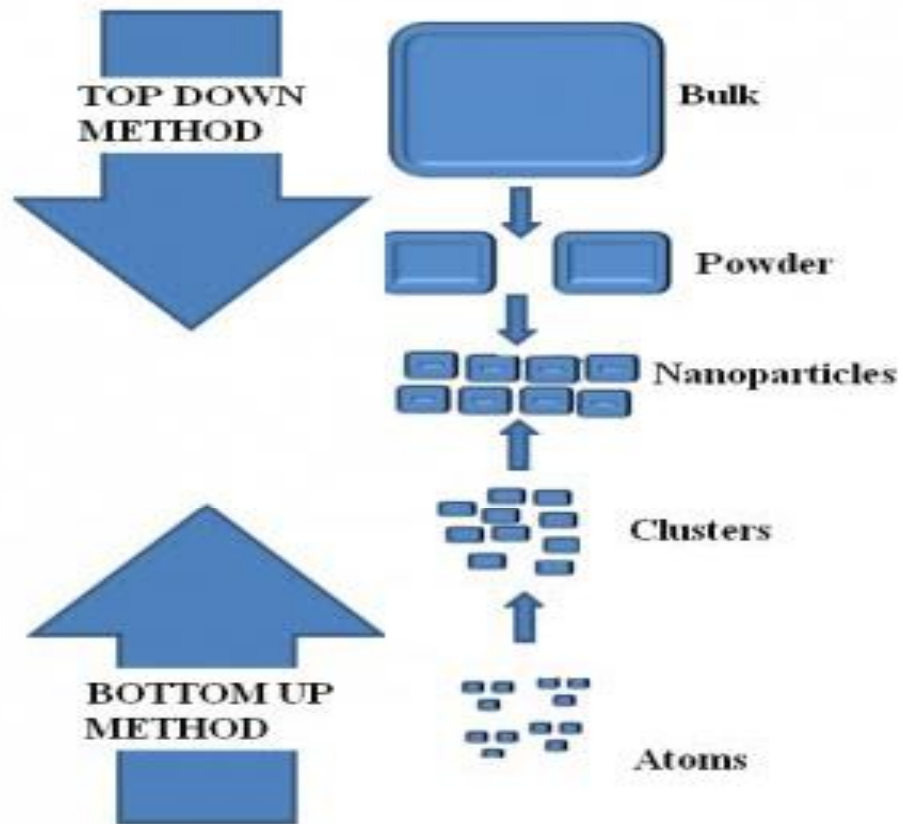


BOTTOM-UP APPROACH

What is bottom-up approach?

- Opposite of top-down approach.
- Build up of a material from the bottom-atom by atom, molecule by molecule or cluster by cluster.

Bottom up approach



Ideas

- Nature uses bottom up approach.
 - cells
 - Crystals
 - Humans
- Chemistry and biology can help to assemble and control growth.



Why it is needed?

- Certain structures like Carbon Nanotubes can be grown.
- New technologies-organic semi conductors employ this.
- Formation of films and structures easier.
- Most economical than top-down approach.
- Does not waste material to etching.

Processes used for bottom up approach

- Chemical processes based on transformation in solution
- Some examples are sol-gel processing , chemical vapour deposition , laser pyrolysis etc.,
- Sol-gel process differs from other chemical processes due to its relatively low processing temperature.

How to control the growth?

There are two general ways available to control the growth of the nanoparticles. They are

- **ARRESTED PARTICIPATION:**

It is introduction of a chemical that would block the reaction.

- **PHYSICAL RESTRICTION:**

That is restriction of the volume available for the growth of the individual nanoparticles.



APPLICATIONS

- Formation of Nanowires.
- Nanotube transistor.
- Carbon nanotube interconnectors.

CONCLUSION

- Newer technologies requires bottom up approach.
- It will become more and more prevalent in semiconductor manufacturing.



THANK YOU