Classification of Materials

Thapar Institute of Engineering & Technology
(Deemed to be University)
Bhadson Road, Patiala, Punjab, Pin-147004
Contact No. : +91-175-2393201
Email : info@thapar.edu

THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

Syllabus

Structure of solids: Classification of engineering materials, Structure-property relationship in engineering materials, Crystalline and non crystalline materials, Miller Indices, Crystal planes and directions, Determination of crystal structure using X-rays, Inorganic solids, Silicate structures and their applications. Defects; Point, line and surface defects.

CLO: Classify engineering materials based on its structure.

CLO: Draw crystallographic planes and directions.

Engineering Materials

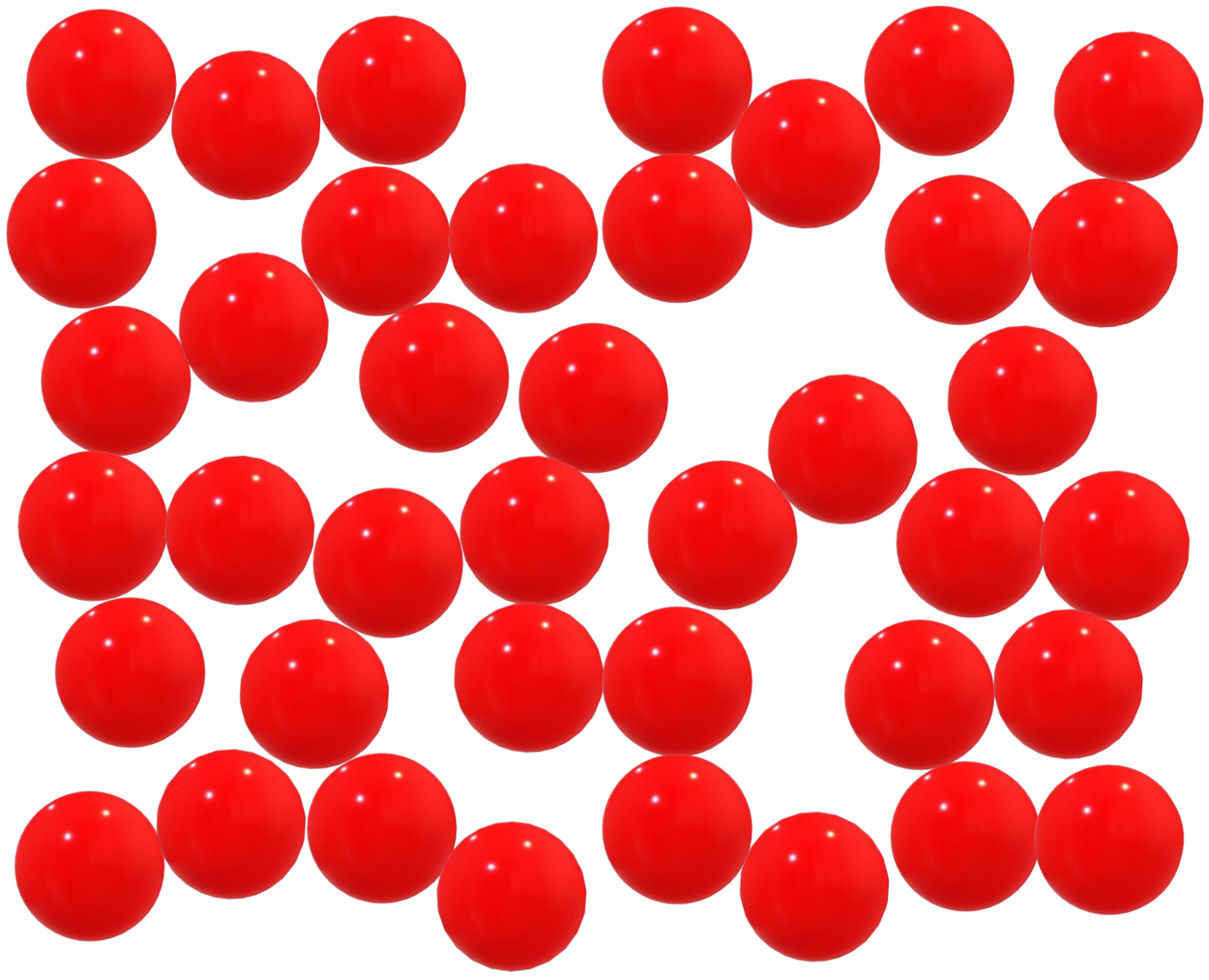
Metals and Alloys

Ceramics and Glasses

Polymers

Amorphous Solid

Particles

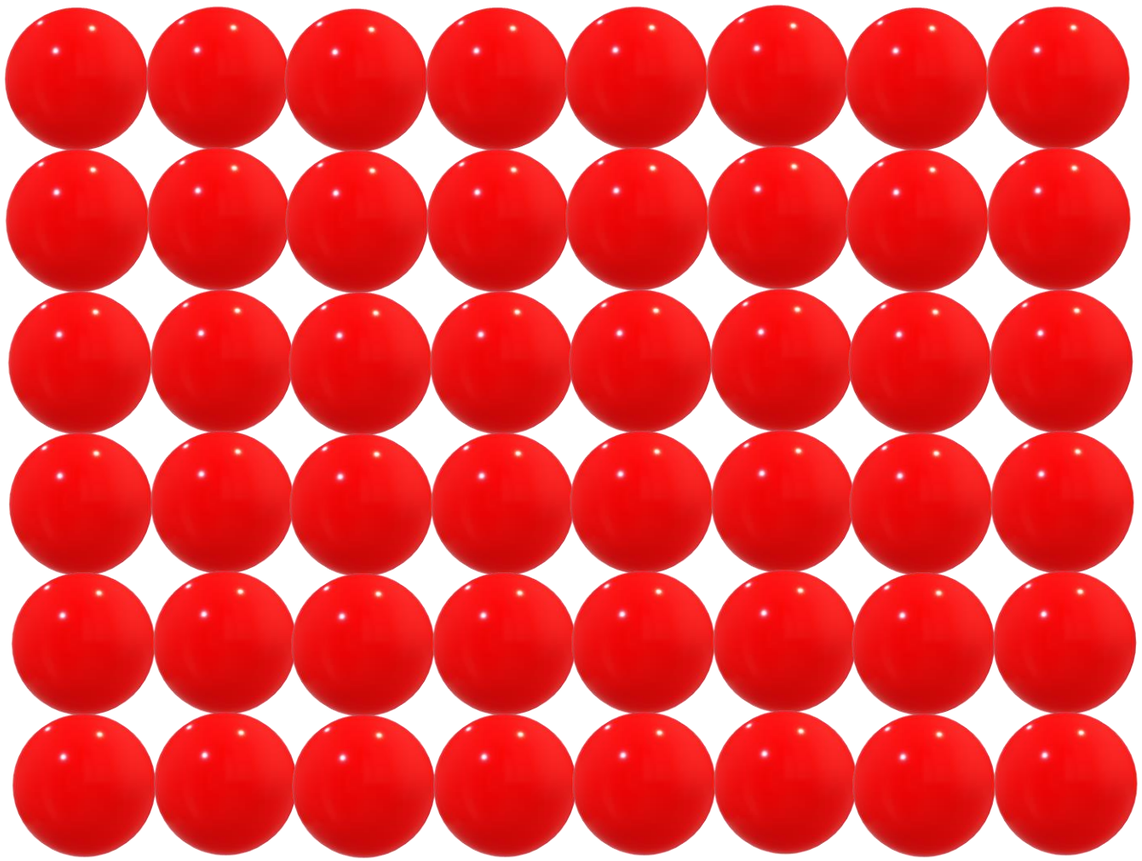


Example: Cotton candy

Generally glasses are amorphous

Crystalline Solid

Particles



Example: Table Salt

Generally metals are crystalline

Properties

Metals

- Ductile
- Opaque
- Good mechanical strength
- Good conductor of heat and electricity

Ceramics

- Hard and Brittle
- Glasses are transparent/translucent
- High Melting point
- Good mechanical strength
- Bad conductor of heat and electricity

Polymers

- Ductile
- Poor tolerance to heat
- Non corrosive
- Light weight
- Low mechanical strength
- Bad conductor of heat and electricity

Common Engineering Materials

Metals

Metals: Cu, Ni, Fe, Au, Si, Al, Brass (Cu-Zn alloy)

