon and metal gates are promising choices available now.

5. PREPARATION OF NONOMATERIAL AS A GATE ELECTRODE FOR MOSFET

The gate electrode involves two terminal devices. Real two terminals integrated MOSFET is an electrical switch (between source and drain) which is control by electrical potential at the terminal of the gate, MOSFET two terminal characteristics gives it advantage over other device for possibility to build first logical gate from metal oxide silicon semiconductor. Manufacturing of MOSFET using nanotechnology will sprang and generate a real and revolution electronics fabrication.

5.1 Conventional Material Being Use in the MOSFET Fabrication

Metal oxide is widely being used for semiconductor fabrication for years in fabrication of modern integrated circuit due to low cost, small size and lower power consumption. Among them, silicon oxide is the most effective oxide because devices exhibit good properties, grown thermally, cheap, found in abundance, bonds difficult to break and no free electron. Conventional MOSFET is produced using oxide or mixture of oxidizing agent as gate dielectric, with 1.5-2.0nm thickness, and maintaining temperature at 900-1000. The standard thermal diffusion is used to grow the transistors layer by layer on a substrate by grove reaction model. MOSFET materials are metal (aluminum), Oxide (silicon dioxide), and Semiconductor silicon. MOSFET fabrication steps were listed in Table 3.

Table3: MOSFET fabrication steps

Lithogra-phy step	Process step	Process
1	Field oxide growth Oxide etch Source – drain diffusion	Thermal oxidation HF etch Boron diffusion
2	Oxide etch Gate oxide diffusion	HF etch Thermal oxidation

3	Via hole etch	HF etch
4	Aluminum metal deposition Aluminum etch Contact aneal and surface reduction	Evaporation Wet chemical etch Furnace anneals in H_2/N_2

6. NEW TECHNOLOGY AVAILABLE

Electrodeposition technique is a new technology considered to be suitable for preparation of nanomaterial for MOSFET gate. Some of them are achieved using the following process techniques:

- Silicon on oxide (SOI) - replace bulk silicon wafer, wafer bonding or etch back (BESOI) or ion implantation is used.
- SIMOX- improved SIO silicon with implantation of oxide (atom or ion)
- Precision slicing method- used by a French company called SOITEC (Soitec smart cut) – Hydrogen bombardment on silicon and its oxide
- Silicon On Nothing (SON)

7. CONCLUSION

Recent research engaging graphene nanowire and carbon nanotube Quantum dots in creating next generation solar cells have been briefly reviewed. The graphene can be utilised as clear conductive electrodes for solar cells, its high electron mobility can furthermore be utilized to advance separation nd assemblage of carriers. Quantum dots not only can transfer electrons or holes much effectively, but furthermore has a good photovoltaic property. Combining graphene and Quantum dots may be undertaking to get a new kind of solar cells. We have suggested a likely way to arrange this hybrid components founded on the present synthesis techniques. Considering this, result from this research will substantially improve existence solar cell efficiency and could have dramatic impact in terms and cost.

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