

Permanent filling materials

Amalgam

Composites

Glasionomers

Amalgam

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Amalgam

Metal-like restorative material composed of silver-tin-copper alloy and mercury.

Particles of the alloy

- ✓ Irregularly shaped (filings - lathe cut)
- ✓ Microspheres
- ✓ Combination of the two
- ✓ Spheroids

Production of irregular particles

Metal ingredients heated, protected from oxidation, melted and poured into a mold to form an ingot.

Phases of the alloy: (intermetallic compounds)



Production of irregular particles

cooled slowly

Ingot heated at 400°C (6 – 8 hours)
(homogeneous distribution of Ag₃Sn)

Ingot cut on the lathe, particles passed through a fine sieve and ball milled to form the proper particle size.

Aging of particles (60 - 100°C, 6 – 8 hours)

Particle size: 60 – 120 μm in length

10 – 70 μm in width

10 – 35 μm in thickness

Production of irregular particles

Molten alloy is spraying into water under high pressure



Irregularly shaped high-copper particles

Production of spherical particles

Molten alloy is spraying under high pressure of inert gas through a fine crack in a crucible into a large chamber

Diameter of the spheres: 2 – 43 μ m

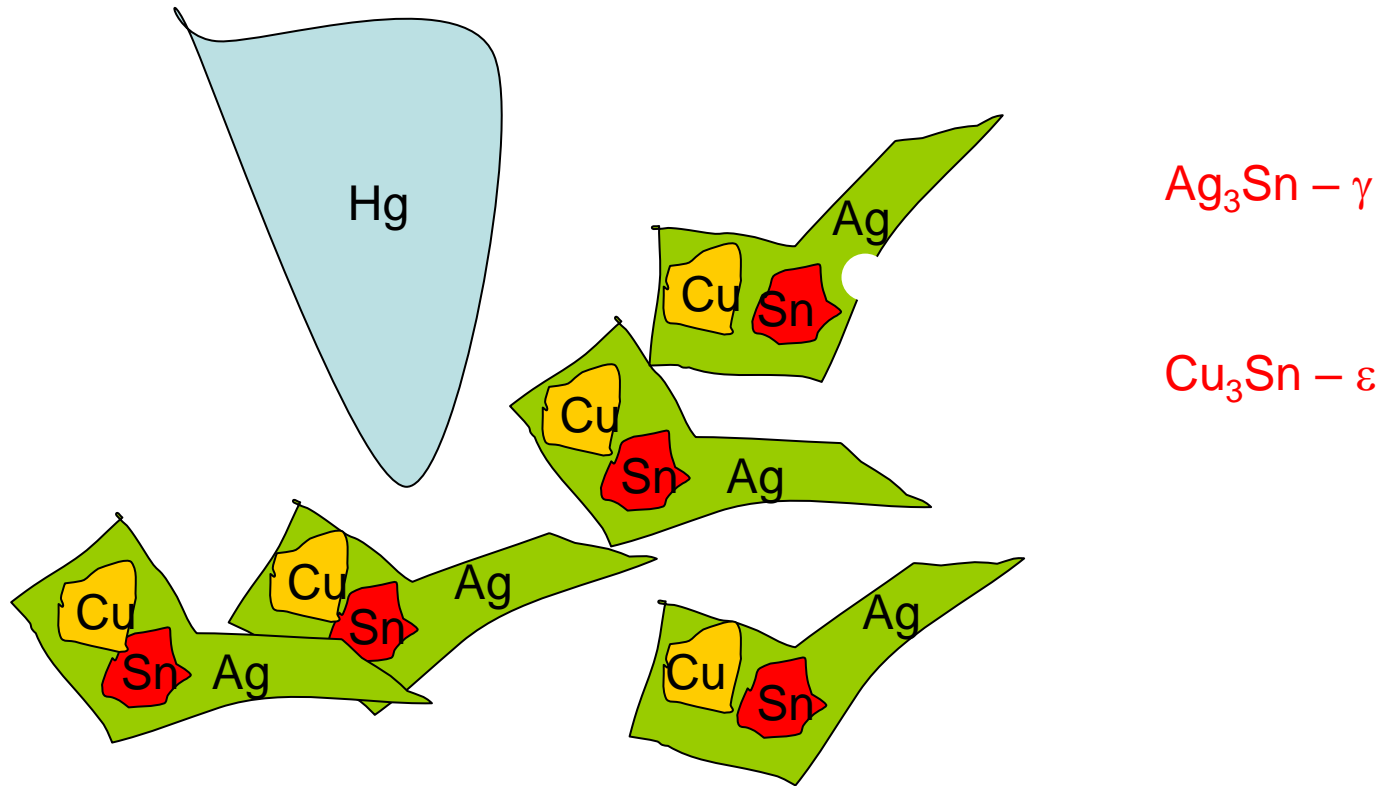
Amalgamation processes

alloy is mixed with pure mercury



Trituration

Amalgamation processes



Types of amalgam restorative materials

Low – Copper Amalgam (5% or less copper)

