

Al-Mustaqbal University-College

Department of medical physics

The Second Stage



Fourth lecture

Nano-Material Fabrication Methods

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Classification of Fabrication Methods of nano-materials

Nano-Material Fabrication Methods

- ✓ **Mechanical Grinding (Milling)**
- ✓ **Thermal Evaporation Method Using Tube Furnace**

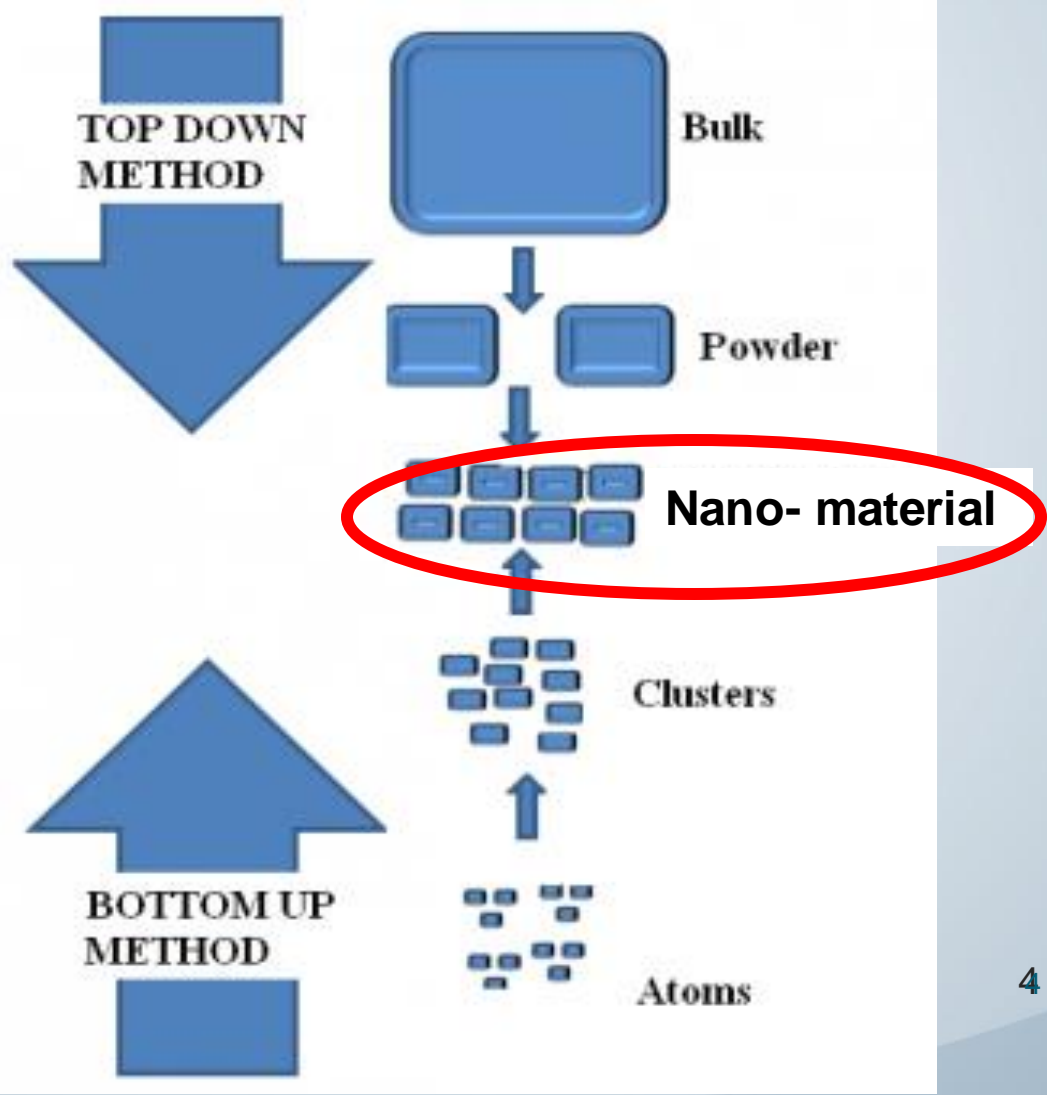
Classification of Fabrication Methods of nano-materials

