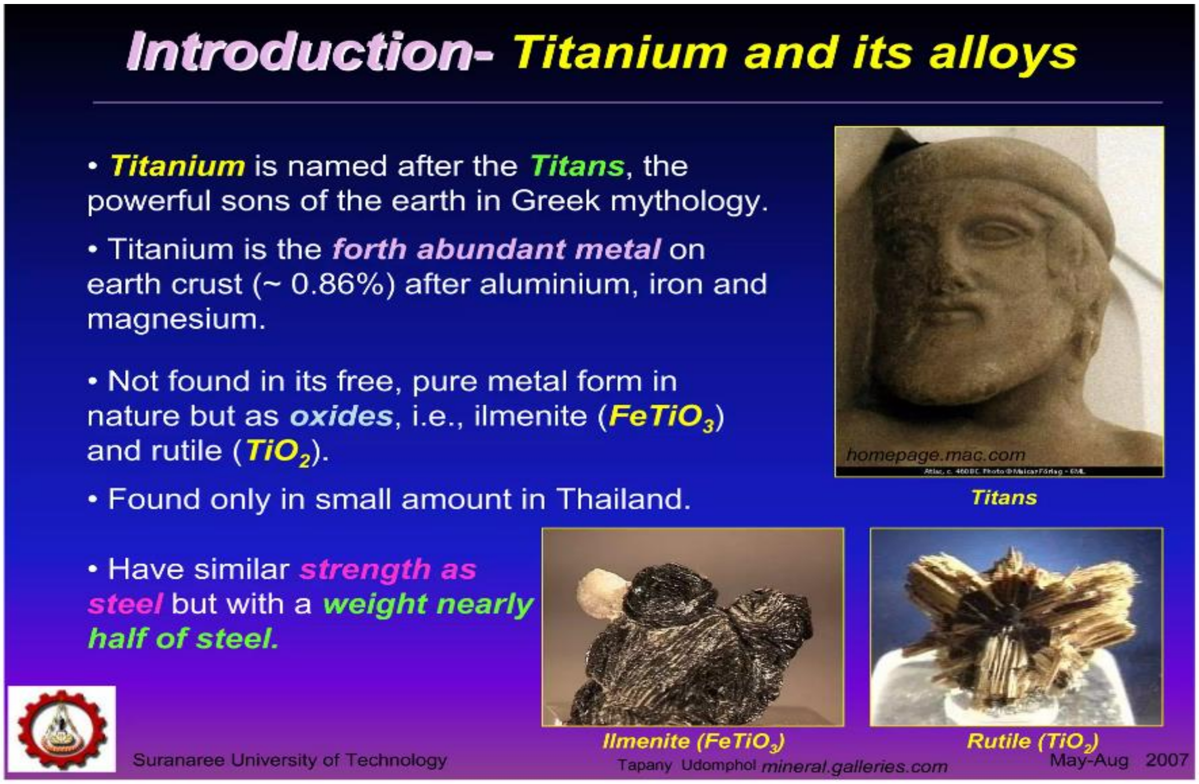
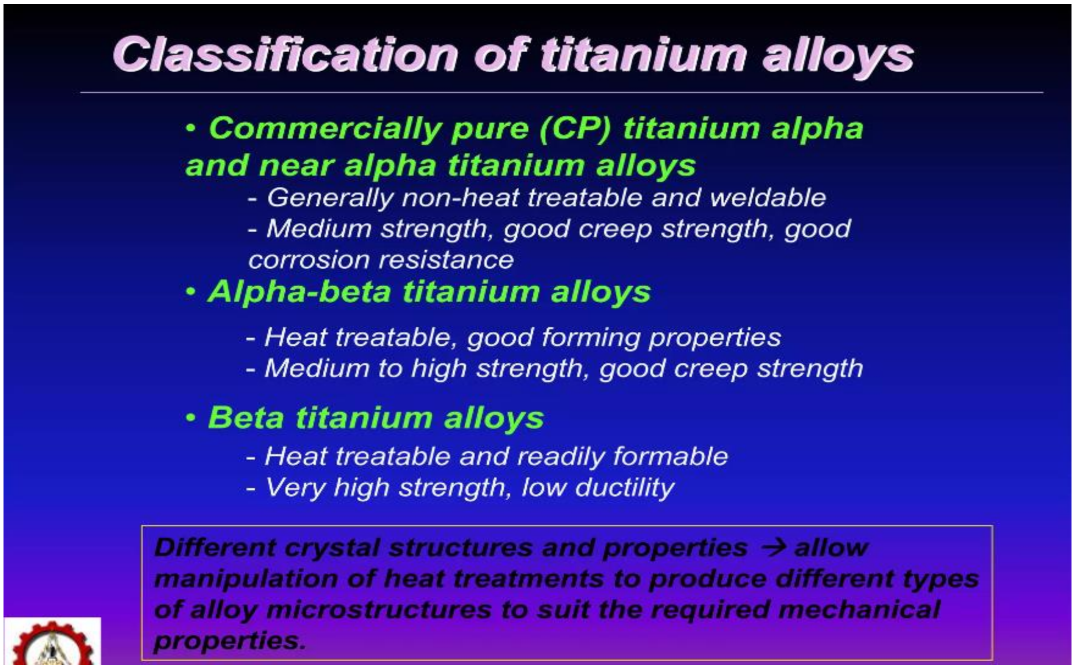
Titanium alloys



