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Nanowires - Physics for Growth of Nanostructure

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ABSTRACT

In this article, we are introducing some technique of growth Nanowire for Nanostructures for physics, A Nanowire considered as a Nanostructure which is build blocks for the generation of electrons protons neutrons positions and the sensor and also the energy applications. In this project, we are to synthesis and growth of semiconductor nanowire made by metallic both of the axial and radial structure and their properties discuss here. In one-dimensional nanostructure of control, density States turned into the electronic and optic properties. There is a new technique of growth metallic and semiconducting material develop in the International Science. A nanowire is a nanostructure, with the diameter of the order of a nanometer (10−9 meters) and an unconstrained length. At these scales, quantum mechanical effects are important — which coined the term "quantum wires." Quantum confinement produces new material behaviour/phenomena. Based on the degree of confinement different Structures arise.

Keywords: Nano Physics, Nano Technology, Nano Material, Nano made wire, Nano-Function, Nano mathematics, Nanotech, CMOS transistors, Nano-Structure, Nano Growth and Nano Synthesis.

1. Introduction

In this paper, we report how Si NW arrays can be monolithically incorporated into novel metal–insulator–semiconductor (MIS) photodetectors. A nanowire is a nanostructure, with the diameter of the order of a nanometer (10−9 meters). In recent years, semiconductor nanowires (NWs) have played a major role in photo detection and photovoltaics. Therefore, the inclusion of Si NWs in Si-based photodetectors or solar cells and an unconstrained length. At these scales, quantum mechanical effects are important — which coined the term "wires." Quantum confinement produces new material behaviour/phenomena. Based on the degree of confinement different Structures arise. A very convenient way of keeping track of the number of Spin Eigen functions of a given multiplicity for an N-electron system is the branching diagram shown below [1].

2. Motivation – Quantum Confinement

1. Trap particles and restrict their motion.
2. Quantum confinement produces new material behaviour/phenomena.
3. Engineer confinement"- control for specific applications Structures.

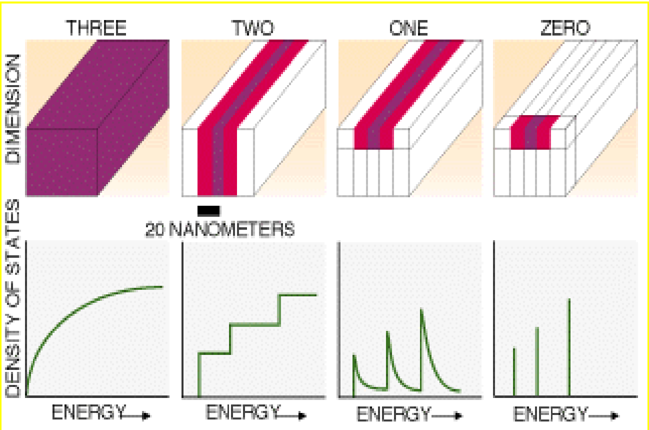

Fig.1. Density of States to the Dimension

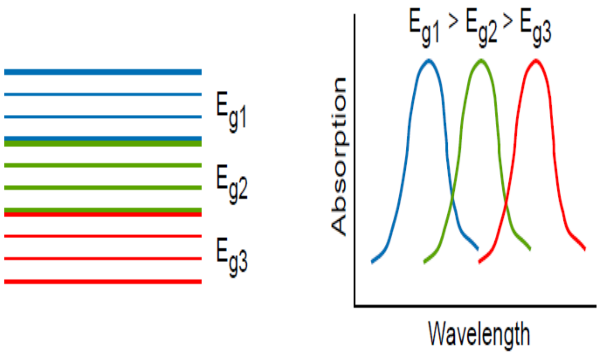

Fig.2. Need antireflection coating

Quantum dots (0-D) only confined states and no freely moving ones. Nanowires (1-D) particles travel only along the wire. Quantum wells (2-D) confines particles within a thin layer [2-3].

Why Nanowires

They represent the smallest dimension for efficient transport of electrons and excitons, and thus will use as interconnects and critical devices in Nano-electronics and Nano-optoelectronics." (CM Liebert, Harvard).

3. General attributes & desired properties

- Single crystal formation -- common crystallographic orientation along the nanowire axis.
- Minimal defects within the wire.
- Minimal irregularities within nanowire arrays <100 nm Diameter Nanowire---Not quantum confinement.

Nanowires have many interesting properties that are not seeing in bulk or 3-D materials. This because electrons in nanowires are quantum confined laterally and thus occupy energy levels that are different from the traditional continuum of energy levels or bands found in bulk materials. Silicon nanowires (SiNWs) have received great interest hinge upon their unique electrical and optical properties. Even more important, SiNWs-based Nanodevices are compatible with the current Si-based microelectronics industry [4].

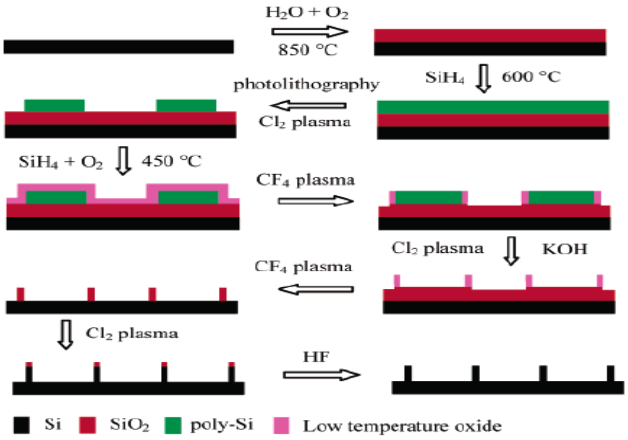

Fig.3. 10 nm Silicon nanowire arrays by size reduction Lithography

4. APPLICATIONS OF NANOWIRES

Nanowires still belong to the experimental world of laboratories. However, they have exhibited certain unique properties which make them promising materials for a wide variety of applications [5].

