Nanotechnology

Lecture 3

Nano Materials applications

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4nd stage

Second Course

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Introduction

Nano Materials applications

One : Medicine (Nanomedicine(

Two : Electronics and Computing

Three : Energy

Four : Environment

Five: : Opto-Electronics

Six : Sensors of Gases

Seven : Food

Eight : Paints

Nine : Catalysis

Ten : Construction

Introduction

Why have nanomaterials, nanotechnology, and nanoscience gained interest, and played an important role in improving modern applications ?

Answer

▪ Reducing the size of the material to the nanoscale causes its unique of properties

▪ when materials are reduced to nano scale, their physical and chemical properties change dramatically, leading to some pretty "superpowered" applications.

▪ The controlled synthesis of nanostructures is a promising candidate that plays a vital role in the potential applications

▪ Nanotechnology and nanoscience have gained remarkable interest since the last decade and played an important role in improving modern applications due to its unique combination of properties.

One : Medicine (Nanomedicine)

This is maybe the area that most significantly impact people's lives in the field of nanotechnology **Targeted Drug Delivery:** Instead of flooding the whole body with medicine (like traditional chemotherapy),,, drug nanoparticles can be engineered to deliver drugs directly to cancer cells, with safety for tissues and other cells.

Diagnostic Sensors :

Nano-biosensors can detect diseases early-stage cancer from a single drop of blood with far higher sensitivity than standard tests.

TWO : Electronics and Computing

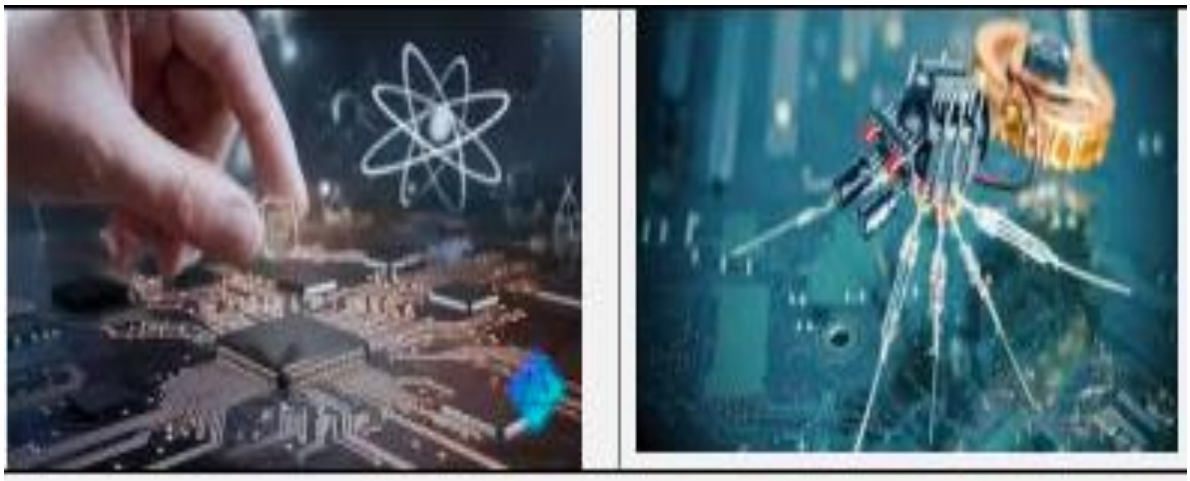
As we hit the physical limits of traditional silicon chips, nanotechnology keeps our device getting smaller and faster.

• Nano-transistors:

The use of nanomaterials in transistors manufacturing , leads to the creation of smaller switches or parts in transistor, allows for more processing power and better energy efficiency in smartphones and laptops.

• Quantum Dots:

The semiconductor nano-particles used in advanced TV displays (QLED), which leads to produce more clearer colors and images, in addition to small size of the devices.



THREE : Energy

Nanotechnology is a heavy hitter in the fight against climate change and resource scarcity.

• High-Efficiency Solar Cells :

Using nanomaterials in this field lead to significantly increase in the amount of sunlight converted into electricity compared to bulky silicon panels.

