

November 2016

HASEEB KM
S3 ME

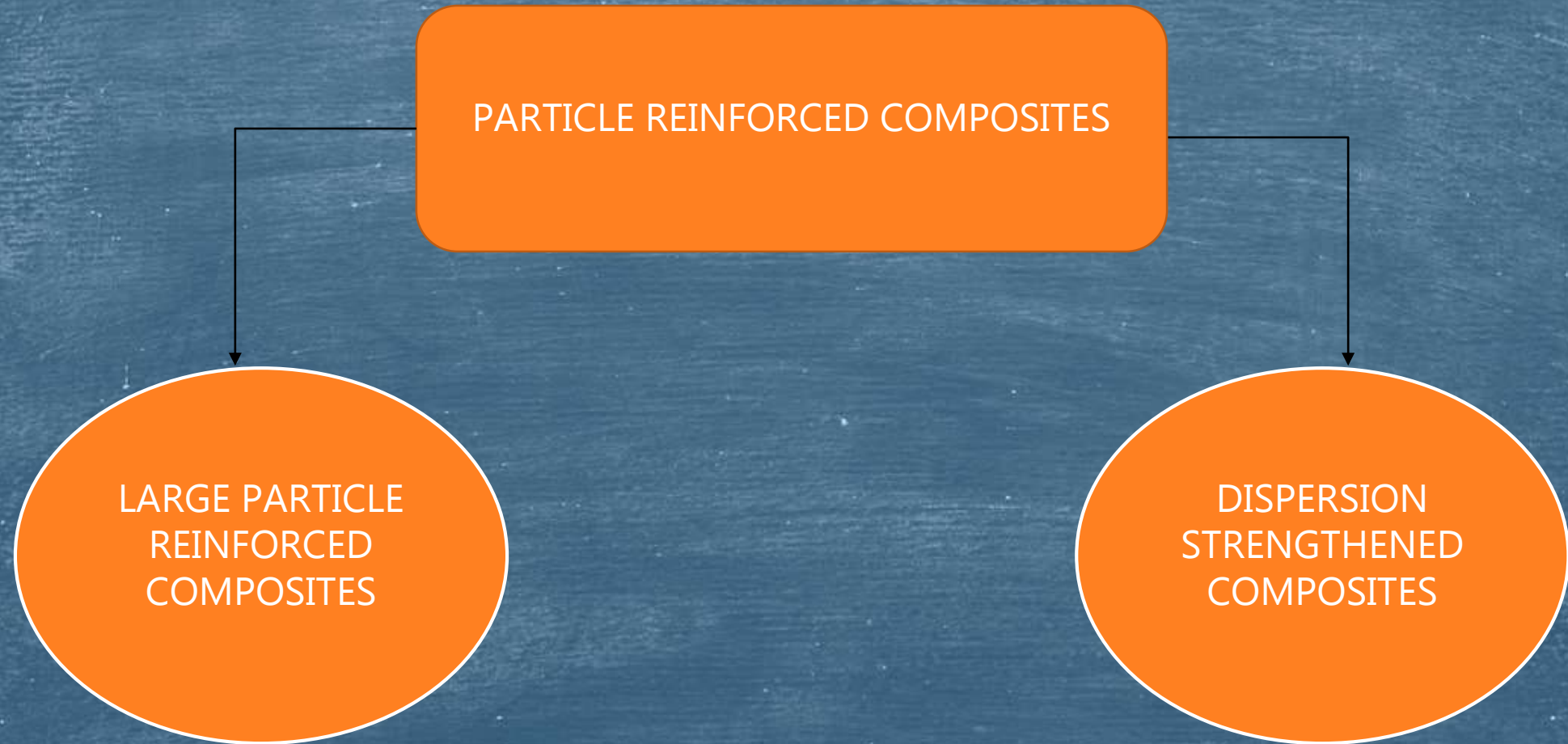
PARTICLE REINFORCED COMPOSITES

“With the help of composite material technology, design engineers will be able to choose material for their product under consideration”

Overview

- ▶ Composite:- Physical mixture of two or more materials that are chemically different and separated by a distinct interface.
- ▶ The need of new material in the field of technology.
- ▶ In order to obtain the required properties.
- ▶ It can be broadly classified as:
 - (1) Particle reinforced composites
 - (2) Fibre reinforced composites

Area of study...



