Materials

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Silicone impression materials are elastic, irreversible and artificial (not hydrocolloid) materials. They are classified according to their method of polymerization on setting to:

1- Condensation silicone (condensation polymerization reaction => by-product will be produced)
2- addition silicone (addition polymerization ↑↑reaction).

Silicone rubbers are available in a similar range of viscosities to the polysulfides (light, medium and heavy). However, the range is supplemented by a fourth viscosity; a very high viscosity or ‘putty’ material. The high filler loading of the putty was initially devised to reduce the effects of polymerization shrinkage.

The viscosity of silicone materials is higher than the viscosity of impression compound.

The putty is commonly combined with a low viscosity silicone when recording impressions, a procedure known as the ‘putty-wash technique’. => assuming that putty is highly viscous (the viscosity is Inversely proportional to production details), so putty will give proper surface details.

2 step impression => we put the putty (high viscous materials) and measure the size then put the low viscous materials and measure the size
** 1 step => loading the tray by putty and put the low viscous materials where the teeth will set.

***As with polysulfides, silicone rubbers are very hydrophobic so unless the teeth are properly dried ‘blowholes’ are likely to be produced in the set impression, we use 3 in 1 syringe dental to dry it ( 3 in 1 syringe dental can produce air or water or water+air , we use only the air “air drying” in this case ) . If we don’t dry well, we will have blowholes.

*blowholes=فقاقةيع

***Both types of silicone rubber have the best elastic properties of any impression material, the recovery of strain being said to be almost instantaneous, but polysulfide materials need 2 min (poor elastic recovery)

*** Like the other elastomers, they have adequate tear resistance. They are non-toxic and absolutely neutral in both color and taste. So, silicone materials are the best materials that we use in the impression.

***REMЕBER:
- We use polyether in the incense.

*** As with the polysulfides, the setting reaction produces a volatile byproduct, but with type I silicones (condensation) it is ethyl alcohol, not water. Loss of the by-product leads to measurable weight loss accompanied by shrinkage of the impression material on storage. So, we do not use it much.

***The dimensional changes of condensation silicones are slightly greater than those of polysulfides, but the changes in both types of materials are small in comparison to the changes which occur with alginate.
To produce the most accurate models, regular and heavy body impressions should be cast within 6 hours of being recorded. (exactly 6 hours no more or less). Polysulfide and polyether should be cast within 48 hours.

Polymer + monomer (by ether bonds so we need hydroxyl group and Si atoms) R-Si-O-Si-R'

### Composition of Condensation silicone:

<table>
<thead>
<tr>
<th>Component</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paste</td>
<td>Hydroxyl-terminated polydimethylsiloxane (liquid silicone prepolymer) Inert filler such as silica</td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid</td>
<td>Alkyl silicate such as tetraethylsilicate</td>
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</tbody>
</table>

### Addition silicone (or polyvinylsiloxane PVS):

Composition:
/Supplied as two pastes. Each paste contains a liquid silicone prepolymer and filler. One of the pastes contains a catalyst (platinum-containing compound such as chloroplatinic acid). **** the catalyst is sensitive to latex, so we don't use latex gloves BE CAREFUL.

/One paste contains a polydimethylsiloxane prepolymer in which some of the methyl groups are replaced by hydrogen. The other paste contains a prepolymer in which some methyl groups are replaced by vinyl groups.

* refer to the book, page 289 and see the structure to make things clear.

*** H gas is occasionally produced after polymerization. (it’s not a by-product). Bubbles are caused by the release of hydrogen. we can remove these bubbles by evaporation (all of the H gas must be released before
we pour the addition silicone impression in the high strength stone) or **palladium hydrogen absorber will be included in the impression materials.**

***we pour the impression materials after a certain time has passed (this time depends on different factors)

♦ additional silicone gives Superior dimensional stability
♦ A great deal of recent research has been centered around the production of hydrophilic silicone rubbers. Some commercial addition cured products have recently been introduced. A study by Pratten and Craig showed one of these ‘hydrophilic’ addition silicone materials to have a wettability similar to that of polyethers. Other studies have also shown that treatment of impression materials with topical agents, including surfactants, results in a decrease in the number of voids found in the final impression and the dies poured from them.
♦ The platinum catalyst system is relatively easy to poison, inhibiting the set of the material. (No latex gloves, composite, light cured GIC, ferric salts)

****** Non-elastic impression materials: we use them in special cases:
1- completely edentulous patient 2- no undercut cases or mild undercuts
We can’t use them on natural teeth

*undercut: when we look to the tooth vertically, we can't see some places, we called them **undercut** (hidden area)
A factor which links the materials is their inability to accurately record undercuts. One of the materials (plaster) is brittle when set and fractures when withdrawn over undercuts. The other products are likely to undergo gross distortions due to plastic flow if used in undercut situations.

*Non-elastic impression material that has low viscosity can fit in this hidden area (undercut) so when we try to remove it, the teeth will be broken.

