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.**

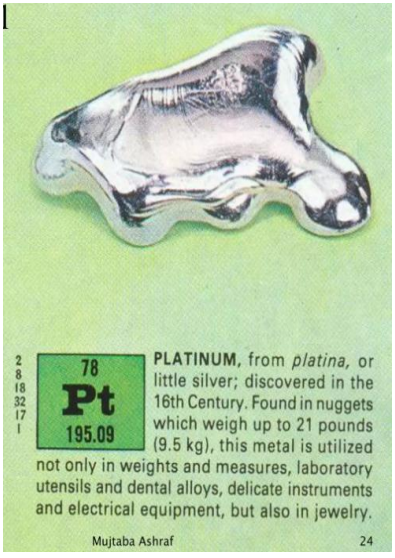
***All noble alloys are based on gold or palladium as the principal noble species.**

***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.**

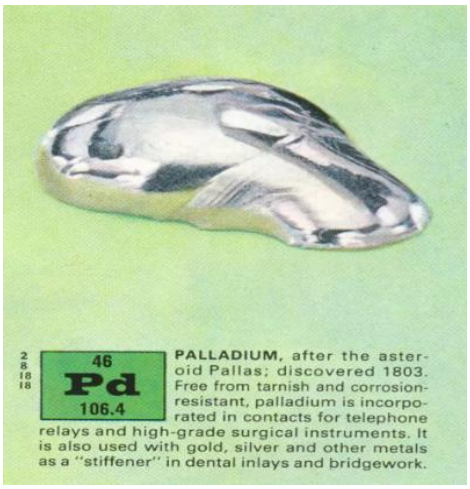
2. Platinum (Pt):



- **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.**
- **even in small amounts of platinum raises the melting temperature severely and is rarely used in greater than 3-4% of the total composition.**
- **used for the construction of pins, posts in the crown, bridge restoration, and alloys may be cast or soldered to the post without damage.**

3. Palladium (Pd):

- **Is a white metal somewhat darker than platinum.**
- **Its density is a little more than half that of platinum, and gold. 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):

- **Iridium & Ruthenium are used in small amounts in dental alloys as grain refiners to keep the grain size small.**
- **A small grain size is desirable because it improves the mechanical properties and uniformity of properties within an alloy.**
- **Iridium & Ruthenium have high melting points (2410 Cº &2310 Cº) thus these elements don't melt during the casting of the alloy & serve as nucleating centers for the melt as it cools.**
- **Rhodium also has a high melting point (1966Cº) & has been used in alloys with platinum to form wire used in dentistry.**

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.**
- **It modifies the color of the alloy neutralizes the redness from copper and tends to enrich the gold appearance of the alloy.**
- **Silver has little effect on the strength of dental alloys, although it increases ductility when used with palladium.**
- **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.**
- **It is a malleable & ductile metal with high thermal & electrical conductivity & characteristic red color.**
- **Copper reduces the resistance to tarnish and corrosion of the alloy and therefore is used in amounts up to 20%.**

- Excessive amounts of copper will redden the alloy.
- Copper reduces the melting range of the alloy and when combined with gold, increases the ductility of the alloy in the presence of other metals.
- Copper is a common component of the hardest dental solders.

3. Zinc (Zn):

- Is a blue–white metal with a tendency to tarnish in moist air.
- In its pure form, it's a soft, brittle metal with low strength.
- When heated in air, zinc oxidizes readily to form white oxide.
- It acts as a scavenger for the oxides.
- Its only beneficial property to the alloy is its ability to reduce oxidation during the casting procedure.

4. Indium (In):

- Is a soft gray–white metal with a low melting point of 156.6C º, it is used in some gold-based alloys as a replacement for zinc& it is a common minor component of some noble ceramic dental alloys.
- It 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:**

- **Is a grayish metal, has a very low melting point of 28.9C, not used as pure metal in dentistry but as a component of some gold & palladium-based dental alloys, especially ceramic alloy.**

Thank you