- Titanium in its pure form is a silvery metal known for its strength and low density compared to other similarly hard metals. In most industries, however, titanium alloy is much more commonly used.

- Because of its physical and chemical properties, the metal has become useful in a wide variety of industries and applications such as medical equipment, chemical plants, military installations, and sports gear.



Ti in dentistry

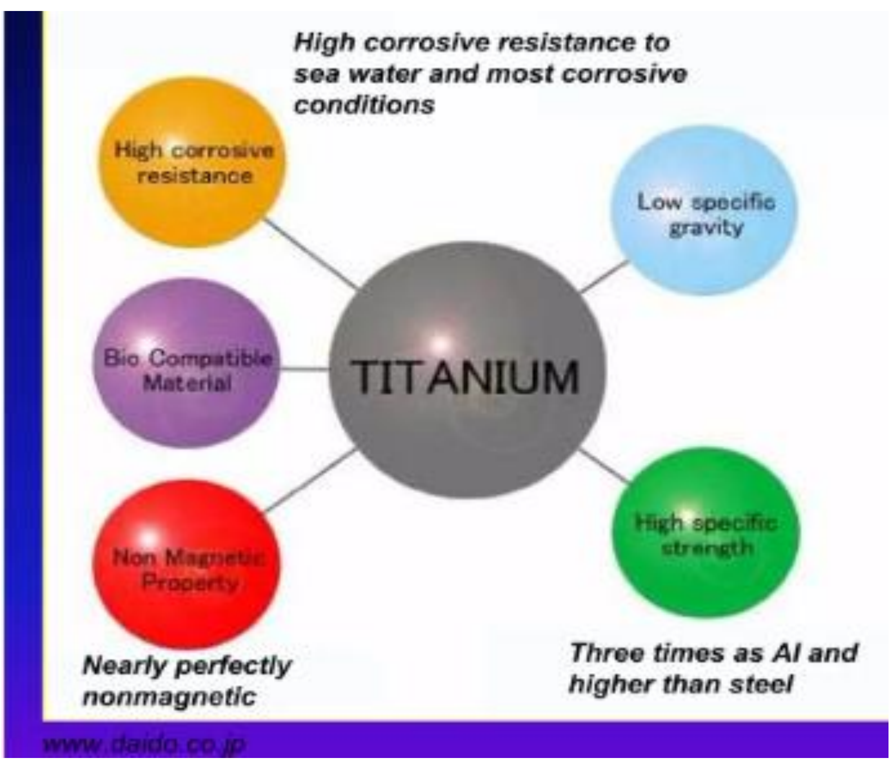
- **The most widely used titanium alloy in dentistry and for general engineering applications is Ti-6Al-4V, which is an α-β alloy.**
- **Although this alloy has greater strength than CP Ti, it is not as attractive for dentistry and biomedical applications because of some concerns about health hazards from the slow release of aluminum and vanadium.**

BIOMEDICAL APPLICATION:

- Titanium alloys have been extensively used for the manufacturing of metal orthopedic joint replacements and bone plate surgeries. They are normally produced from wrought or cast bar stock by CNC, CAD-driven machining, or powder metallurgy.