Top-down Method

Bottom-up Method

Classification of Fabrication Methods of nano-materials

Top-down Method

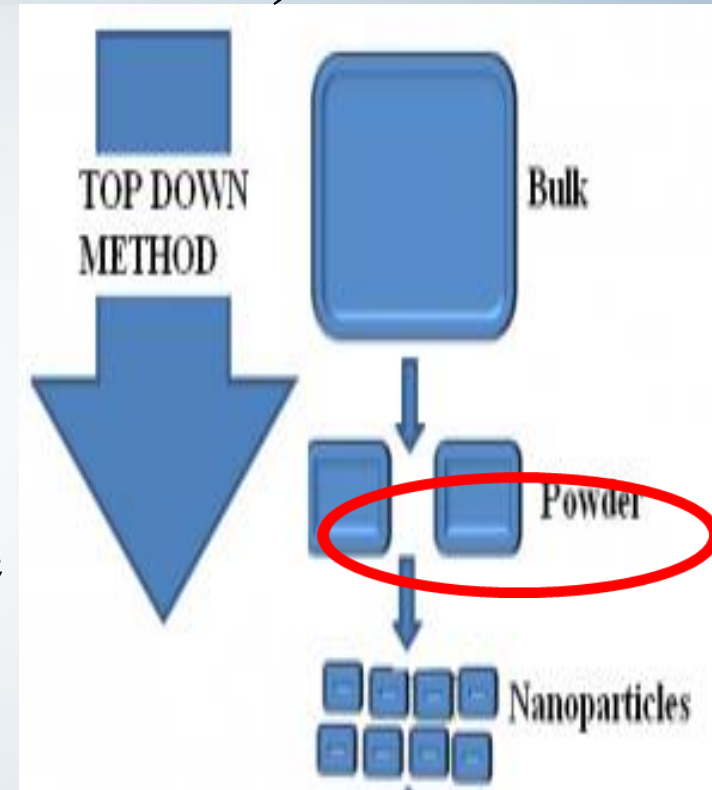


Bottom-up Method

There are two main ways to classification of fabrication methods of nano-materials;

1- Top-down Method

Top-down method is reduced in size of material from large size to smallest size at nano-scale.. These techniques include

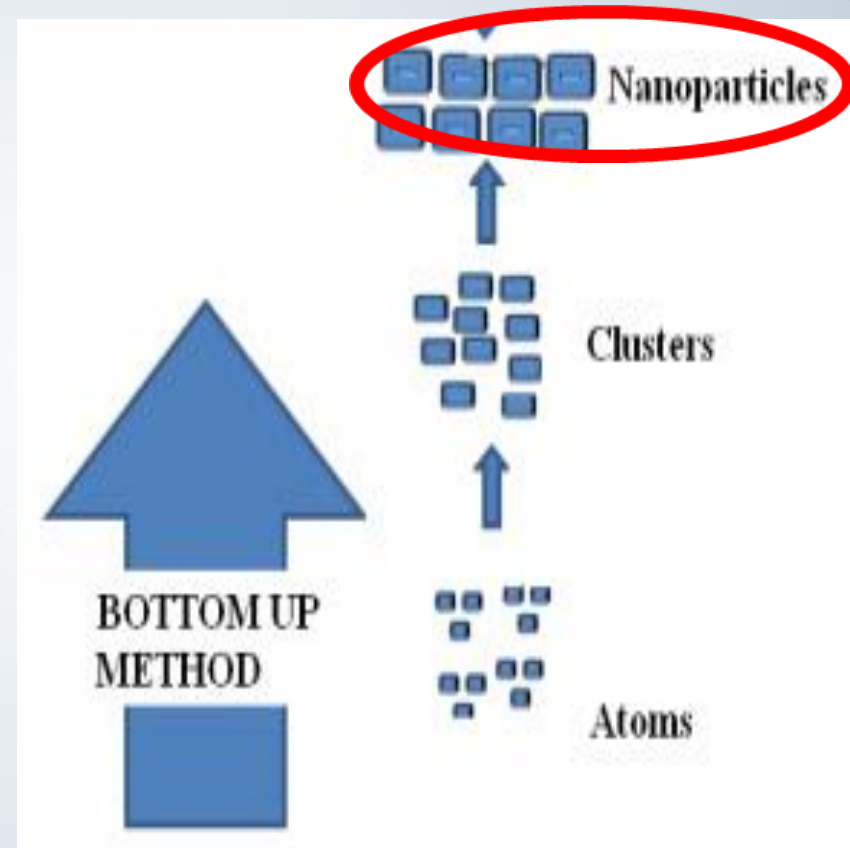


Mechanical Grinding (Milling)

There are two main ways to classification of fabrication methods of nano-materials;

