

Casting alloys I

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Aims & Objectives

- Metals and Alloys Properties
- Phase diagram
- Microstructure
- Classification of casting alloys

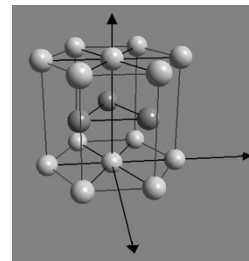
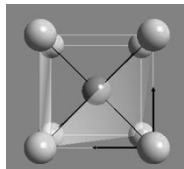
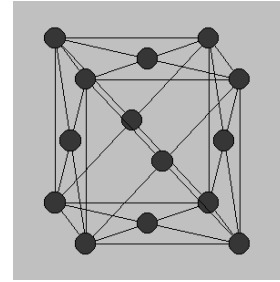
Why alloys and not pure metal?

Metallic bonding

- Electrons are loosely held
- Opaque
- Lustrous

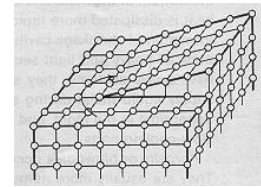
Crystal structure

- 14 types
- The three most common for metals in dentistry;
 - > Body centred cubic
 - > Face centred cubic
 - > Hexagonal close packed



Deformation of metal

- Vacancies
- Interstitial
- Dislocations
 - Edge dislocation
 - Screw dislocation



How to improve strength

- Alloying
- Precipitation hardening
- Grain refining
- Cold working

Alloys

- A blend of two metal or more
- Types of alloys
 - Solid solution (Two metals completely miscible)
 - Inter metallic compounds (most Dental amalgam phases)
 - Eutectic mixtures (Miscible in liquid state but separate in the solid state)

Solid solutions

- Melting range less than the higher MP metal
- Corrosion resistance increased with Iron alloys(Stainless steel) but decreased with gold

Eutectic mixtures

- Harder and stronger
- Brittle
- Melting point
- Poor corrosion resistance
- Prone to galvanic action

Intermetallic

- Very hard and brittle

Grain size

- Crystals formed from a nuclei.
- The smaller the grain the better mechanical properties.

Strength& hardness

- Compressive
- Tensile
- Tensile yield strength
- Hardness Vs Wear

Solidification shrinkage

- How to compensate?!
 - While still in liquid state
 - While cooling at room temperature

Corrosion

- Tarnish versus corrosion
- Noble alloys
- Base metal alloys

Types of corrosions

- Dry
- Wet
 - Generalised
 - Localised
 - ✓ Pitting corrosion
 - ✓ Crevice corrosion
 - ✓ inter granular corrosion

Biocompatibility

- Nickel alloys
- Silver and Copper alloys
- The greyish appearance

Types and classifications

ADA Classification of casting alloys

- High Noble alloys
- Noble alloys
- Base metal alloys

ADA's Classification (1984)

1. **High noble** (HN)
2. **Noble** (N)
3. **(Predominantly) Base metal** (PB)

Alloy Type	Total Noble Metal Content
High noble metal	Contains ≥ 40 wt% Au and $> 60\%$ of the noble metal elements
Noble metal	Contains ≥ 25 wt% of the noble metal elements (Au, Pd, Pt)
Base metal	Contains < 25 wt% of the noble metal elements

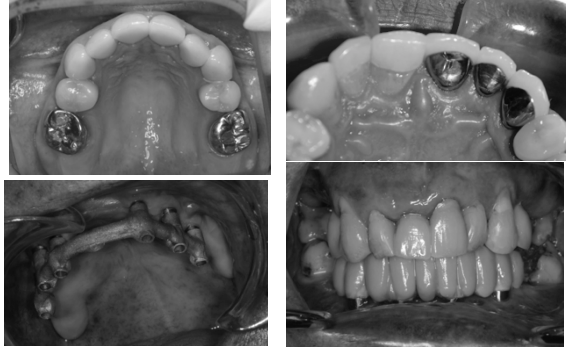
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Descriptive Classification

- Normal-fusing alloys
 - Medium-gold
 - Low-gold
 - Silver-palladium
 - Silver-indium
- High-fusing alloys (*mostly for PFM*)
 - Gold-platinum-palladium
 - Gold-palladium-silver
 - Gold-palladium
 - High-palladium
 - Palladium-silver
 - Base-metal
 - Cr/Co; Cr/Ni

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Applications



Thank you