*** ZnO eugenol: it's very important materials => use it in secondary impression.
* supplied by 2 pastes:
  1- ZnO =WHITE
  2- EUGENOL = RED (قرنفل).
  => MIXED THEM TOGETHER BY GLASTIC NOT PLASTIC ROD. (acid-base reaction).
*the product (ZnO eugenol) has good viscosity, we use it for record secondary impression, it gives fine details.

*The basis of the reaction is that the phenolic – OH of the eugenol acts as a weak acid and undergoes an acid – base reaction with zinc oxide to form a salt, zinc eugenolate, as follows:

\[ 2C10H12O2 + ZnO \rightarrow Zn(C10H11O2)2 + H2O \]

- Should be around 1mm in thickness
- Very good dimensional stability
- Low initial viscosity
- Occasionally, patients may be sensitive to Eugenol (in this case we should ask the patient, instead of using it, we can use silicone)
- Rigid on setting
- These materials are normally used to record the major impressions of edentulous arches.
*** Impression plaster: it gives fine details. It’s the most nonelastic material that gives fine details but it has some disadvantages and that’s why we don’t use it.

♦ Impression plaster is similar in composition to the dental plaster used to construct models and dies
  (models= cast / dies = for one tooth)
  ♦ It consists of calcined, β-calcium sulphate hemihydrate which when mixed with water reacts to form calcium sulphate dihydrate. (very important)
  ♦ High water/powder ratio (very low viscous = 0.6)
  ♦ Mucostatic impression
    -muco=mucous tissue
    -static=normal, fixed, not compressive
  *** on the other hand, there are mucocompressives that are used when we put the section on the tightened teeth and tissues; to make sure that gap won't appear.
  *** flabby bridge=> if we compress on the tissue and teeth to make mucocompressive impression, after we put the section, it will be broken because the teeth and tissue will want to return to their normal shape (recoil) (as long the section is put on the teeth, they will stay compressive)
  ♦ Hydrophilic.

♦ Excellent dimensional stability
  ♦ Gypsum products tend to expand on setting, which compromises the accuracy of the impression. Therefore, potassium sulfate (anti-expansion agent) has been added to the material.
  ♦ Potassium sulfate will also accelerate the setting reaction. For that reason, Borax has been added to control the setting time.
  *** borax = powder + water + other liquids, like slime.

*Special considerations:
  - Custom tray is needed with 1-1.5 mm spacer.
- Coat the impression with a separating medium before pouring with gypsum products.

♦ Disadvantages:
- Following setting, the plaster impression material is very brittle. It can undergo virtually no compressive or tensile strain without fracturing. The material is, therefore, not suitable for use in any undercut situations.

*** Impression compound: => primary impression
♦ A thermoplastic material
♦ Composed of natural or synthetic resins and waxes.
*** thermoplastic => affected by temperature
- high T= plastic (you can mold it)
- low T= hard

*** classification:
1- class one (lower fusing) => impression materials =>
   1-sheet, high filler and viscosity, low details production
   2- sticks (green sticks), low filler and viscosity, high details production
2- class two (higher fusing => need higher T for softening), used for constructing impression trays =>. +++ the temperature in the mouth is low so it doesn't affect its plasticity.

♦ A temperature in the range of 55–60ºC is normally found to be ideal to soften the compound.
We preform “border molding” on green sticks. Because it has a low viscosity, it will give fine details and this helps the borders of the denture to be perfectly installed and sealed.

***POOR THERMAL CONDUCTIVITY: ***

if we heat the materials from one side, heat will be distributed to the other side => to make things clear:

عندك قطعة حديد سخنها من طرف واحد وبعدها حط ايدك ع الطرف الثاني راح تحس أنه الحرارة بتزيد لأنه الحديد موصل كوبس للحرارة. بس جرب على قطعة خشب خشب سخنها من طرف واحد ما راح تحس بالحرارة ع الطرف الثاني راح تنحرق القطعة وانتا بتنصني اصلا. ***

problems:

1-

![Diagram 1](image1)

so, we must (نعجن المادة) to make the T inside equal to the T outside (kneading)

2- temp in the mouth = 37
temp in the room=20, so when we take out the impression material from the mouth to the room =>

![Diagram 2](image2)
we can use the previous technique or we can use the water bath (T=30) => it will give good details.

Three factors combine to produce significant internal stresses within the compound impression.
1. The high value of coefficient of thermal expansion.
2. The poor thermal conductivity.
3. The relatively large temperature drop from the softening temperature to room temperature.

***Impression waxes:
- They are thermoplastic materials which flow readily at mouth temperature and are relatively soft even at room temperature.
- Impression waxes are rarely used to record complete impressions but are normally used to correct small imperfections in other impressions, particularly those of the zinc oxide/eugenol type.
- These materials consist, typically, of a mixture of a low melting paraffin wax and beeswax in a ratio of about 3:1.