Composition – wt%

Silver	63 - 70 %
Tin	26 – 28 %
Copper	2 - 5%
Zinc	0 - 2%

High copper amalgam

Copper 13% - 40%)

Blend alloy:

Irregularly shaped particles :Ag 40 – 70 %
Sn 26 – 30 %
Cu 2-30 %
Zn 0-2 %

Spherical particles Ag 46 – 65 %
Sn 0 – 30 %
Cu 20 – 40 %



High copper amalgam

Sférické

Ag 40 – 60 %

Sn 22 – 30 %

Cu 13 – 30 %



Setting of low copper amalgam

Principle of setting is crystallization

Structure of the amalgam filling

Ag-Hg: gamma 1 }
Sn-Hg: gamma 2 } **These phases crystallized**

Gamma phase (Ag-Sn) does not dissolve completely

Risks of the gamma 2 phase

- Non stable
- Tin is released due to electrogalvanism in oral cavity and mercury from this phase reacts with remaining gamma phase.
- This is external electrochemical corrosion.

Low copper amalgam has worse mechanical and corrosion resistance than high copper amalgam

High copper amalgam

- Content of copper increased: 12 – 13%
- (less tin)

- Or up to 25% (Less tin and silver)

Better mechanical and corrosion resistance

High copper amalgam

Copper 13% - 40%)

Blend alloy:

Irregularly shaped particles :Ag 40 – 70 %
Sn 26 – 30 %
Cu 2-30 %
Zn 0-2 %

Spherical particles Ag 46 – 65 %
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Cu 20 – 40 %