• Batteries :

With the growth in portable electronic equipment (mobile phones, laptop computers, remote sensors), there is request for low-weight, high-energy density batteries. This is achieved through use and development of nanomaterials**.**

• Displays :

The big market for large area, high brightness, flat-panel displays, as used in television screens and computer, is driving the development of some nanomaterials**.**

• Energy :

The most advanced nanotechnology projects related to energy are: storage, conversion, manufacturing improvements by reducing materials and process rates with energy saving.

FOUR : Environment

• Water Purification :

Nano-filters and membranes can remove salt from seawater or filter out microscopic pollutants and heavy metals that traditional filters miss.

• Environmental :

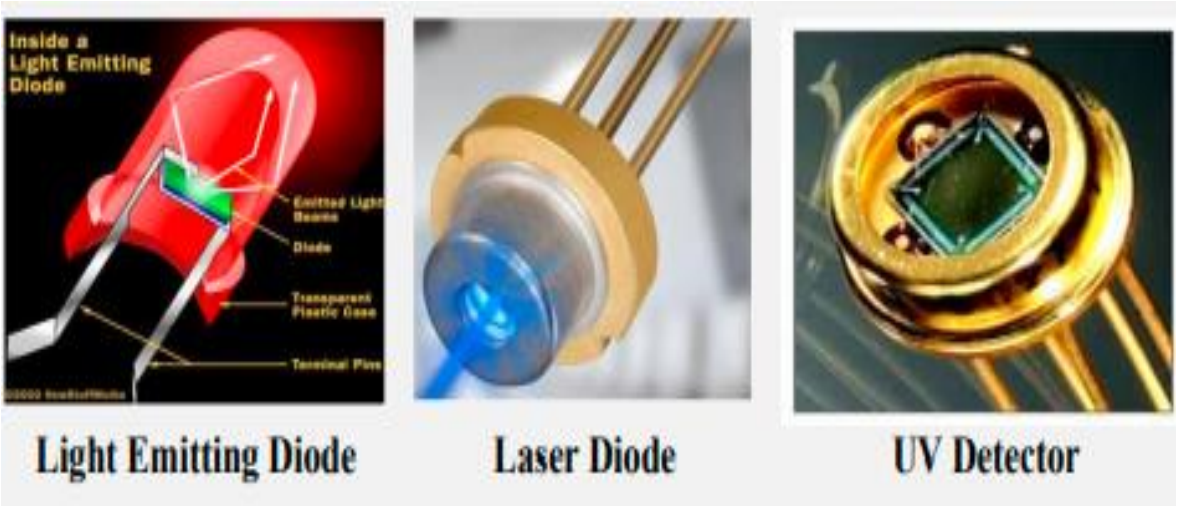
i)This includes cleaning up present pollution .

ii) Improving manufacturing methods to reduce the generation of new pollution .

iii) Making alternative energy sources more cost effective.

FIVE: Opto-Electronics

Optoelectronics is an interesting **branch of electronics that combines both electronics and optics**. Optoelectronic devices find different applications in **laser diodes, light emitting diodes, solar cell and plasma screen displays, UV detector etc.**



Six : Sensors of Gases

The gases like **N2** and **NH3** can be detected on the basis of **increase in electrical conductivity of nanomaterials.**

This is attributed to **increase in holes concentration** in nanomaterials due to **charge transfer from nanomaterials to N2** as the gas molecules bind the nanomaterials.

Seven :

Food Nanotechnology is used in the food industry in the following areas :

Smart & Active Packaging

▪ **Nano-Barriers**: This makes it much harder for oxygen to enter into foods.

▪ **Active Anti-microbials**: **Silver, copper, or zinc oxide nanoparticles** are **added into packaging films** to **actively kill bacteria** and **keeping food fresh** without adding chemical materials directly to the food.

Eight : Paints

Nanoparticles in paints can improve their performance and properties , for example making them **lighter, light weighting**, and **higher quality**.

Nine : Catalysis

Nanoparticles have a **high surface area**, and hence provide **higher catalytic activity.**

Ten : Construction

▪ Nanotechnology has the potential to make construction **more solid, faster, cheaper and safer.**

▪ Nanotechnology construction can allow for the creation of structures from **advanced homes and much more quickly and at much lower cost.**