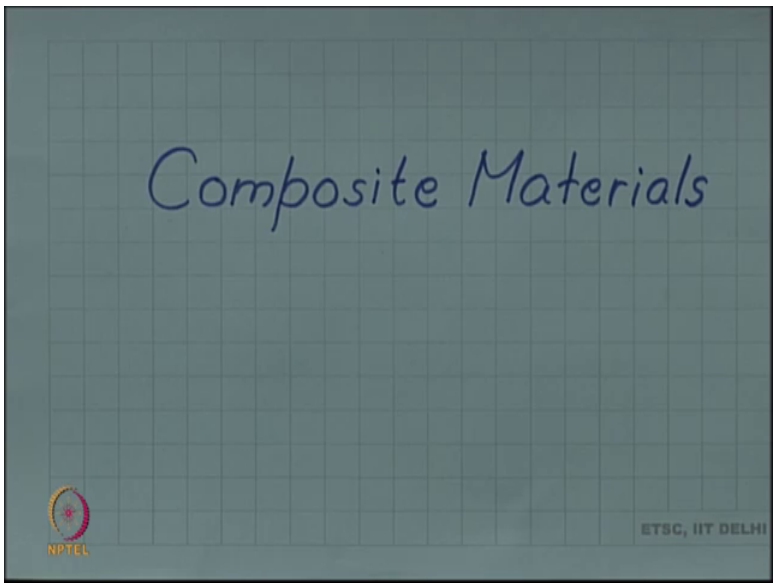
Introduction to Materials Science and Engineering
Prof. Rajesh Prasad
Department of Applied Mechanics
Indian Institute of Technology, Delhi

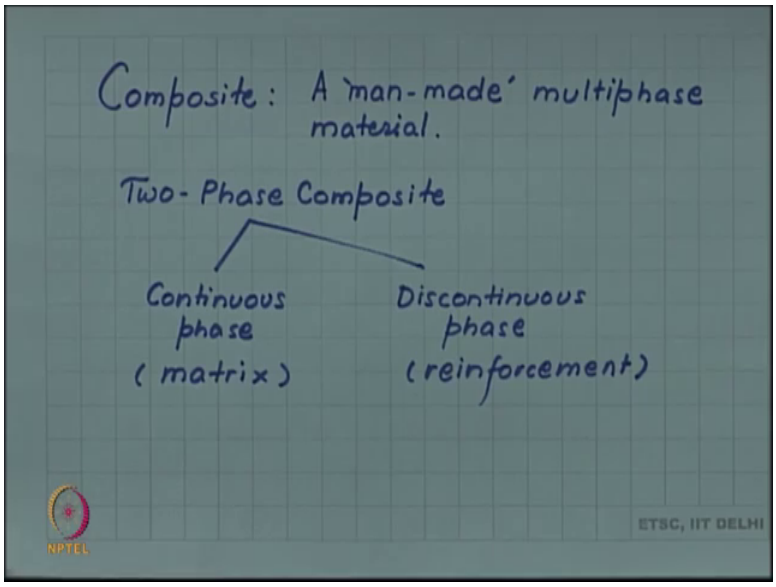
Lecture -134
Composites

(Refer Slide Time: 00:06)



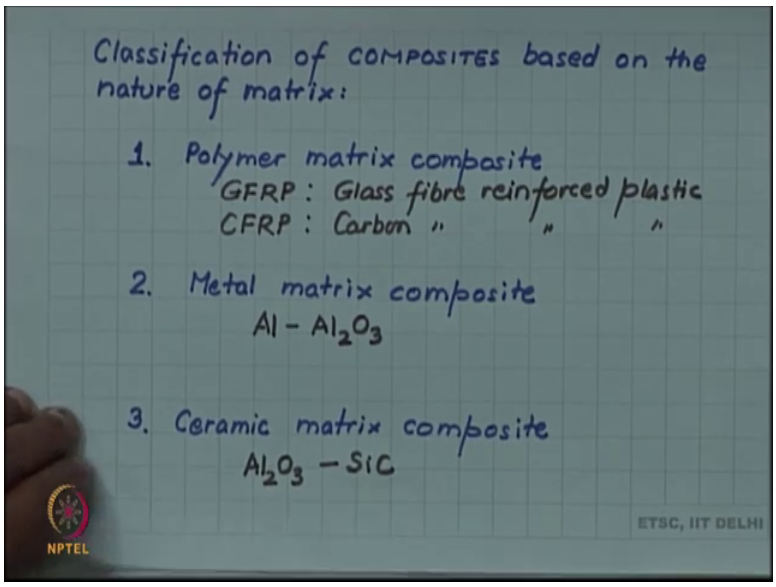
An important class of material is composite materials.