- Among all titanium and its alloys, the mainly used materials in biomedical field are the commercially pure titanium (cp Ti, grade 2) and Ti-6Al-4V (grade 5) alloy. They are widely used as **hard tissue replacements in artificial bones, joints and dental implants**.

Advantages of titanium alloy



General application of titanium

AEROSPACE

- Civil
- Military
- Space

MEDICAL

- Orthopaedic Implants
- Bone Screws
- Trauma Plates
- Dental Fixtures
- Surgical Instruments

INDUSTRIAL

- Petrochemical
- Offshore
- Subsea
- Metal Finishing
- Pulp & Paper
- General Engineering

SPECIALIST

- Body Jewellery
- Ultrasonic Welding
- Motor Racing Components
- Marine
- Bicycle
- Sports Equipment

Wrought Alloys

- Wrought: Beaten to shape.
- Alloys: A metal made by combining two or more metallic elements to give greater strength or resistance to corrosion

- What are wrought metal alloys?

These are cold worked metals that are plastically deformed to bring about a change in shape of structure and their mechanical properties.

How wrought alloys are made?

Where all they are used?

ORTHODONTIC WIRES

ORTHODONTIC BRACKETS

PRE-FABRICATED CROWNS

Wrought Alloys types

Stainless steel
Orthowires,paed crowns,Endo instts,surgical instt,clasps

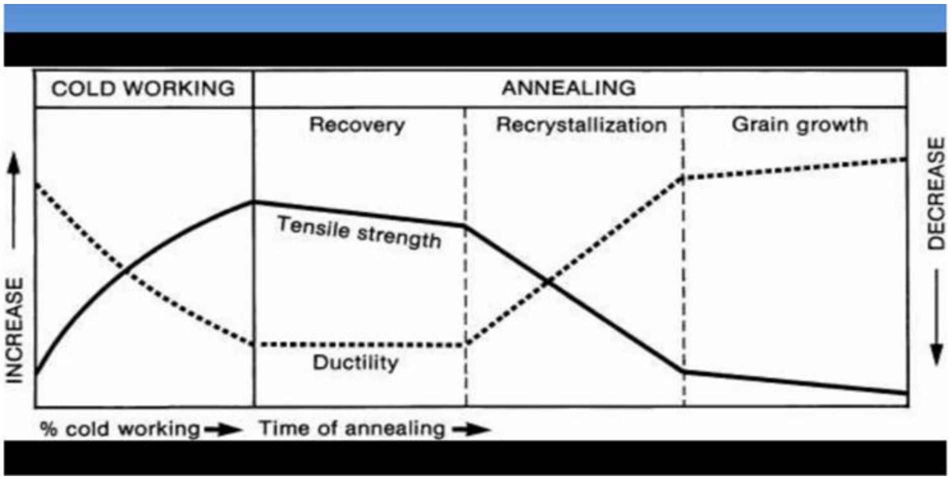
Nickle Titanium (Ni ti)
Ortho wires
Endo instruments

Cobalt Chromium

Beta Titanium

Wrought commercially pure Titanium

Manipulations



COLD WORKING

- ***<u>Process in which a metal is hammered, drawn or bent into shapes at temperature well below the crystallization temperature of metal(often at room temperature)</u>***
- Cold working increase hardness, strength and prop.limit
- Decrease corrosion resistance and ductility

ANNEALING

- Controlled heating and cooling process designed to produce the desired properties
- Annealing temperature is half the melting point of a pure metal or the fusion temperature of an alloy
- Increase softening, plastic deformation potential and improve machinability

- **Recovery**

  Recovery of ductility and corrosion resistance

- **Recrystallization/Re crystallization Temperature**

  Usually 1 hour in which the crystalline grain structure is revived. makes metal soft and ductile(suitable for clasps)

- **Grain growth**
- Occurs in a way to minimize grain boundery area with large grains consuming small grains. Coarse grain structure is produced

THANK YOU