High copper amalgam

Unicomponental

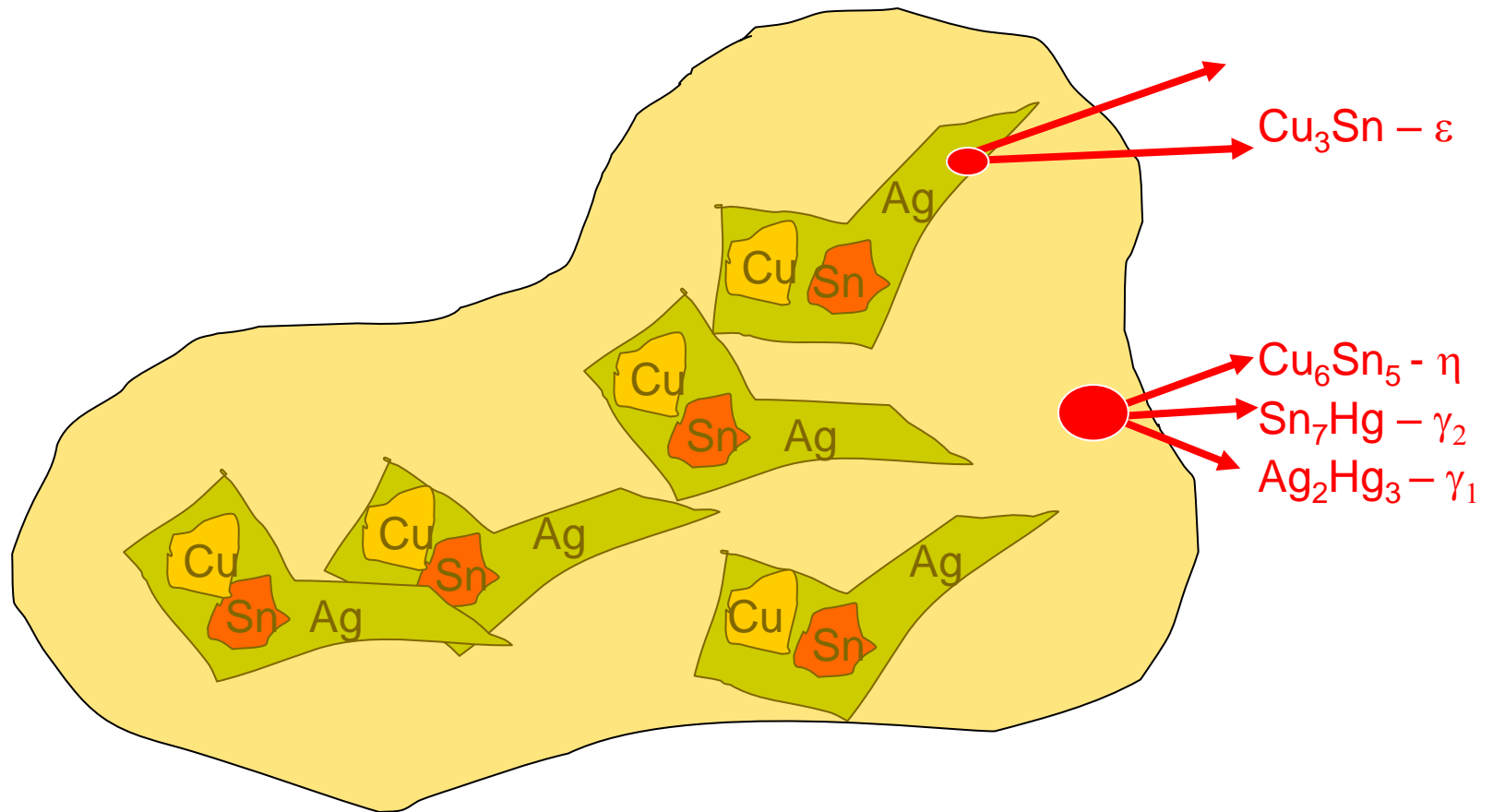