LARGE PARTICLE REINFORCED COMPOSITES

- ▶ The particle-matrix interaction is treated in macroscopic level.
- ▶ Particle size=1-50 μm .
- ▶ Concentration=15-40% by volume.
- ▶ Particulate phase is harder and stiffer than matrix.
- ▶ Matrix phase transfers applied stress to particle which bears most of the applied load.
- ▶ Reinforcement depends on volume fraction and strength of bonding.
- ▶ Particles of different dimensions should be equiaxed.

Some examples...

► Cermets

Are composites of ceramic particles (strong, brittle) in a metal matrix (soft, ductile) that enhances toughness. For instance, tungsten carbide or titanium carbide ceramics in Co or Ni. They are used for cutting tools for hardened steels.



► Vulcanized rubber

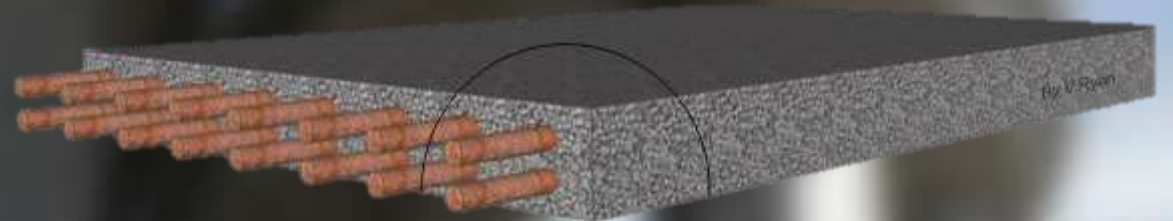
Vulcanized rubber is a material that undergoes a chemical process known as vulcanization. This process involves mixing natural rubber with additives such as sulfur and other curatives. Also called reinforced rubber.

- Obtained by strengthening with 20-50 nm carbon-black particles. Used in auto tires.



► Concrete

The most common large-particle composite is concrete, made of a cement matrix that bonds particles of different size (gravel and sand). cement is a fine mixture of lime, alumina, silica, and water. Concrete is cement strengthened by adding particulates. The use of different size (stone and sand) allows better packing factor than when using particles of similar size. *Reinforced concrete* is obtained by adding steel rods, wires, mesh. A common use is in railroad or highway bridges.



DISPERSION STRENGTHENED COMPOSITES

- ▶ Uniformly dispersed fine, hard and inert particle is used for reinforcement
- ▶ Particle size $< 0.1\mu\text{m}$
- ▶ Volume fraction is between 15-40%.
- ▶ More stronger than pure metal.
- ▶ Can be metallic, nonmetallic, intermetallic.
- ▶ Dispersoids are carbides, oxides, borides.
- ▶ Shape can be round, disc, needle(max strength).

-
- ▶ Matrix-Load bearing phase
 - ▶ Matrix is strengthened by impeding motion of dislocations or by the interaction between dispersoids and matrix.
 - ▶ Strengthening is happened at elevated temperature for extended periods of time.
 - ▶ Strengthening depends on size of particle and intermolecular spacing.

(Use of very hard, small particles to strengthen metals and metal alloys. The effect is like precipitation hardening but not so strong. Particles like oxides do not react so the strengthening action is retained at high temperatures.)

Some examples...

- ▶ SAP(Sintered aluminium powder/product)

Fine Al_2O_3 particles are dispersed in pure aluminium matrix and TD-Nickel.

- ▶ Thoriated cobalt and tungsten(Similar).



Much more...

THANK YOU... 

