Tikrit University
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Subject name: Special Material(Nano).

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Lect.2.

8-Nano composites

They are materials to which nanoparticles are added during the manufacture of these materials, and as a result, the nanomaterial shows a significant improvement in its properties.

Adding carbon nanotubes changes the electrical and thermal conductivity properties of the material.

Adding other types of nanoparticles may improve optical and dielectric properties as well as mechanical properties such as hardness and strength.

The volume percentage of nanoparticles added should be very low (in the range of 0.5% to 5%) because the surface area to volume ratio of nanoparticles is high.

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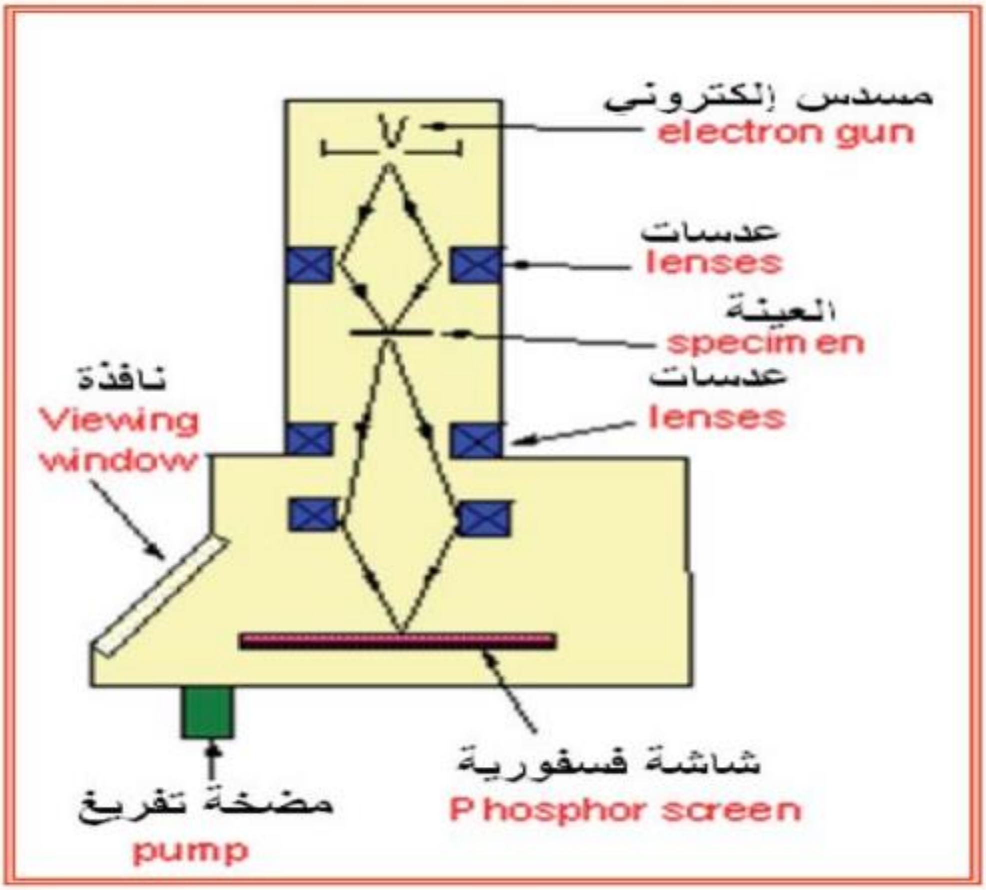
Types of nano microscopes

1- Transmission Electron Microscope

Abbreviated as TEM, the transmission electron microscope is a very powerful tool for materials science.

A high-energy beam of electrons shines through a very thin sample, and interactions between electrons and atoms can be used to observe features such as crystal structure.



Transmission Electron Microscope

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2- Scanning EltecronMicroscope (SEM)

It is a type of electron microscope that produces images of a sample by scanning it with a focused beam of electrons.

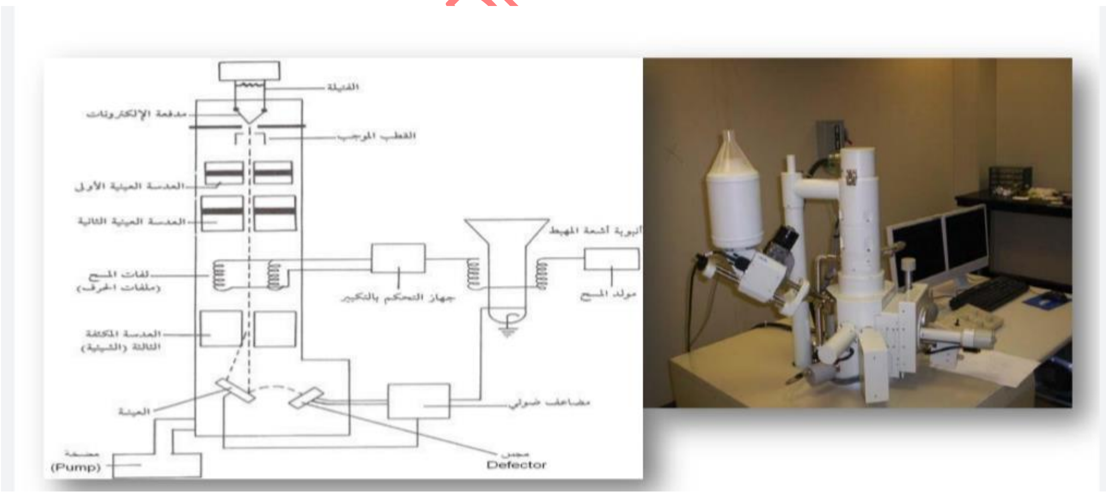
Electrons interact with atoms in the sample, producing various . signals that contain information about the surface topography and composition.