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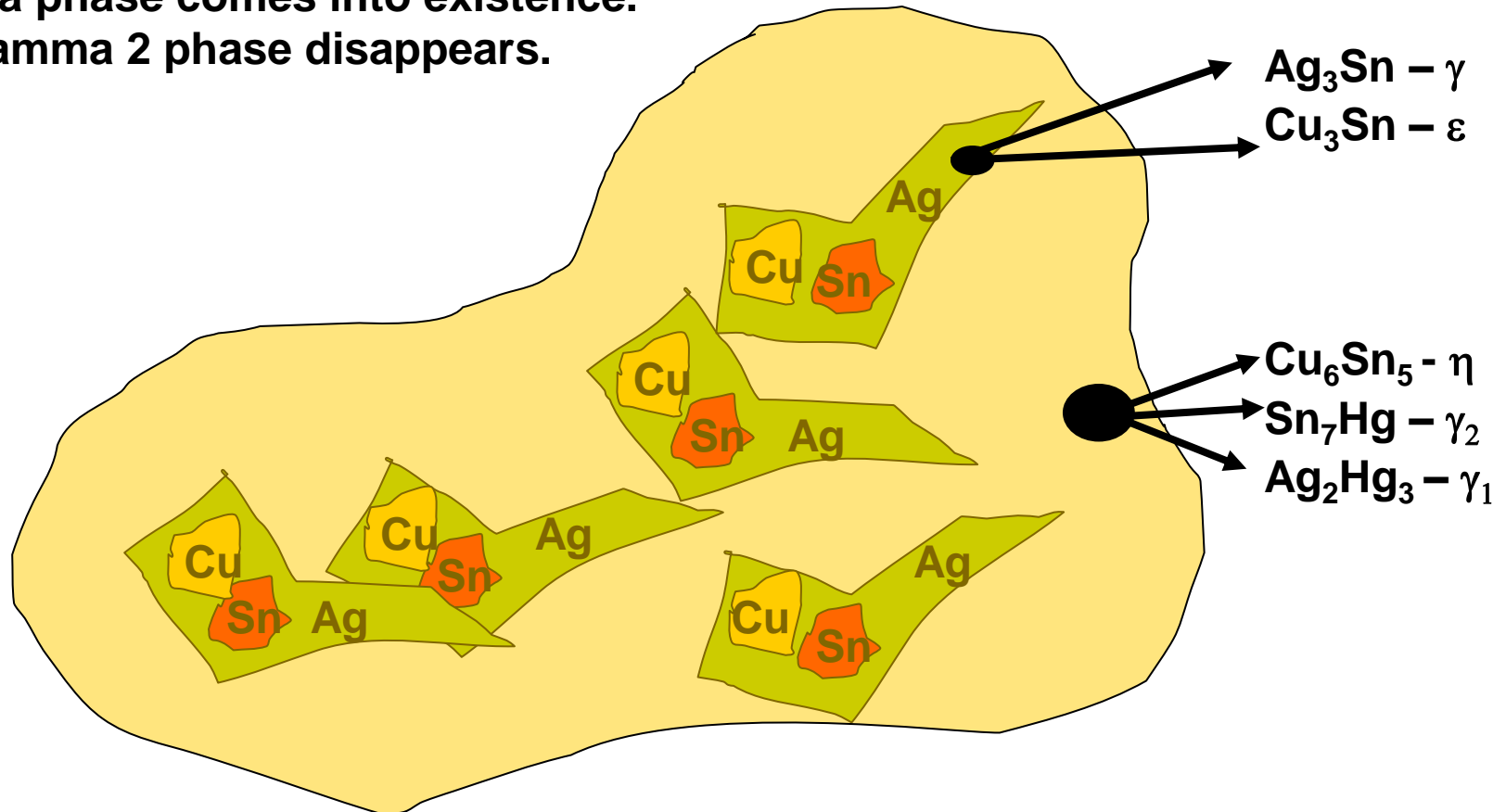


