Addition silicone impression materials:
They have better properties than condensation silicone and the polysulphide. This material is often called a polyvinyl siloxane (PVS) or vinyl polysiloxane (VPS) impression material. Addition silicone is available in extra low, low, medium, heavy, and very heavy (putty) consistencies.

- **Presentation:** The materials are supplied as
  - Two-paste system: The base and catalyst pastes come in equal size tube (unlike condensation silicones).
  - Two-putty system (jars): Two equal size jars, one containing the base and the other the catalyst.

- **Composition:**
  **Base:**
  1. Poly methyl hydrogen siloxane.
  2. Other siloxane prepolymer.
  3. Fillers.

  **Accelerator:**
  1. Divinyl polysiloxane.
  2. Other siloxane prepolymer.
  3. Platinum salt (chloroplatinic acid), catalyst.
  4. Palladium or hydrogen absorber.
  5. Retarders.
  6. Fillers.

- **Setting reaction:**
  It is addition reaction. Base polymer is terminated with vinyl group and is cross linked with silane (hydride group). The reaction is activated by the platinum salt (chloroplatinic acid). There are no by products.
  Sulfur compounds retard the setting of silicones. One source of sulfur contamination is from latex gloves worn by the operator when mixing the impression (the vinyl gloves should be used).

  \[
  \text{Vinyl siloxane} + \text{silane siloxane} \xrightarrow{\text{chloroplatinic acid}} \text{silicon rubber}
  \]

- **Properties:**
  1. Pleasant odor and color.
  2. Direct skin contact should be avoided because of the allergic reaction.
  3. Excellent reproduction of surface details.
  4. Setting time is (5-9) min.
5. It has the best dimensional stability among the elastomers even after 1 week (dimensional stability), it has low curing shrinkage 0.17% and the lowest permanent deformation (0.05-0.3).
6. It has good tear strength.
7. It is hydrophobic. Care should be taken while making the impression and pouring the wet stone, some manufacture adds a surfactant to make it more hydrophilic.
8. It has low flexible and harder than polysulphides. Extra spacing 3mm. should be provided in the impression tray. Care should be taken while removing the stone cast from the impression to avoid any breakage.
9. Shelf life range from 1 to 2 years.
10. More expensive.
11. Need to paint the tray with adhesive.

**Polyether impression material**

It has good mechanical properties and dimensional stability. Its disadvantages were that the working time was short and the material was very stiff. It is also expensive and bitter in taste. Polyethers remain popular among a large number of clinicians mainly because of their hydrophilic nature. The water-loving elastomeric material provides superior wettability and adherence to preparations, resulting in good surface detail. Their use is ideal in situations where it is difficult to maintain a dry environment.

- **Presentation:**
  Available as base and accelerator in collapsible tubes (the accelerator tube is usually smaller). A third tube containing a thinner was provided. It is available in three viscosities (light bodied, medium bodied and heavy bodied).

- **Composition:**
  **Base:**
  1. Polyether polymer.
  2. Colloidal silica (filler).
  3. Glycolether or phthalate (plasticizer).
Accelerator:
1. Aromatic sulfonate (cross linking agent).
2. Colloidal silica (filler).
3. Phthalate or glycolether (plasticizer).

- **Setting reaction:**
  
  \[ \text{Polyether} + \text{sulphonic ester} \rightarrow \text{cross linked rubber} \]

  The reaction is exothermic (4 to 5 C) rise.

- **Properties:**
  1. Pleasant color and odor.
  2. Bitter in taste.
  3. Direct skin contact should be avoided (the sulphonic ester may cause skin reaction).
  4. Setting time is (3-5) min. heat decrease the setting time.
  5. Excellent reproduction of surface details.
  6. Dimensional stability is very good. Curing shrinkage (0.24) % and permanent deformation is low. Polyether absorbed water and can change dimension (should not be stored in water or in humid climates).
  7. Tear strength is good.
  8. It is extremely stiff and its hardness is higher than the polysulphides and increase with time. Removing it from undercuts is difficult. So extra spacing (4 mm) should be given. Care should be also taken while removing the cast from the impression to avoid any breakage.
  9. It is hydrophilic. So moisture in the impression field is not critical. It has the best compatibility with stone.
  10. Shelf life is excellent (more than 2 years).
  11. Tray adhesive used before putting the impression in the tray.
  12. Expensive.

**Light activated polyether impression material:**

- **Available** as two viscosities:
  1. Light body: packed in disposable syringe.
  2. Heavy body: packed in tubes.

- **Composition:**
  1. Visible light curing polyether (urethane dimethacrylate elastomeric resin.
  2. Visible light cured photo initiator.
  3. Photo accelerators.
4. Silicon dioxide as filler: it has refractive index close to that of resin, in order to provide translucency necessary for the depth of the cure.

- **Properties:**
  1. Excellent elasticity.
  2. Very low dimensional changes upon setting, it can be poured immediately or up to two weeks.
  3. Polyether is very rigid (stiff) so undercuts should be blocked out for easy removal of the impression.