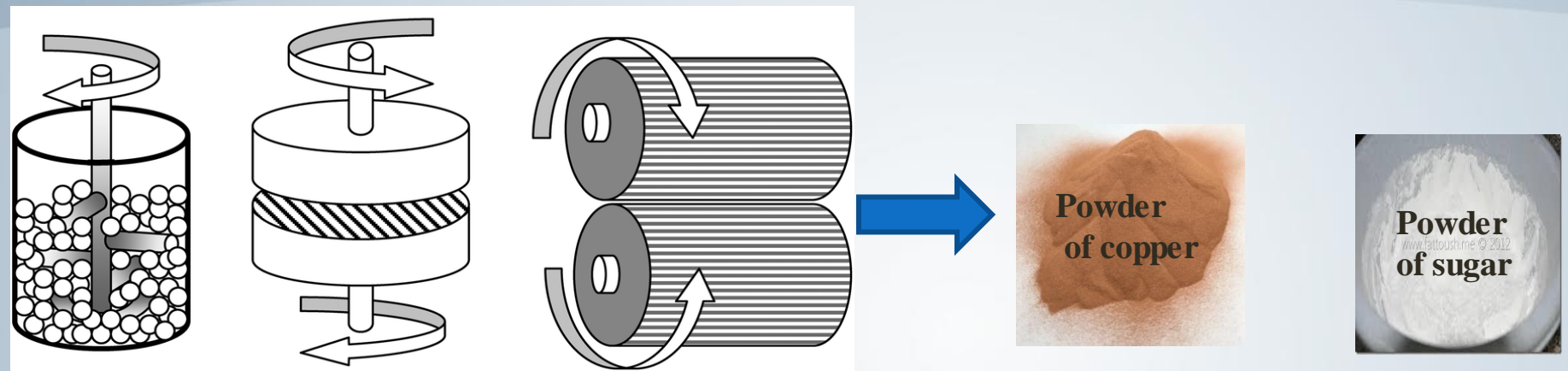
2- Bottom-up Method

Bottom-up method is build larger structures of nano-materials by atom or molecule. These techniques include;



Thermal Evaporation Using Tube Furnace

Mechanical Grinding (Milling)



What is mechanical grinding (milling)?

Mechanical grinding is a typical example of ‘top down’ method which carried out by decomposition of structures or materials, where achieved using electric mixers at high energy with mills vibrators or non-vibrators

What are the properties of mechanical grinding (milling)?

- (i) Simple method.**
- (ii) Cheap equipment.**
- (iii) Possibility of making of all types of materials.**
- (iv) Possibility for increasing the quantities of material.**

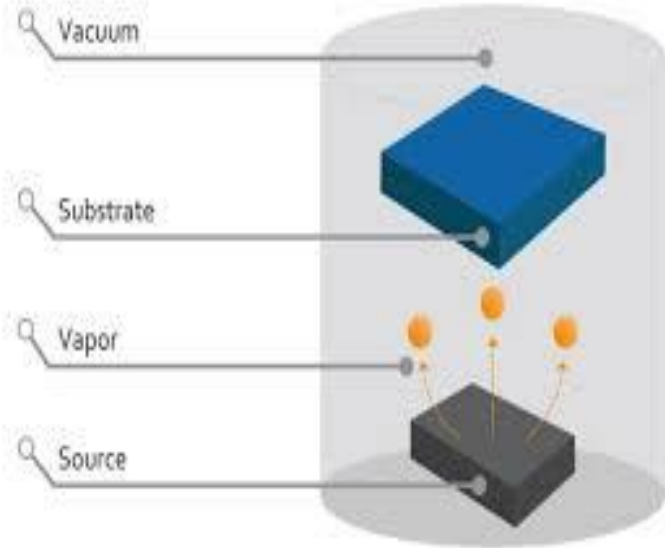
What are the problems of mechanical grinding (milling)?

- (i) Impurity from milling media and/or atmosphere.**
- (ii) Product is not uniform in size of nano-crystalline .**

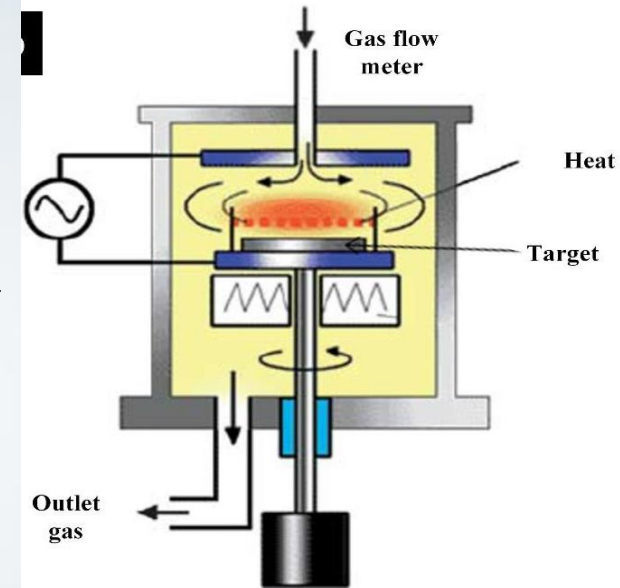
What are the factors affecting mechanical grinding speed?

- (i) Rotational or vibration speed**
- (ii) Size and number of the balls used**
- (iii) Ratio of the ball to powder mass**
- (iv) Time of milling**
- (v) Milling atmosphere.**
- (vi) Milling in cold liquids can reduce the dimensions of powder particles.**
- (vii) Stop oxidation is necessary to get a good size and uniform of particles.**

Thermal Evaporation



Thermal evaporation method using tube furnace



What is a thermal evaporation method?

Thermal evaporation method means heating the powder in the tube. During the heating process, the atoms of powder will evaporated inside the tube. The vapor of the powder will condense into the substrate to produce nano-particles.

What are the factors affecting thermal evaporation using tube furnace?

- i) Rate of evaporation
- ii) Rate of condensation
- iii) Rate of gas flow
- iv) Type of substrate



Thank
You

