

**Nano structured materials-synthesis, properties, self assembly and applications  
by Prof. A.K. Ganguli, Chemistry Department,  
IIT Delhi, New Delhi.**

**MODULE 3 (LECTURE 13 & 14): NANOCOMPOSITES**

***Problem:***

1. What are composites.
2. What are nanocomposites.
3. What is the importance of nanocomposites.
4. What is the difference between nanocomposites and conventional composites.
5. Applications of nanocomposites.
6. Highlight the main properties of nanocomposites.
7. How the depth of scratch in films decreased by incorporation of nanocomposites.
8. What are polymer nanocomposites.
9. What can be predicted from multiscale modeling of polymer nanocomposites.
10. What is the role of polymer nanocomposites in biological applications.
11. What are ceramic – matrix nanocomposites.
12. What is the second component in a ceramic – matrix nanocomposites.
13. What are the applications of ceramic – matrix nanocomposites.
14. What are the different types of nanocomposites.
15. What are the different methods for synthesis of nanocomposites.

## MODULE 3 (LECTURE 13 & 14): NANOCOMPOSITES

### **Solution :**

1. Composites - are materials made from two or more constituent materials with significantly different physical or chemical properties, that when combined, produce a material with characteristics different from the individual components.
2. Nanocomposites - composites which have nano size ingredients.
3. Superior overall properties compared to constituent properties.
4. Nanocomposites have exceptionally high surface to volume ratio of the reinforcing phase and high aspect ratio compared to conventional composite materials.
5. Lithium ion batteries, magnetic microwave absorbents, fuel cells, aerospace and marine applications
6. Mechanical properties – increase ductility with no decrease of strength, scratch resistance  
Optical properties – light transmission characteristics particle size dependent
7. Scratch depth in gelatin films and tearing within the scratch decrease with addition of nanoscale alumina fillers
8. One of the component is polymer to which added nanomaterial.
9. Polymer/particle interaction  
Particle/particle interaction
10. HAP- hydroxyapatite polymer nanocomposites used as osteoconductive substitute for bone repair and implantation.
11. Main part of the volume is occupied by a ceramic and encompass a metal as the second component
12. Metal
13. Ceramic cutting tool, heat shield system for space vehicles
14. Ceramic-matrix nanocomposites, metal-matrix nanocomposites, polymer-matrix nanocomposites
15. Sol gel route, co-precipitation, wet chemical methods, solid state approach.