The electron beam is generally scanned using raster scanning and the location of the beam is combined with the signal to produce an image.

The most common scanning electron microscope technique is to detect secondary electrons emitted by atoms excited by an electron beam.

The number of secondary electrons that can be detected depends, among other things, on the topography of the sample.

By scanning the sample and collecting the secondary electrons that are emitted using a special detector, an image is created that displays the surface topography.



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3-Scanning Tunneling Microscope(STM).

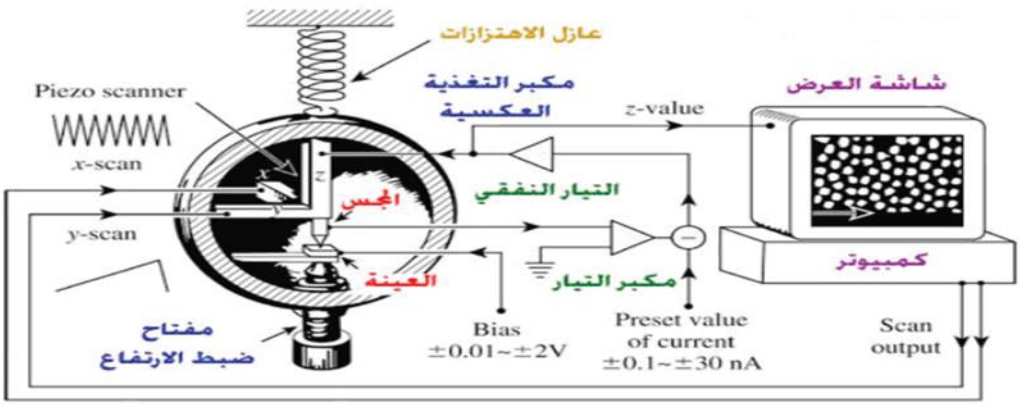
scanning tunneling microscope) (STM), The magnification power of the scanning tube microscope is approximately one hundred million times, and a computer is connected to it that analyzes the information received to it to show an image of the sample in its three dimensions.

This microscope is known as a scanning tunneling microscope. The scanning tunneling microscope is one of the basic devices in the science of nanotechnology, as it helps in studying materials at the atomic level, and in constructing and examining nanostructures.

The idea of its work is based on the principle of quantum tunneling.

When the tip of the electrically conductive probe approaches the surface to be examined, a potential difference is applied between the surface and the tip of the probe, allowing electrons to pass through a tunnel between them known as tunneling current.

The tunneling current depends on the position of the probe on the surface, the applied potential difference, and the local electronic density of the sample.



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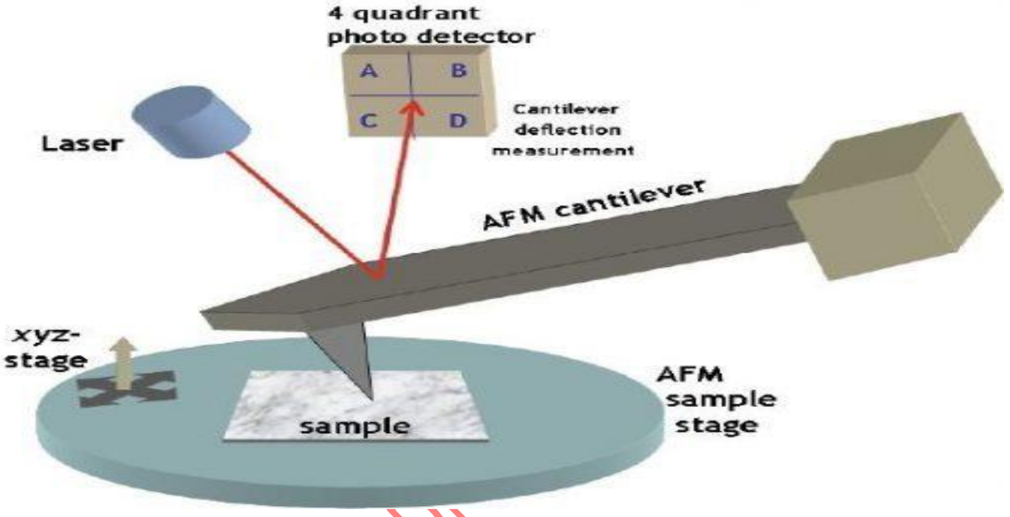
4-Atomic Force microscopy(AFM)

The atomic force microscope or scanning force microscope is one of the probe microscopes The survey has a very high resolution and has an analysis capacity of up to parts of Nanometer, through which three topographical images can be obtained Dimensions of the studied sample.