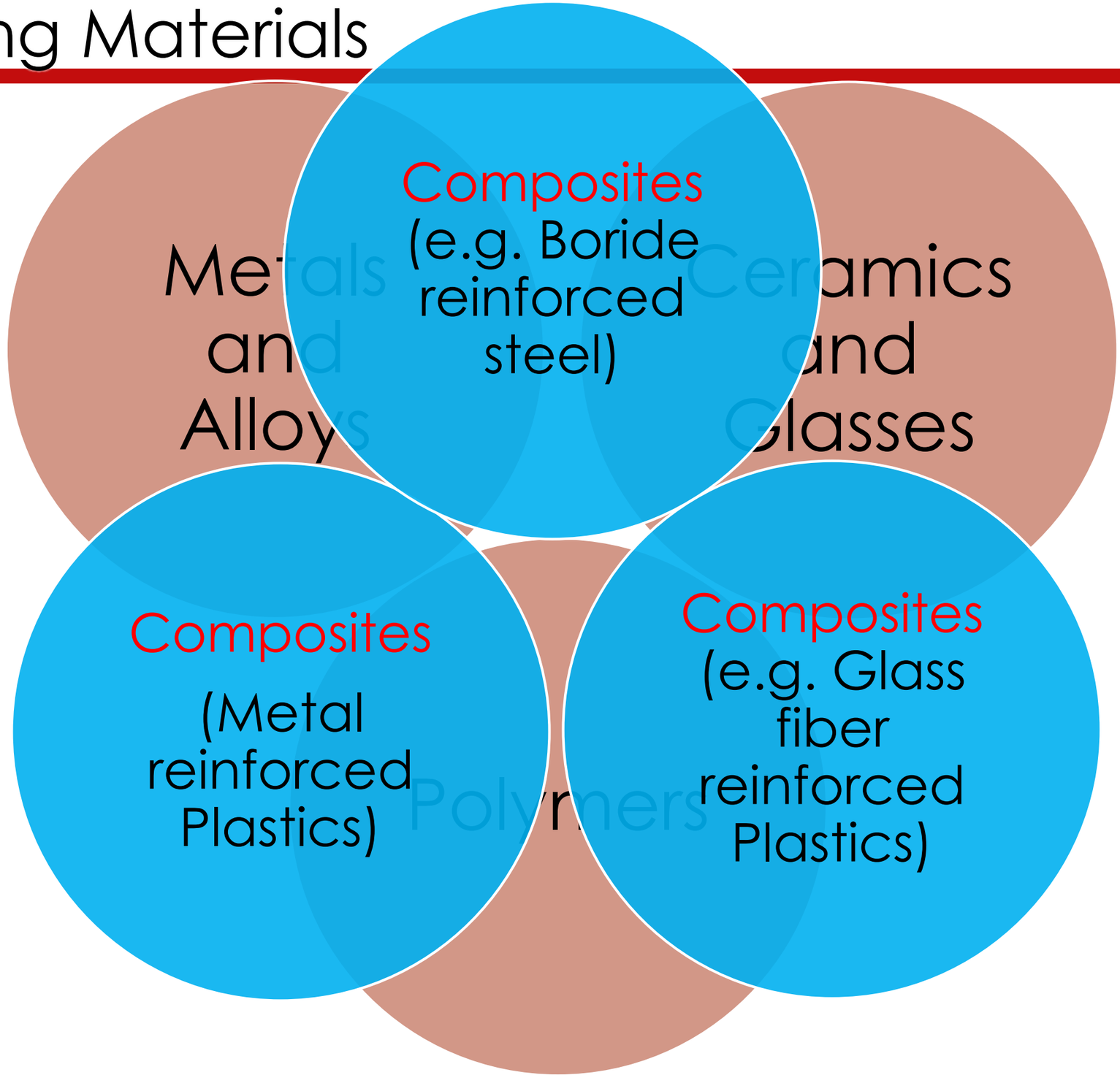
Ceramics

Ceramics: Usually oxides, nitrides, carbides) Alumina (Al_2O_3), Zirconia (Zr_2O_3)

Polymers

Polymers: Thermoplasts, Elastomers, Polythene, Polyvinyl Chloride (PVC), Polypropylene, Nylon

Engineering Materials



Remember

- Alloys have two or more than two metals. At least on of the element should be a metal.
- Composites have two different material types.