Amalgamation processes



Amalgamation processes

High copper amalgam – copper dissolved in mercury has high reaction affinity to tin that is also dissolved in mercury. It reacts with tin in gamma2 phase and eta phase comes into existence. The gamma 2 phase disappears.



Amalgam - properties

Amalgam

- **Wear and pressure resistance (2mm thickness at least)- brittleness**
- **Easy handling**
- **Low price**
- **Thermal and electrical conductivity**
- **Corrosion**
- **Bad aesthetics**
- **Creep**
- **Flow**

Biocompatibility

- More than 160 years, more than 200 millions Ag fillings every year in USA.
- Allergy rare
- Precautions in children and in pregnancy.

AMALGAM IS STILL A MATERIAL OF CHOICE

Toxicity

■ Organic compounds

Vapours, aerosol

Precautions

- Ventilation
- Rests of amalgam in water
- Amalgam separators
- Dangerous waste (180 110)

Indications and contraindications of amalgam

Indications

- Moderate and large cavities in posterior area (class I., II. V)

Contraindications

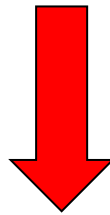
Fillings in frontal area

Pregnancy, children till the age of 6

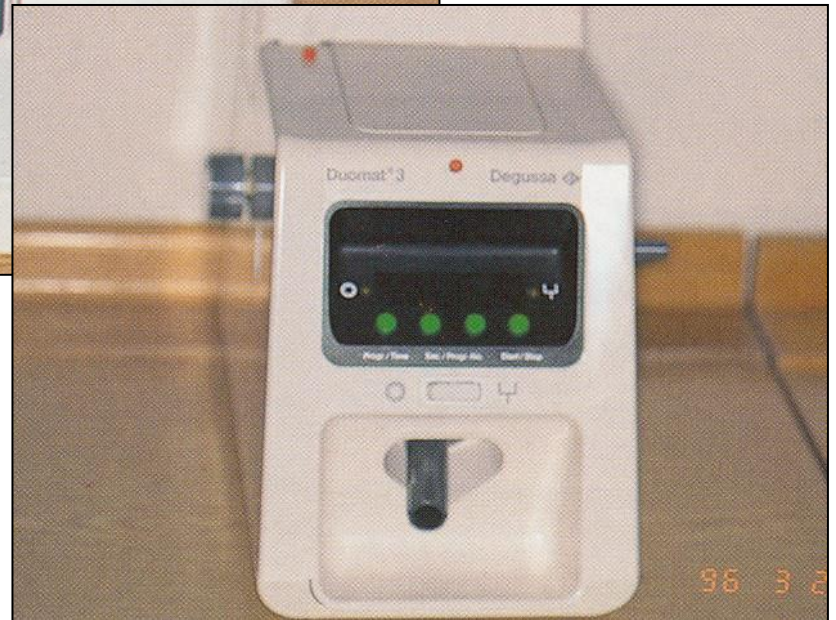
Allergy

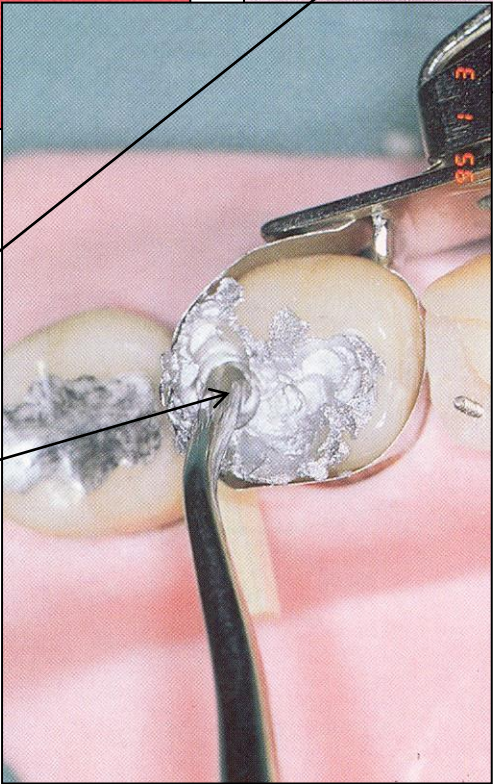
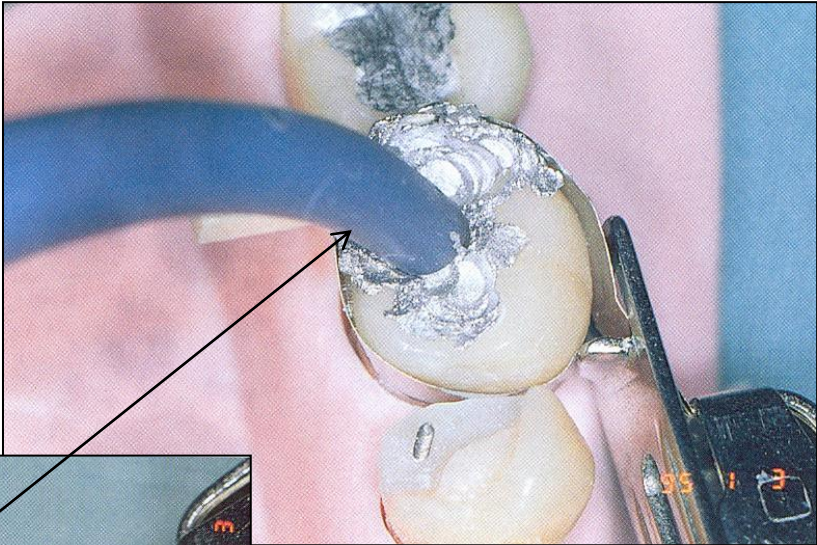
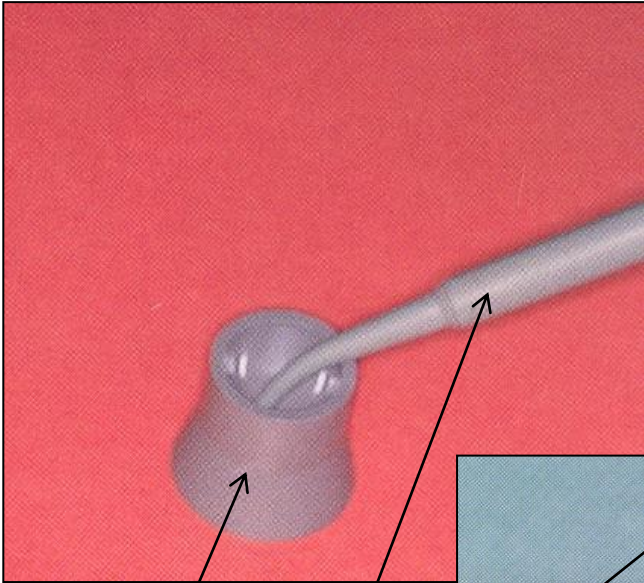
Mixing of amalgam

