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## Dental Material

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Lecture 5

# DENTAL CASTING ALLOY

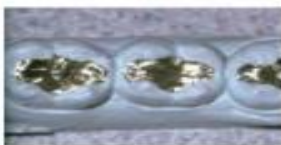
## Introduction:

Today the dental profession has access to a wide variety of casting alloys.

These alloys are designed for specific clinical purposes like:

- . Inlays
- . Onlays
- . Crowns
- . Bridges
- . Partial dentures; and
- . Porcelain fused to metal restorations.

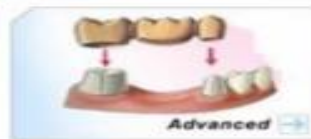
## Dental applications:



Inlay



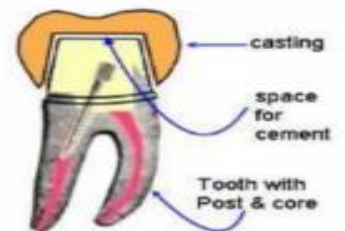
Dental Implant



Metallic bridge



Ceramometallic bridge



**Alloy** is any combination of two or more metals. An alloy system is a blend of two or more. **Example:** the Gold-Copper system includes all the possible alloys of gold and copper. The distinguished binary system, which involves only two metals. The ternary system includes three metals.

**Casting** Something has been cast in a mold, an object formed by the solidification of a fluid that has been poured or injected into a mold.



## General requirements of dental alloy

1. **Biocompatibility:** the alloys should not react with oral fluids and release any harmful products in oral environments.

2. **Resistance to tarnish:** *A tarnish is a thin film of a surface deposit or an interaction layer that is adherent to the metal surface.*

Tarnish is usually on silver alloys and on gold alloys with higher silver content.

3. **Resistance to corrosion:** *Corrosion is the gradual deterioration of metals caused by the action of air, moisture, or a chemical reaction (such as an acid) on their surface.*

Released metallic components may cause a metallic taste in the mouth.

4. **Nonallergic:** all the toxic materials are eliminated from the alloys.
5. **Aesthetic:** the alloys must be in optimal balance among the properties of aesthetics.
6. **Ease to fabricate:** They must be easy to melt, cast, cut, and grind.
7. **Hardness:** should be sufficient enough to resist wear by the opposing tooth restorations.
8. **Ease to solder.**

## Classification of high Noble and Noble alloy

### ADA Classification of Alloy:

- 1. High–noble metal alloy** (more than 40 wt. % gold (Au) + 60wt % of the noble metal element).
- 2. Nobel metal alloy** (more than 25wt.% of the noble metal element, but not necessarily gold).
- 3. Base metal alloy** (less than 25wt.% of the noble metal element + more than 75% base metal).
- 4. Titanium and Titanium alloys.**

**\*The noble metal includes gold, platinum, palladium, rhodium, ruthenium, iridium and osmium.**

**\*All noble alloys are based on gold or palladium as the principal noble species.**

**\*Noble Metals:** These are elements with good metallic surfaces that retain their surface, they are resistant to oxidation, tarnish, and corrosion during heating, casting, soldering, and use in the mouth is very good.

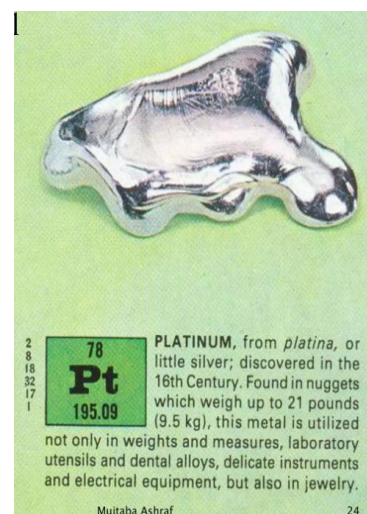
## 1. Gold (Au):

- Pure gold is a soft, malleable, ductile metal with a yellow color and a strong metallic luster.
- Because gold is nearly as soft as lead, it must be alloyed with copper, silver, platinum, and other metals added to the gold to develop its hardness, durability & elasticity like (platinum, silver, etc.).
- Gold influences the color of the alloy and also its ductility. Air or water at any temperature does not affect or tarnish gold.



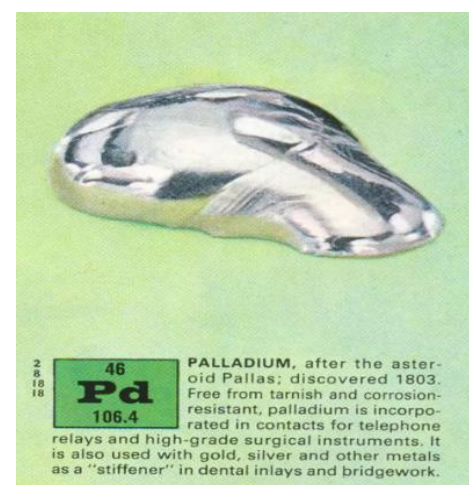
## 2. Platinum (Pt):

- Is a bluish-white metal, is tough, ductile, and malleable & can be produced as a foil or fine-drawn wire.
- the best hardener in the alloy, superior to copper.



## 3. Palladium (Pd):

- It has the quality of absorbing large quantities of hydrogen gas when heated which is an undesirable quantity.





#### **4. Iridium (Ir), Ruthenium (Ru) & Rhodium (Rh):**




### **Requirements of noble metals used with metal-ceramic restorations:**

- 1. Thermal stability.**
- 2. Bonding to the ceramic.**
- 3. Compatibility with ceramic.**
- 4. Support for ceramic.**



### **Base (Non-Noble) metals:**

Several bases are combined with noble metals to develop alloys with properties suitable for dental restorations.

#### **1. Silver (Ag):**

-  Is a malleable, ductile, white metal, it is the best-known conductor of heat & electricity.
-  It is stronger & harder than gold.
-  Pure silver is not used in dental restorations because of the black sulfide that forms on the metal in the mouth.


#### **2. Copper (Cu):**

-  One of the most important metals in the dental gold alloy increases the strength and hardness of the alloy.
-  In an alloy of 6% copper and 94% gold, the hardness is more than double that of pure gold.

 **Copper allows the gold alloy to be successfully heat treated.**

### **3. Zinc (Zn):**

 **Is a blue–white metal with a tendency to tarnish in moist air.**

 **Its only beneficial property to the alloy is its ability to reduce oxidation during the casting procedure.**

### **4. Indium (In):**

 **It is added to increase fluidity during the casting procedure.**

### **5. Tin (Sn):**

 **Is soft, luster, white metal, not subjected to tarnish.**

 **Some gold-based alloys contain limited quantities of tin, usually less than 5% by weight.**

 **It combines with platinum & palladium to produce a hardening effect.**

### **6. Gallium**