

## Base metal alloy types

# BASE METAL ALLOYS

Alloys that contain less than 25% w t of the precious elements like gold, silver, platinum and palladium.

Two most commonly used base metal casting alloys in dentistry are

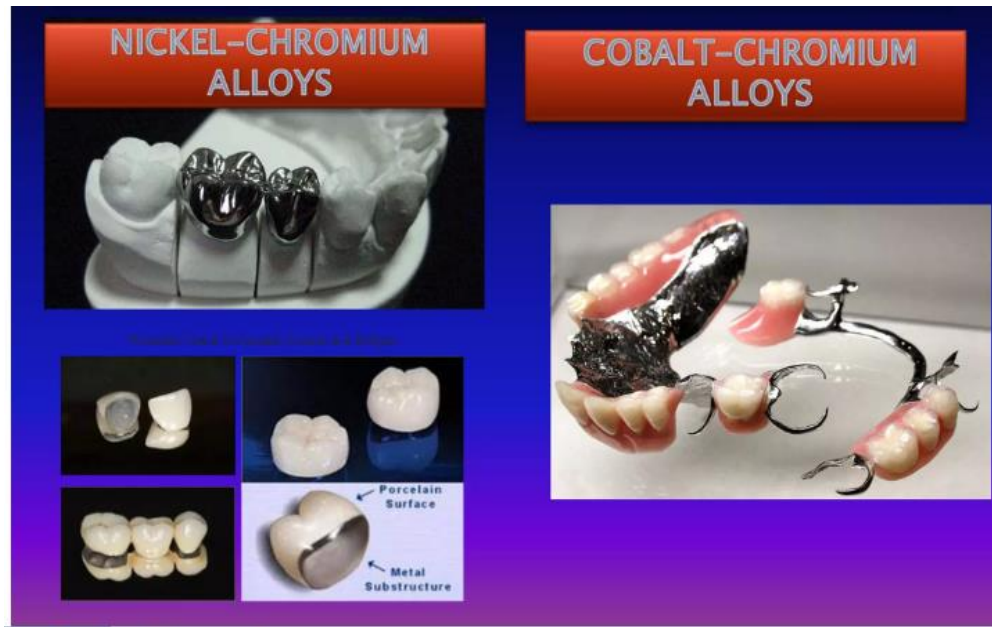
- 1) **Nickel-Chromium Alloys**
- 2) **Cobalt-Chromium Alloys.**

### NICKEL-CHROMIUM ALLOYS

Used for crown & bridge casting including porcelain fused to metal (PFM) restorations.

### COBALT-CHROMIUM ALLOYS

Used for partial denture framework castings.



### Properties of base metal alloy:

1. They are very hard; this makes finishing and polishing difficult.
2. Fine margins are less likely to be lost.
3. Have good corrosion resistance.
4. Fusion temperature is about (1200 C° – 1500 C°) which is higher than casting gold alloy.

COMPOSITION	
NICKEL-CHROMIUM ALLOYS	COBALT-CHROMIUM ALLOYS
<ol style="list-style-type: none"> <li>1) Nickel (Main constituent)</li> <li>2) Chromium (no less than 20%)</li> <li>3) Molybdenum (No less than 4%)</li> <li>4) Beryllium (No more than 2%)</li> </ol>	<ol style="list-style-type: none"> <li>1) Cobalt (Main constituent)</li> <li>2) Chromium (No less than 25%)</li> <li>3) Nickel (0–30%)</li> <li>4) Molybdenum (no less than 4%)</li> </ol> <p>Traces of Beryllium, Silicon &amp; Carbon</p>

# BASE METAL ALLOYS MANIPULATION

## Fusion temperature range

(1200–1500°C)

## Two Methods

- 1) Acetylene–Oxygen Flame.
- 2) Electrical Induction Furnace.

## Investment Material used

- 1) Silica Bonded Investment Material.
- 2) Phosphate Bonded Investment Material.

## FUNCTION OF VARIOUS ALLOYING ELEMENTS

- ❖ **Chromium** is responsible for the tarnish and corrosion resistance of these alloys.
- ❖ When the chromium content of an alloy is higher than 30%, the alloy is more difficult to cast. Therefore, cast base-metal dental alloys should not contain more than 28% or 29% chromium.
- ❖ **Cobalt** increases the alloy elastic modulus, strength, and hardness more than nickel.
- ❖ **Carbon**: One of the most effective ways of increasing the hardness of cobalt-based alloys is by increasing their carbon content.

- ❖ **Aluminum:** in Ni-Cr alloy, it forms a compound of Ni and Al ( $\text{Ni}_3\text{Al}$ ). This compound increases the ultimate tensile strength and yield strength of the alloy. Such concentration may adversely affect ductility.
- ❖ **Silicon and Manganese** are added to increase the alloy fluidity and cast ability.
- ❖ **Nitrogen** contributes to the brittle quality of the cast alloy.
- ❖ **Molybdenum:** The presence of 3% to 6% contributes to the strength of the alloys.
- ❖ **Beryllium:** The addition of 1% to 2% beryllium to Ni-base alloys lowers the fusion range by about  $100^\circ\text{C}$ . The addition of beryllium to base metal alloys improves its cast ability by lowering the alloy melting temperature and surface tension.