- **Hand mixing (obsolete)**
- **Power driven trituration**



Amalgamators

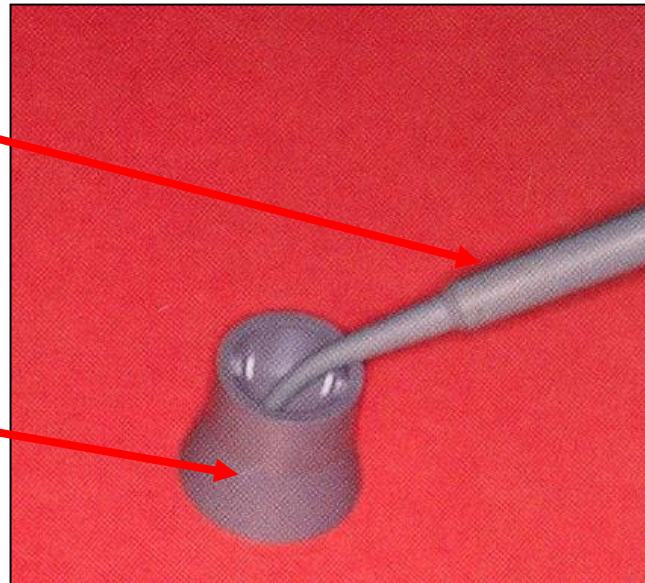


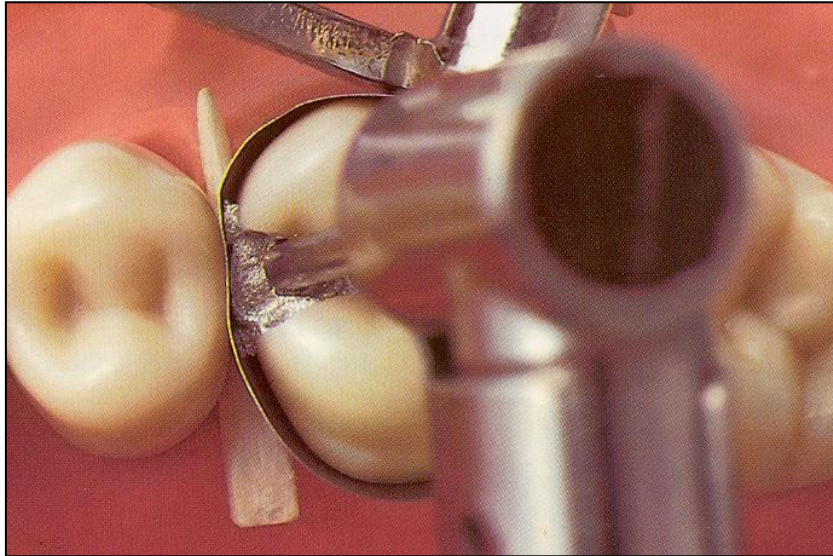


Cup
Amalgam gun
Condensor

Amalgam gun

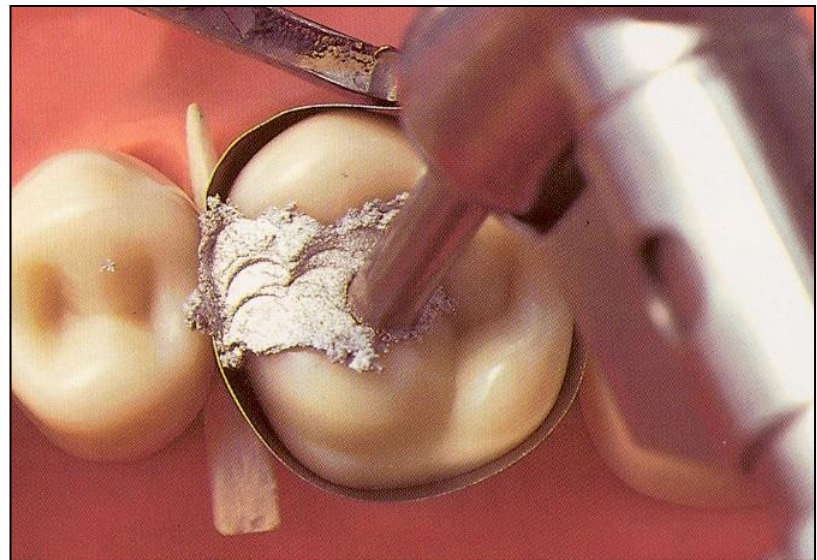
Crucible (cup)

