

# Nano material Synthesis & Controlling Aspects: A State-of-the-art Review

REENA KUMARI

Government College, Bahadurgarh, Haryana

## Abstract

Nanomaterials can be delivered with different strategies: Mechanical processing, Electrospinning, Chemical vapour deposition method, laser pyrolysis, solvation method, hard and soft template strategy and Reverse micelles. This review explicit different thermodynamic elements and controlling variables influencing the Nano-scale development of nanomaterials. This survey addresses comparative examination of different strategies of synthesis of nanoparticles, class of compounds developed and comparative advantages.

## Introduction

The first academic talk about the nanotechnology was given by Nobel prize laureate Richard Feynman in 1959 during the American physical society annual meeting. Feynman explained in his talk about requirement of appropriate techniques that can overcome our limitation of not working at atomic and molecular level. Then Norio Taniguchi was the first person to introduce term nanotechnology in 1974. Currently the field of nanotechnology is evolving day by day due to its diverse application in every field.

## Design/Other information

S.No	Name of Method	Class of Compound Synthesized	Advantages
1	Chemical vapour deposition	Carbon Nano tubes multi layer and mono layer graphene	Formation of high quality two dimension materials.
2	Ball milling	Oxides and carbides, Transition metal nano alloy	Nanomaterials satisfy Energy storage and energy conversion demands.
3	Sol - gel method	Nano particles	Economically friendly, Homogeneous nature, Performed at low temperature
4	Laser ablation	Metal nanoparticles, carbon nanomaterials, Oxides and ceramics	It is green technique in which stabilizing agent or other chemicals are not needed.
5	Reverse micelle method	Nanoparticles	Nanoparticles with precisely controlled size, fine and mono dispersed in nature

## Set up

Various Bottom up approach are as follows :

Chemical vapour deposition, Sol- gel method, Hard and soft templating and Reverse micelle method.

Various Top Down Approach:

1. Mechanical milling
2. Electro spinning
3. Sputtering
4. lithography
5. The arc discharge method

## Results

- In ball mill process number, size and density depends upon mill used to process it.
- Formation of vapour using various technique depend upon physicochemical properties of the compounds to be vaporized.
- Condensation of vapour to obtain large number of particle depends upon critical germ size and nucleation rate.
- Conditions Play important role in achieving different carbon based nanoparticles.
- Average size distribution is controlled in laser pyrolysis by adjusting fluence, wavelength and laser salt addition.
- In sol gel method final products depends upon nature of Precursor hydrolysis rate, aging time, pH, molar ratio between water and precursor
- In hard and soft templating methods the product depends upon surfactant and precursor concentration, surfactant structure and environmental condition.
- Size of nanoparticles controlled by varying water to surfactant ratio & decrease water concentration results in smaller droplets.

## Conclusion

Nano powders produced in a temperature gradient with a corresponding vapour density gradient. The predominant harmful effect destroying nanometric scale is coalescent coagulation. Future perspective is to develop green technique such as laser ablation.

## References

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