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Classification of nanomaterials

Nano scale materials are classified according to the number of dimensions they have that are not in the nanometer range, Thus, it is divided into

1-Zero-dimensional materials

These are materials whose dimensions are all more than 100 nanometers, and one of their examples is quantum dots, which have recently been used in the manufacture of solar cells and transistors.

2-One-dimensional materials

These are materials that have only one dimension larger than 100 nanometers, such as tubes and Nano filaments, which have an important role in electronics manufacturing, and are currently used in surface coatings, such as coating the surfaces of metal products to protect them from corrosion and rust, and are also used to wrap food products with the aim of protecting them from pollution, And damage.

3-Two-dimensional materials

They are materials whose dimensions are greater than 100 nanometers, and they have a Nano-crystalline structure or contain other materials that are zero, one-dimensional, or two-dimensional, which gives them some Nano-scale properties.

They are classified as one of the types of nanomaterial's, examples of which include Nano grains, as well as metal powders and ceramic materials.

Extremely soft, and we must point out here that this category of three-dimensional nanomaterial's tops the list of global production of nanomaterial's in general due to its various uses in technological applications.

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Uses of fluorines

1- As antioxidants and biological preparations.

2-Fluorines also act as antia therosclerosis and antiviral drugs.

3-Researchers are trying to modify the nano-buckyball to contain the part of the HIV virus that binds to the protein, possibly preventing the spread of the virus.

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Applications of Nanotechnology

1-Medicine .

Drug Delivery: Nanoparticles can be engineered to deliver drugs directly to targeted cells, improving the efficacy of treatments while minimizing side effects.

2-Diagnostics: Nano sensors and imaging agents enhance the detection of diseases at early stages, allowing for timely intervention.

3- Tissue Engineering: Nanomaterials are used to create scaffolds that support cell growth and tissue regeneration.

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Nano Toxicity

Nanoparticles are tiny particles that range in size from 1 to 100 nanometers. Their . unique properties, such as high surface area and reactivity, make them valuable in various applications, including medicine, electronics, and materials science. However, understanding their health and environmental impacts is crucial.

Health Effects

1-Toxicity: Some nanoparticles can be toxic to cells and may cause oxidative stress, inflammation, or other adverse effects.

2-Bioavailability: Their small size allows for easy entry into biological systems, potentially affecting organs and tissues.

3-Long-term Exposure: Chronic exposure to certain nanoparticles may lead to respiratory issues, cardiovascular diseases, and other health problems.

Environmental Effects

1-Ecotoxicity: Nanoparticles can be harmful to aquatic life and ecosystems, affecting organisms at various trophic levels.

2-Persistence: Some nanoparticles may persist in the environment, raising concerns about long-term ecological impacts.

3-Soil and Water Contamination: The release of nanoparticles into the environment can contaminate soil and water systems, posing risks to wildlife and human health.

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importance of nanotechnology

The importance of nanotechnology lies in its potential to revolutionize various fields through the manipulation of matter at the atomic and molecular scale. Here are some key points highlighting its significance:

1-Medical Advances: Nanotechnology enables targeted drug delivery systems, improving the effectiveness of treatments while minimizing side effects. It also plays a role in diagnostics, allowing for early detection of diseases.

2- Materials Science: The development of nanomaterials leads to stronger, lighter, and more durable materials. These materials can be used in construction, electronics, and consumer products.

3- Energy Efficiency: Nanotechnology can enhance the efficiency of solar cells and batteries, contributing to cleaner energy solutions. Nanomaterials can also improve the performance of fuel cells.

4- Food Safety: Nanotechnology is used in food packaging to improve shelf life and reduce contamination, ensuring safer food products.

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Lipids play a significant role in the context of nanomaterials, Here are some key points:

1-Structural Components: Lipids are fundamental components of cell membranes, contributing to the formation of lipid bilayers that can be utilized in nanocarriers for drug delivery.

2- Drug Delivery Systems: Nanoparticles made from lipids, such as liposomes, can encapsulate drugs, enhancing their solubility and bioavailability while providing targeted delivery.

3- Biocompatibility: Lipid-based nanomaterials exhibit high biocompatibility, making them suitable for biomedical applications, including imaging and therapy.

4-Stability and Release Control: Lipid nanoparticles can offer controlled release of therapeutic agents, allowing for sustained and localized treatment effects.

5- Research and Development: Ongoing research is focused on optimizing lipid formulations for various applications, including cancer therapy, vaccines, and gene delivery.

6- Nanostructured Lipids: Solid lipid nanoparticles and nanostructured lipid carriers combine solid and liquid lipids to enhance drug loading capacity and stability.

7-Surface Modification: The surface of lipid nanoparticles can be easily modified with ligands or antibodies to improve targeting to specific cells or tissues