Properties of Materials

Property is the response to the stimulus

Mechanical
- Tensile strength
- Hardness
- Ductility
- Brittleness

Electrical
- Resistivity
- Electrical Conductivity

Thermal
- Thermal conductivity
- Specific Heat

Physical
- Density
- Porosity

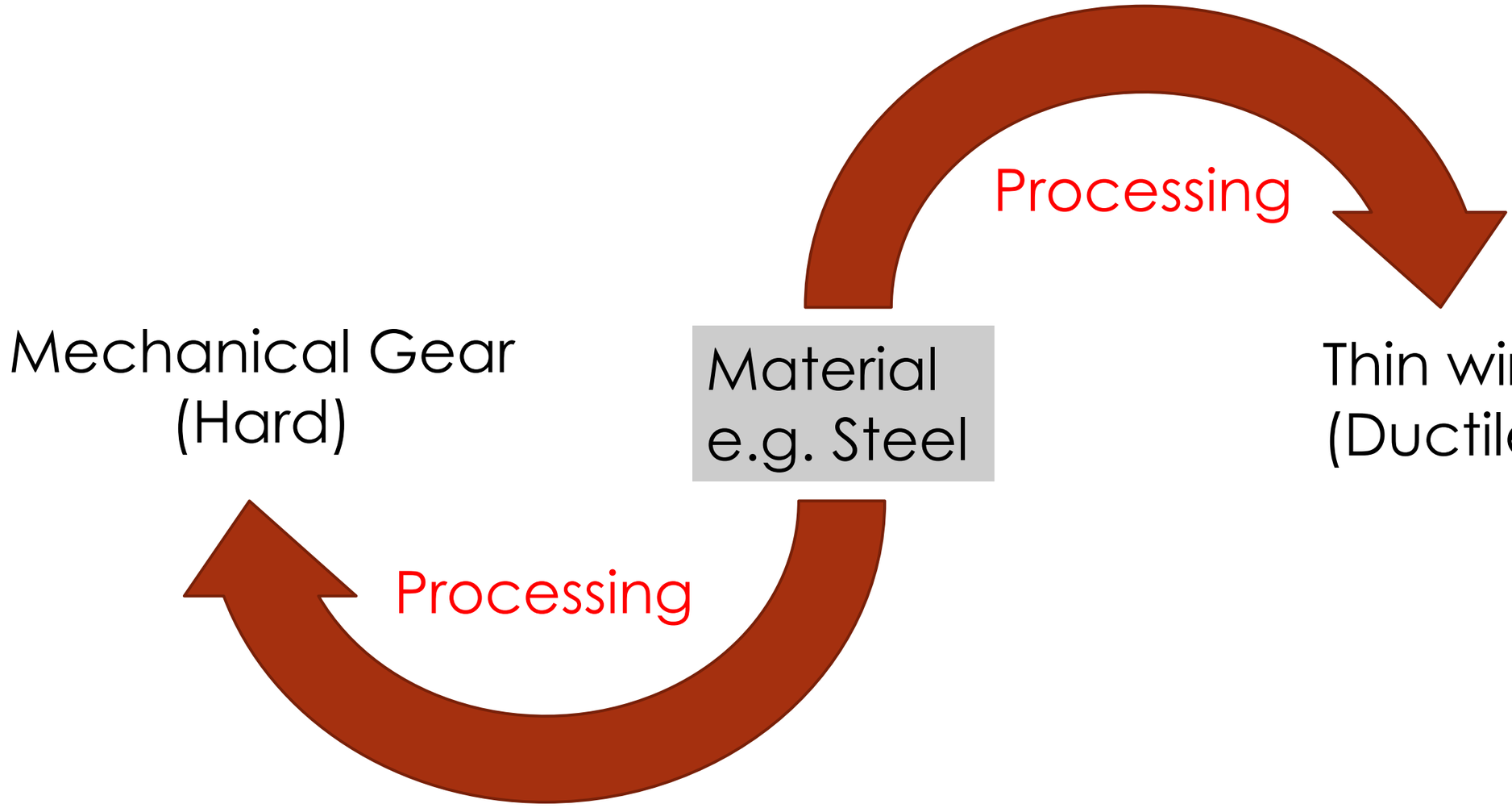
Optical
- Refraction
- Reflection
- Absorption
- Transmission

Magnetic
- Ferromagnetism
- Diamagnetism
- paramagnetism

Dielectric
- Polarizability
- Dielectric constant
- Ferroelectric
- Piezoelectric

Materials design approach

- Processing of material is very important to get desired properties.
- Properties are depend on the structure of the material.



Summary

1. Alloys have two or more than two metals. At least on of the element should be a metal.
2. Composites have two different material types.
3. Response to the stimulus is called as properties.
4. Properties needs specific structure for optimum performance.