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**Investment materials**

It is ceramic material used to form a mold into which an alloy is cast.

**Requirements of an ideal investment material:**

1. Easy to use and reasonable setting time
2. Sufficient strength at room temp. and a high temp.
3. Must not decompose at high temp.
4. Should have enough expansion to compensate for shrinkage of wax and metal.
5. Should be porous to allow air and other gases to escape.
6. Should produce smooth surface and fine details.
7. Should break easily after casting is completed.
8. Should be inexpensive.

**Types:**

1. **Low temperature casting investment:** Gypsum – bonded investment
2. **High temperature casting investment:**
* Phosphate – bonded investment.
* Ethyl silicate – bonded investment.

**Each type of investment should be composed of:**

1. **Refractory material** like silicone dioxide such as quartz, tridymite or cristobolite or mixture of them.
2. **Binder:** because of the refractory material alone does not form a coherent mass the binder is needed. so alpha calcium sulphate hemi-hydrate is the binder for gypsum –bonded investment or phosphate for phosphate – bonded investment or ethyl silicate for silicate bonded investment.
3. **Modifiers:** to modify the physical properties such as sodium chloride. Boric acid and potassium sulphate.

**Gypsum bonded investment**

* **Uses:** it is used to form mold for casting gold alloys for crown and bridges.
* **Manipulation:** The powder is mixed with water and poured around wax pattern and allow for setting.
* **Properties:**
1. Thermal, setting and hygroscopic expansion is about 1.3% - 2%.
2. It will decompose to sulfur dioxide and sulfur trioxide when heated above 700 C tending to embrittle the alloy therefore it is not used for casting co / cr or palladium alloys but used for gold alloy.
3. Three types of expansion may develop: setting, thermal and hygroscopic expansion.

**Phosphate bonded investment**

Uses: to form mold for casting high temp. dental alloys like co / cr. Also as fixture for holding dental appliance to be soldered or welded.

It is composed of powder which is silica dioxide 80%, ammonium diacid phosphate 20%, and magnesium oxide. The liquid is colloidal silica suspended in water.

 the powder is mixed with the liquid and poured around the wax pattern and allowed to set for 15-30 minute. it is placed in a furnace to burn out the wax pattern. Then heat the investment and melt the alloy and make the casting.

**Ethyl silicate – bonded investment**

The same uses as phosphate bonded investment. It is composed of powder which is silica dioxide, magnesium oxide, the liquid is supplied into 2 or 3 liquid systems mixed to form solution then mix the powder with it. The liquid is composed of ethyl silicate and denaturized acid. Expansion is about 1.7-2.1%.

**Soldering investment:**

It is composed of quartz and calcium sulphate hemihydrates binder for low melting point alloys. For high melting point alloys phosphate bonded investment should be used. Soldering investment should have lower setting and thermal expansion than casting investment. They are made of ingredients that do not have as fine particles size as casting investment

**All ceramic crown investment:**

This investment must accurately reproduce the fine details; remain undamaged during firing of ceramic. And have thermal expansion compatible with that of ceramic. They are also phosphate bonded and contained fine grained refractory fillers to allow accurate reproduction of details.

 