Tikrit University
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Subject name: Special Material\Nano

Subject year:2025\ 3 \11

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Lect.5.

Preparation of Nanoparticaies by physicalmethod:

Physical methods include the following:

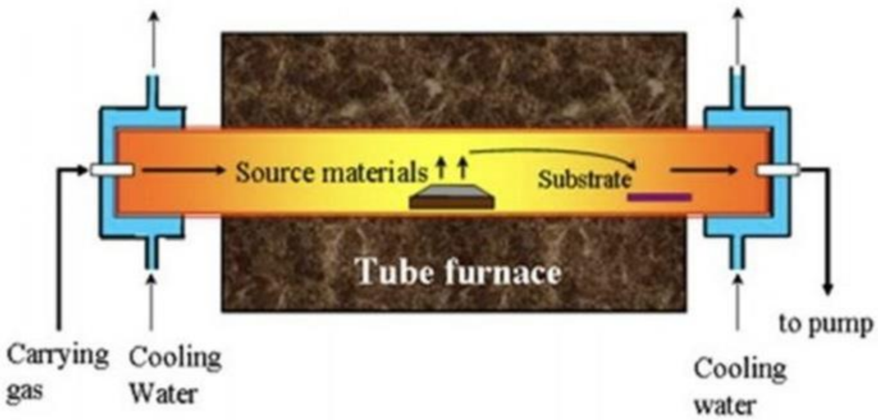
1-Physical vapor deposition

2-Arc discharge method

3-Laser method

1-Physical vapor deposition:

The thermal evaporation process is essentially a physical vapor deposition process and has been successfully used to fabricate a variety of oxidized and non-oxidized nanobelts and nanowires. This method can also be used for chemical vapor deposition (CVD) simply by applying reaction gases in the middle of the tube Evaporation instead of the carrier gas and placing the substrates in the thermal is one of the most common preparation methods. The vapor deposition method consists of sublimating (materials) in the form of powder at a high temperature, and subsequent deposition of vapor in a certain temperature region to form the desired nanostructures.



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2-Arc discharge method

The arc discharge method The arc discharge technique in generally involves the use of two high-purity graphite electrodes, the anode is either pure graphite and contains metals, the metals are mixed with graphite powder and inserted into a hole made in the center of the anode and the electrodes are momentarily connected by striking an electric arc, and the preparation is carried out under low pressure of in a controlled atmosphere consisting of inert gas and or reactive gas, and the distance between the electrodes is reduced until the current flows between (50-150), the temperature in the area between the electrodes is so high that the carbon rises to the positive electrode (anode) consumed, a constant gap is maintained between the anode and the cathode by adjusting the position of the anode and the plasma is formed Between the electrodes, the plasma can be stabilized for a long reaction time by controlling the distance between the electrodes by controlling the voltage (25-40 V), and the reaction time ranges from (30-60 seconds to 2-10 minutes), to form different types of products in different parts of the reactor, to form large amounts of rubbery soot on the walls of the reactor in the form of web-like structures between the cathode and the walls of the chamber and gray solid deposits at the end of the cathode, (D. E. Hanson), and a spongy collar around the cathode deposits and the metals commonly used are (Mo, Fe, CO, Ni), either alone or in a mixture, and better results are obtained using bimetallic catalysts, and there are also amorphous carbon and coated metal nanoparticles and polyhedral carbon, the reaction time ranges from (30-600 seconds) to 2-10 minutes.

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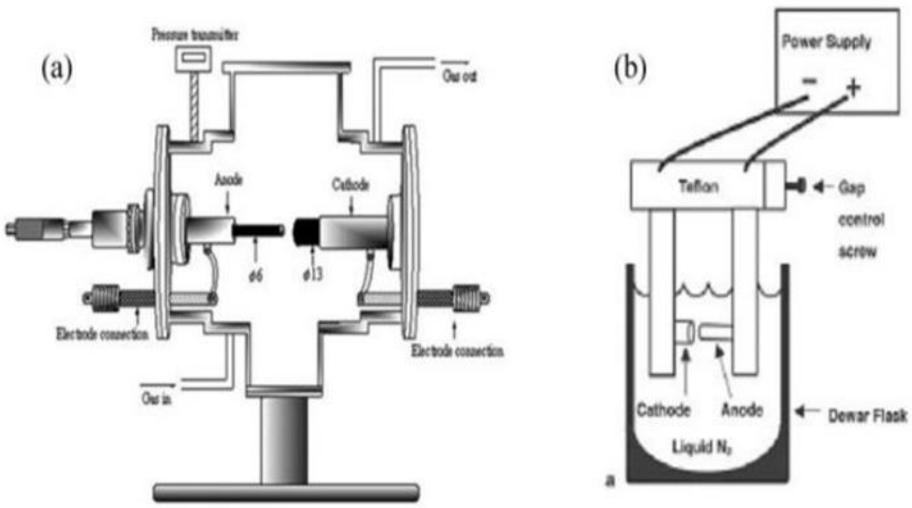
(a)
Pressure transmitter
Gas out
Anode
Cathode
ϕ6
ϕ13
Electrode connection
Electrode connection
Gas in
(b)
Power Supply
−
+
Teflon
Gap
control
screw
Cathode
Anode
Dewar Flask
Liquid N₂
a

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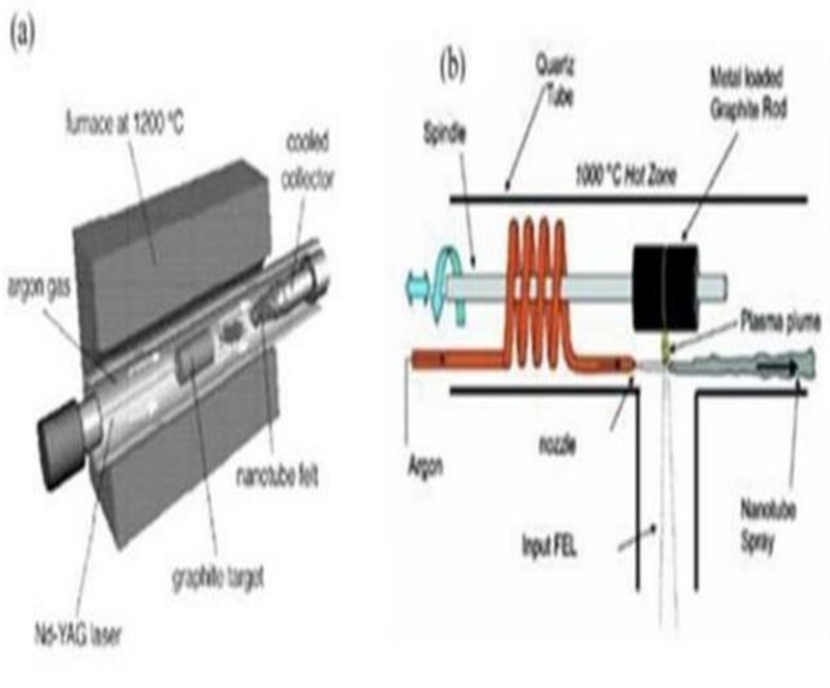
3-Laser method

Pulsed laser ablation process for producing single-walled carbon nanotubes, the method is shown in Figure, it uses a laser ablation method for the mass production of single-walled carbon nanotubes and the method involves using a dual laser beam and the nanotubes produced by laser ablation are characterized by higher purity (up to about 90%) and better drawn structure than those produced in the arc process, the disadvantages of this method are the presence of small carbon deposits and the laser ablation technique is used to help grow single-walled carbon nanotubes (MWNTs) only using special reaction conditions.



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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.

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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.