- **Manipulation:** no mixing is required, light body material is syringed into the impression area. The tray is loaded with heavy body material and placed inside the patient mouth. After the tray is seated in the mouth, both the viscosities are cured simultaneously using a visible light curing unit, having 8mm or larger diameter probe. The curing time is approximately 3 minutes.

- **Advantages:**
  1. Infinitive working time and short setting time.
  2. Excellent physical, mechanical and clinical properties.
  3. Simplification of manipulation technique, i.e. no mixing is required.

- **Disadvantages:**
  1. Need for special tray that are transparent to the visible light and are required to cure material.
  2. The materials should not be used in patient mouth with known allergy or sensitivity to urethane or methacrylate.
  3. The material should be stored in a dark place, away from the light.

**hybrid impression (combination of addition silicon and polyether):**

The vinyl polyether silicon impression material (VPES) represents the next generation of impression material. It combined the benefits of polyether and the vinyl poly siloxane impression materials. It is available in two setting time (fast and regular) and in 4 viscosities (light body, medium body, heavy body and putty).
• properties
  1. Pleasant tasting (mint taste).
  2. Excellent tear strength
  3. Adequate Bond of impression material to tray.
  4. Hydrophilic. Record the finer details of the tooth surface, even in a moist environment.
  5. Superior elasticity – elasticity without distortion allows for easy removal
  6. Multiple pours (allows for multiple pours due to the toughness and elasticity of material)
  7. Excellent dimensional accuracy.
  8. Exceptional reproduction of detail.
  9. Resistance to deformation (great recovery from deformation).
 10. Excellent flow.
 11. Compatible with any disinfection procedure
 12. Little time in mouth. Fast setting time.

• Technical consideration (for rubber impression material):
  1. The regular body and heavy body are usually made in special tray. Perforated stock trays are used only for making impression in putty.
  2. The spacing given is special tray between (2-4) mm.
  3. Elastomers do not adhere well to the tray. An adhesive should be applied onto the tray and allow to dry before making impression except the hybrid type don’t need adhesive.
  4. The bulk of the impression should be made with heavier consistency (to reduce shrinkage). Light bodied should only be used in a thin layer as a wash impression over the putty or heavy body.
  5. The putty type and the heavy bodied rarely could be used alone as primary impression without light body or used with light body or very light body as final impression.
• **Methods of making impression:**

1. **Single mix technique:** Tray used (resin special tray with 2 to 4 mm spacing). Viscosity used (regular only).

2. **Multiple mix technique:** Tray used (resin special tray with 2 to 4 mm spacing). Viscosity used (heavy bodied and light bodied).

3. **Two stage putty wash technique:** Tray used (perforated stock tray). Viscosity used (putty and light bodied).

• **Manipulation of elastomer impression materials**

The user should dispense the correct lengths of materials onto a mixing pad or glass slab. The catalyst paste is first collected by a stainless steel spatula and then spread over the base paste. The mixture is then spread over the mixing pad. The mixing process is continued until the mixed paste is uniform in color, with no streaks of the base or catalyst appearing in the mixture. If one of the components is in liquid form, such as the catalyst for condensation silicones, a length of the base is dispensed from the tube onto a graduated mixing pad and drops of the liquid catalyst corresponding to the length of the base are added. The two-putty systems that available for condensation and addition silicone dispensed by volume using an equal number of scoops of each material. The best mixing technique is to knead the material with fingers until a uniform color is obtained.

Each type of the impression is put in the tray and then inserted in the patient mouth. The impression should not be removed from the patient mouth until the curing has progressed sufficiently to provide adequate elasticity, so that distortion will not occur. Typically, the impression should be ready for removal within at least 10 minutes from the time of mixing. Manufacturers usually provide the optimal time for removal after mixing. Finally we pouring the impression according to the type of the material (either immediately or waiting for a period). No separating medium is needed before pouring the gypsum products. All the type of elastomeric impression material except the hybrid impression need tray adhesive.

• **DIGITAL IMPRESSIONS**

Several digital impression systems are currently on the market that allows the dentist to make a digital impression in place of a traditional impression. Digital impressions offer a precise fit with fewer incidents of remakes and shorter adjustment time.
CAD/CAM, the abbreviation for computer-aided design/computer-aided manufacturing, describes a process in which digital images or models of objects are created and used for the design and fabrication of final products.

Dental CAD/CAM systems consist of three components:

1. A scanner or digitizing instrument.
2. Software that processes the scanned data and creates images of the digitized object.
3. Fabrication technology that transforms the digital data of the restoration into a physical product.

Scanners use either a series of static images or a stream of video images to capture the geometry of the tooth preparation and oral tissue.

<table>
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<tr>
<th>Properties</th>
<th>poly sulphide</th>
<th>condensation silicon</th>
<th>addition silicon</th>
<th>polyether</th>
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