(Refer Slide Time: 00:14)



By composite material we mean a manmade multi phase material. We have met multi phase material previously like steel in which ferrite and cementite is there but that we will consider because ferrite and cementite both phases form during natural cooling of a steel from the austenite phase. So, that by manmade we mean that the two phases were individually existing and then they were put together to form this composite material. Out of two phases; one is generally a continuous phase which is called matrix and another is discontinuous phase which is called reinforcement; although, in some composites like sandwich composite both phases may be discontinuous.

(Refer Slide Time: 01:11)



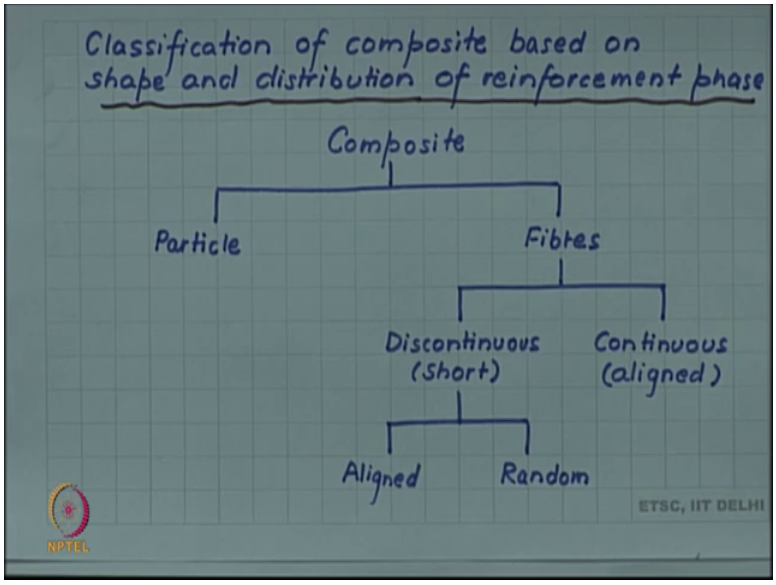
Now composites can be classified on the basis of the nature of matrix. So, we have polymer matrix composite, metal matrix composite and ceramic matrix composite depending on whether the matrix is polymer or metal or ceramic. Example of polymer a matrix composite will be for example, in GFRP which is short for glass fiber reinforced plastic glass fiber reinforced plastic. So, in this in a plastic; for example, polypropylene or epoxy glass fibers are put. So, that is class and for reinforcement.

So, glass fiber reinforced plastic or we have CFRP carbon fiber reinforced plastic. Many times in sports equipment like racket and all are sold as carbon racket; they are actually carbon fiber reinforced plastic. Similarly, many commercial products are known to be made of fiberglass.

But fiberglass is actually glass fiber reinforced plastic. Then you have metal matrix composite, an example a of metal matrix composite one can take aluminium as the matrix and reinforce it with its own oxide Al 2 O 3. So, Al 2 O 3 is alumina is reinforcement and aluminium is the matrix. Ceramic matrix composite in the matrix will be ceramic. So, let us take ceramic Al 2 O 3 alumina as the matrix, this can be reinforced with silicon carbide fibers.

So, silicon carbide fibers can be used as a reinforcement for alumina ceramic. So, it is a ceramic matrix composite.

(Refer Slide Time: 03:37)



Here I show you a classification scheme of composite based on shape and distribution shape and distribution of reinforced reinforcing phase. So, the reinforcing phase can be particle. So, we will say a particle or particulate composite or can be fiber we will call it a fiber composite. The fiber the reinforcing fiber can either be discontinuous or short fibers or can be continuous and long fibers which are aligned. The discontinuous short fiber can also be aligned or could be random.

So, depending on the orientation and shape of the reinforcement, we can classify the composite into different classes as shown here.