



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)



Department of Aerospace Engineering

23AST101-Fundamentals of Aerospace Engineering

UNIT-3:

AIRCRAFT
STRUCTURES AND
MATERIALS

Metallic and Non Metallic Materials

Mr.N.Venkatesh (AP/Aerospace)



Materials can be broadly classified into **metallic** and **non-metallic** based on their composition, properties, and applications.

1. Metallic Materials

Metallic materials are composed of **metals or metal alloys** and exhibit properties such as high electrical and thermal conductivity, malleability, ductility, and luster.

Types of Metallic Materials:

Pure Metals:

Examples: Iron (Fe), Copper (Cu), Aluminum (Al), Gold (Au), Silver (Ag).

Used in electrical wiring, jewelry, construction, and machinery.

Alloys (Combination of Metals):

Steel (Iron + Carbon) – Used in construction, automotive, and tools.

Stainless Steel (Iron + Chromium + Nickel) – Corrosion-resistant, used in cutlery, medical instruments.

Brass (Copper + Zinc) – Used in musical instruments, plumbing.

Bronze (Copper + Tin) – Used in statues, bearings.

Aluminum Alloys (Al + Mg, Si, etc.) – Used in aerospace, packaging.

Properties of Metallic Materials:

- ✓ High strength and hardness (varies with alloying).
- ✓ Good electrical & thermal conductivity.
- ✓ Malleable (can be hammered into sheets) and ductile (can be drawn into wires).
- ✓ Opaque and shiny (metallic luster).
- ✓ Most are prone to corrosion (except noble metals like gold, platinum).



2. Non-Metallic Materials

Non-metallic materials **do not contain metal elements** and are generally poor conductors of heat and electricity. They include polymers, ceramics, composites, and natural materials.

Types of Non-Metallic Materials:

Polymers (Plastics & Rubbers):

Examples: Polyethylene (PE), PVC, Nylon, Teflon, Rubber.

Used in packaging, insulation, textiles, automotive parts.

Ceramics:

Examples: Silica (SiO_2), Alumina (Al_2O_3), Porcelain, Brick.

Used in tiles, insulators, biomedical implants, aerospace.

Composites:

Examples: Fiberglass (Glass fibers + Polymer), Carbon Fiber Reinforced Polymers (CFRP).

Used in aircraft, sports equipment, automotive bodies.

Natural Non-Metallics:

Wood, Leather, Cotton, Stone, Glass.

Used in furniture, construction, clothing.

Properties of Non-Metallic Materials:

- ✓ Generally low electrical & thermal conductivity (insulators).
- ✓ Brittle (ceramics) or flexible (polymers).
- ✓ Lightweight compared to metals.
- ✓ Resistant to corrosion and chemicals.
- ✓ Can be transparent or opaque.



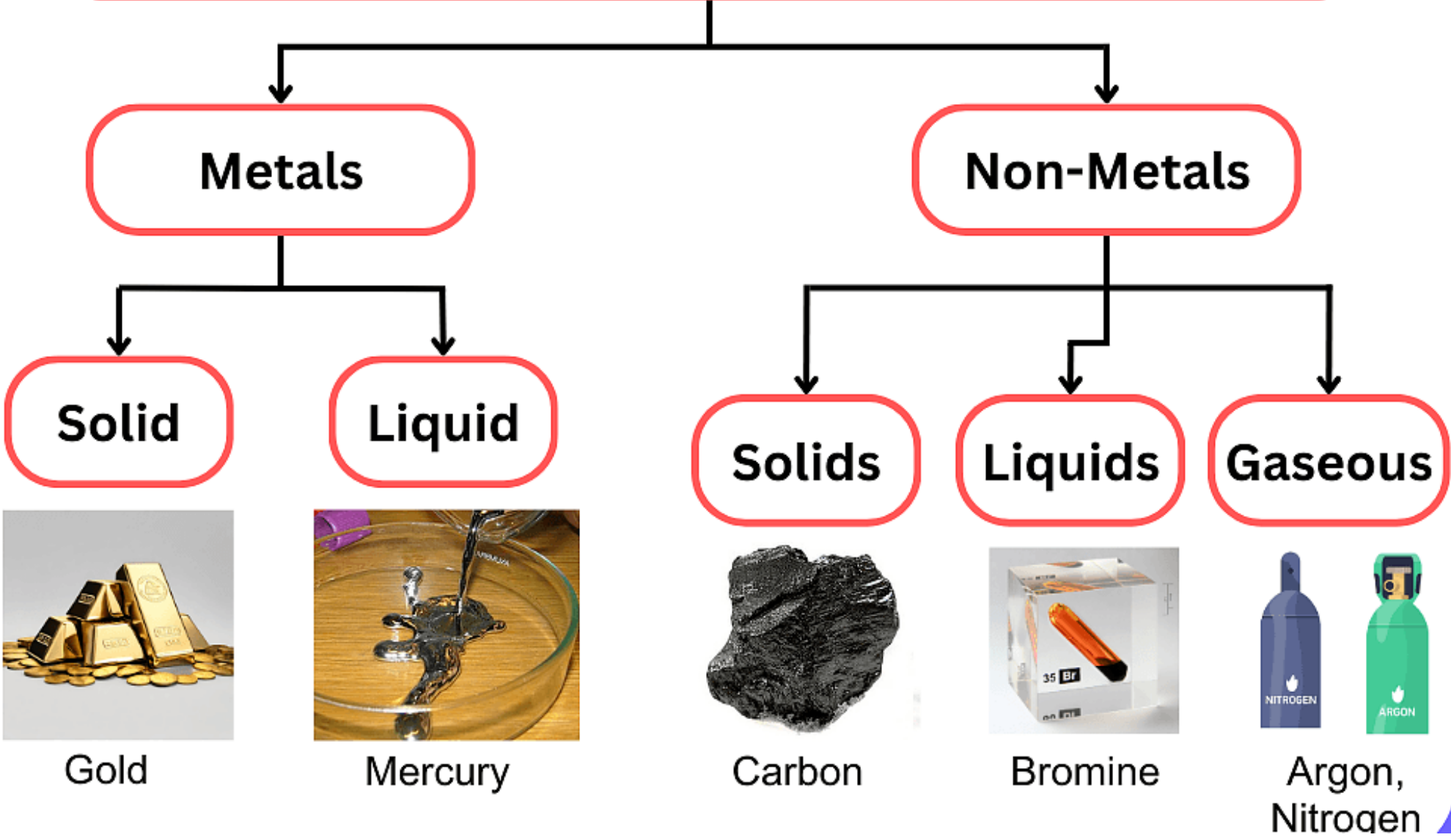
Key Differences Between Metallic & Non-Metallic Materials

Property	Metallic Materials	Non-Metallic Materials
Conductivity	High (electrical/thermal)	Low (mostly insulators)
Ductility	Ductile & Malleable	Brittle (ceramics) or Flexible (polymers)
Density	Generally high	Generally low
Appearance	Shiny (metallic luster)	Dull or transparent
Corrosion	Prone to oxidation	More resistant (e.g., plastics, ceramics)
Examples	Iron, Aluminum, Steel	Plastic, Rubber, Wood, Glass

Applications:

- **Metals** → Construction (steel), Electrical wiring (copper), Aerospace (titanium alloys).
- **Non-Metals** → Insulation (plastics), Electronics (ceramic capacitors), Automotive (composites).

DIFFERENT STATES OF METALS AND NON METALS





THANK YOU!