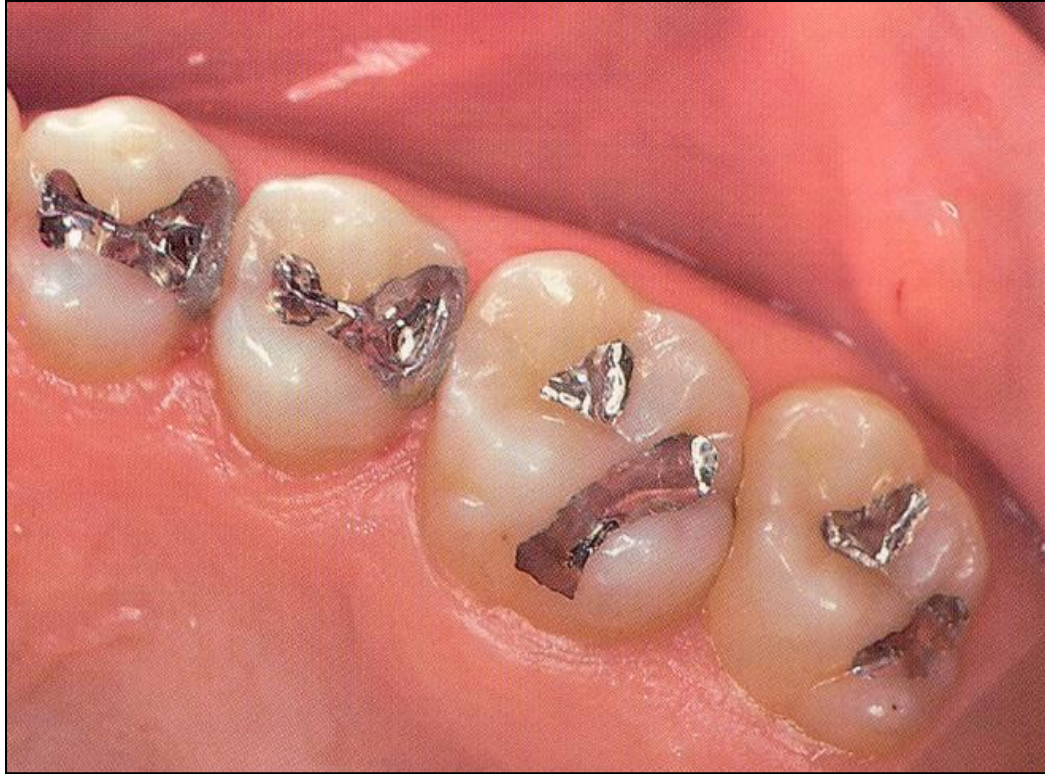




Power driven condensation

**handpiece
condensor**





Instruments

➤ **Preparation instruments**

➤ **Filling instruments**

➤ **Carvers**

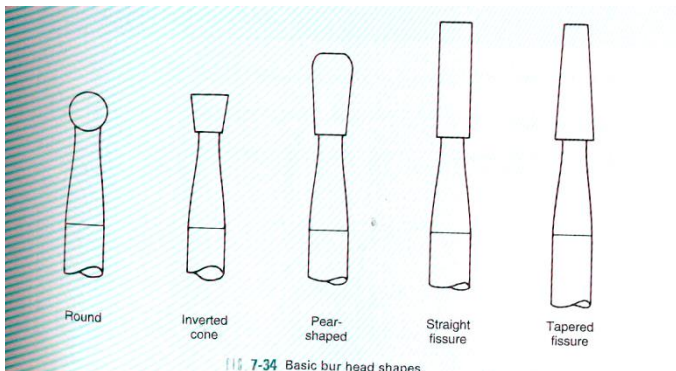
➤ **Burnishers**

Instruments

Preparation instruments - power driven

Burs

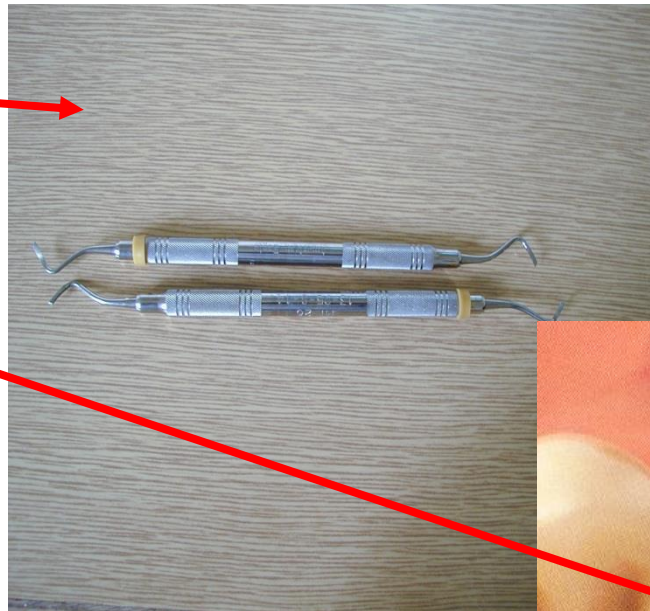
Diamonds



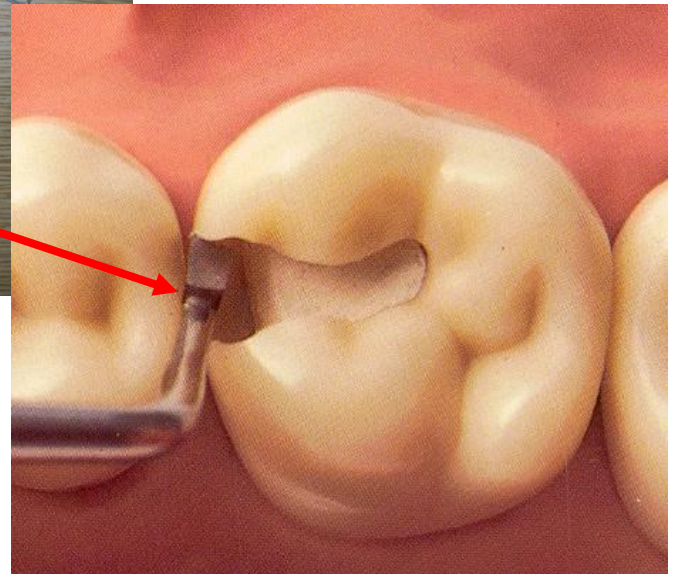
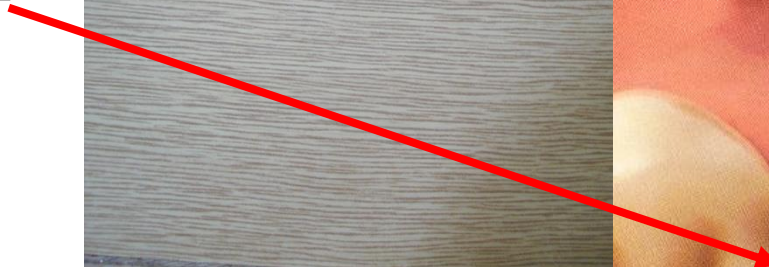
Instruments

➤ Preparation instruments - hand

Chisel