Owing to their high Young's moduli, their use in mechanically enhancing composites is being investigated. As nanowires appear in bundles, they may be used as terminological additives to improve friction characteristics and reliability of electronic transducers and actuators. Because of their high aspect ratio [6-8], nanowires are also uniquely suited to electrophoretic manipulation some early some early experiments have shown how they can be used in:

- Optoelectronic devices;
- Biosensors;
- Solar cells;
- Memory devices.

5. SYNTHESIS OF NANOWIRES

There are two basic approaches of synthesising nanowires: top-down and bottom-up approach.

A. In a top-down approach -a large piece of material is cut down to small pieces through different means such as lithography and electrophoresis.

B. Whereas in a bottom-up approach the nanowire is synthesised by the combination of constituent ad-atoms. Most of the synthesis techniques are based on bottom-up approach. The common techniques in this approach are PVD, CVD, PECVD, MOCVD, MBE

Nanowire structures are grown through several common laboratory techniques including (a) suspension, deposition (electrochemical or otherwise), and (b) VLS (PVD Catalytic) growth. Ion enables growing homogeneous and segmented nanowires down to 8 nm diameter [9].

(a) Suspension

A suspended nanowire is a wire produced in a high-vacuum chamber held at the longitudinal extremities. Suspended nanowires can be produced by:

A. The chemical etching, or bombardment (typically with highly energetic ions) of a larger wire;

B. Indenting the tip of an STM in the surface of metal near its melting point, and then retracting it.

(b) VLS Growth

A common technique for creating a nanowire is the Vapor-Liquid-Solid (VLS) synthesis method. This technique uses as source material either laser ablated particles or a feed gas (such as silane). The source is then exposed to a catalyst. For nanowires, the best catalysts are liquid metal (such as gold) nanoclusters, which can either be purchased in colloidal form and deposited on a substrate or self-assembled from a thin film by de-wetting. This process can often produce crystalline nanowires in the case of semiconductor materials [10].

The source enters these nanoclusters and begins to saturate it. Once supersaturation is reached, the source solidifies and grows outward from the nanocluster. The final product's length can be adjusted by simply turning off the source. Compound nanowires with superlattices of alternating materials can be created by switching sources while still in the growth phase.

"Our team is currently exploring the integration of the monolayer materials with a silicon nitride platform," it said. "Through this work, we hope to achieve the coveted CMOS [complementary metal-oxide-semiconductor] compatibility, which is the same process by which the computer processors are fabricated today."[11-13]

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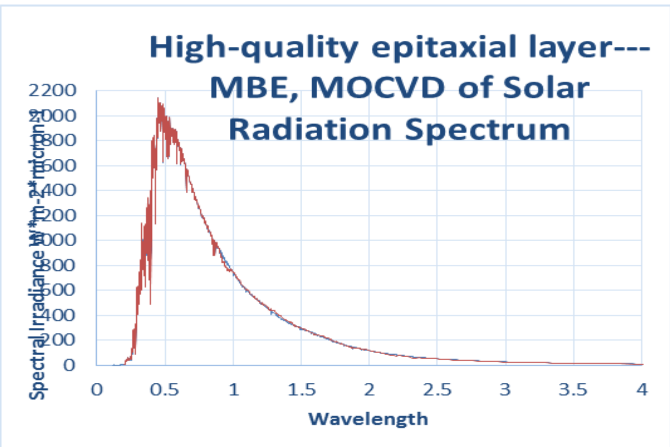

Fig.4. High-quality epitaxial layer--- MBE, MOCVD

In_2O_3: Catalytic Growth of Semiconducting In_2O_3 (The Au nanoclusters play a crucial role in Directing the growth of In_2O_3 Nano-fibers based on the Vapor-Liquid-solid (VLS) mechanism) (ii) TiO_2: TiO_2 films deposited by electron beam evaporation with glancing angle deposition (GLAD) technique[14].

PEG-PDI molecules are true mimics of superoxide dismutase enzymes, protective antioxidants that break down toxic superoxide radicals into harmless molecular oxygen and hydrogen peroxide. The molecules pull electrons from unstable ROS and catalyse their transformation into less reactive species.

Testing the PEG-PDI molecules can be as simple as putting them in a solution that contains reactive oxygen species molecules like potassium superoxide and watching the solution change colour. Further of characterization with electron paramagnetic and resonance spectroscopy was more complicated, but the fact that it's even possible makes them powerful tools in resolving mechanistic details, the researchers said.

6. Conclusion

Although much of the development in nanowires is presently at the laboratory stage, it promises to be the material of the future. There are many applications where nanowires may become important in electronic, optoelectronic and nanoelectromechanical devices, as additives in advanced composites, for metallic interconnects in nanoscale quantum devices, as field emitters and as leads for biomolecular Nanosensors.

The conductivity of a nanowire is expected to be much less than that of the corresponding bulk material. Primarily due to scattering from the wire boundaries, Nanowires also show other peculiar electrical properties due to their size; unlike the ballistic transport of carbon nanotubes nanowire conductivity is strongly influenced by edge effects due to larger surface to volume ratio a property which makes it ideal for solar cells [17].

"This allows us to see the structure of these active particles," Tour said. "We can get a view of every atom and the distances between them, and get a lot of information about how these molecules quench destructive oxidants in biological tissue.

"Lots of people get crystal structures for stable compounds, but this is a transient intermediate during a catalytic reaction," he said. "To be able to crystallise a reactive intermediate like that is amazing [18].

7. ACKNOWLEDGMENT

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