Excavator



Amalgam carrier



Amalgam carrier



Instruments

- **Filling instruments condensers and spatulas**

Condensor with
flat front



Condensor with flat front

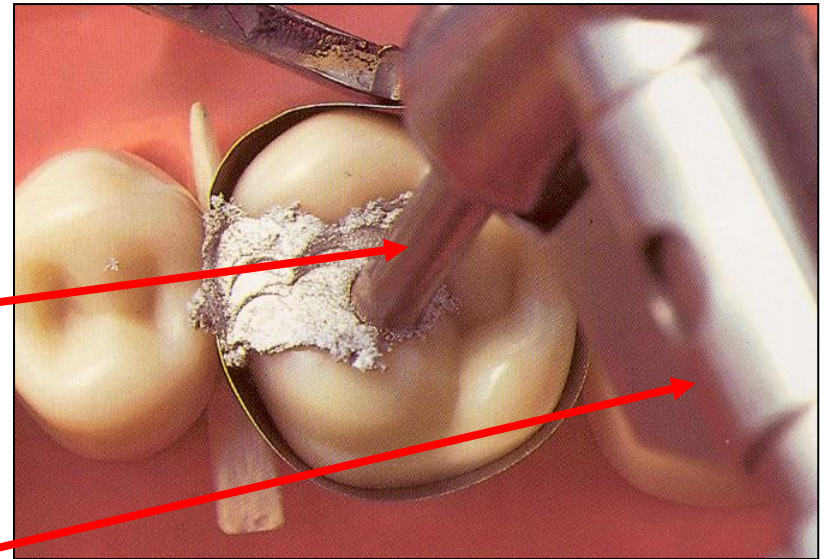


Condensor and burnisher - spatula combined



**Power driven
condensor**

**Special
handpiece**



Burnisher - spatula

Angular- trough edge trough
face



Burnisher – spatula, angular three face



Instruments

➤ **Burnishers**

Ball condensor – used as a
burnisher at most

