Dental Material

Gypsum Products

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الكورس الثاني

المرحلة الأولى

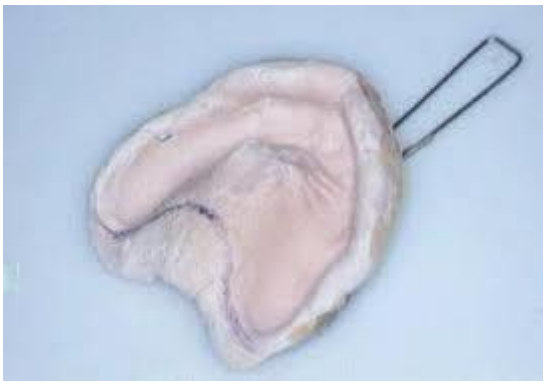
Gypsum products

Introduction

Products of gypsum are used widely in dentistry. At first, Gypsum was found in mines around the city of Paris, so it is also called plaster of Paris and then gypsum is found in most countries. The mineral gypsum CaSO4.2H2O is usually white to yellowish white in color.

Application in dentistry

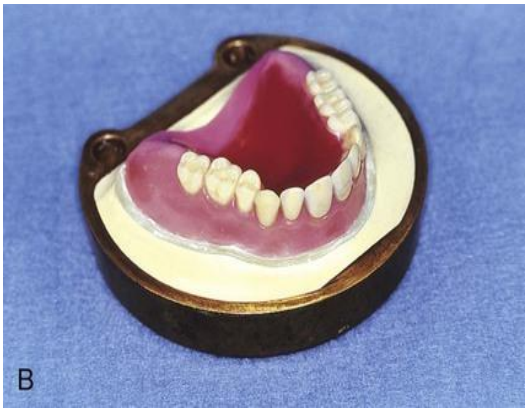
1. Impression plaster used for impressions of the mouth.



2. Used to make molds, casts and dies for making restorations.

3.To attach casts to an articulator

4.Molds for processing dental polymers



5.Dental investments: when plaster is mixed with silica it is known as dental investment. They are used to form molds for metal casting.

Properties of ideal model material

1. Dimensional stability.
2. High strength.
3. Hardness.
4. Reproduce the fine details.
5. Produce smooth surface.
6. Reasonable setting time.
7. Compatible with impression materials.
8. Can be disinfected.

Types of gypsum products

Type 1: Dental plaster for impressions.

Type 2: Dental plaster for mounting or for models.

Type 3: Dental stone for models Type.

4: Dental stone (high strength, low expansion) for dies Type.

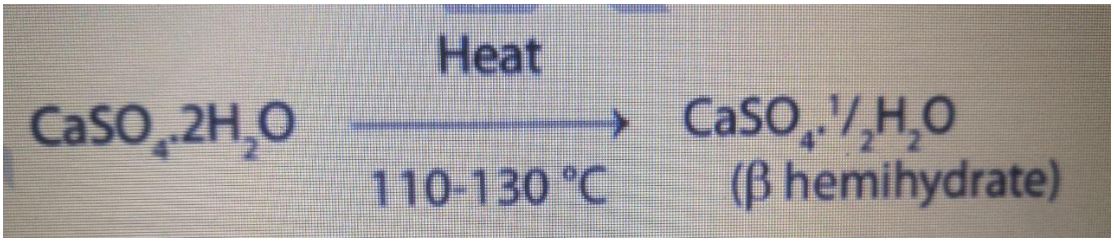
5: Dental stone (high strength, high expansion) for dies.

Manufacture of gypsum products

Calcination: it is a process of heating gypsum to produce plaster.

- Mined gypsum is ground and heated. When heated, gypsum (calcium sulphate dihydrate) ($CaSO_4.2H_2O$) loses part of its water and changes to calcium sulphate hemihydrate ($CaSO_4.1/2H_2O$).

Manufacture of dental Plaster: it is produced by heating gypsum in open container to (110 – 130 C) which loses water to form plaster (CaSO4.1/2H2O). The crystals of plaster are irregular in shape and porous called Beta-hemihydrate.



W/P ratio

The powder is mixed with water at a certain ratio according to the type of gypsum product, W/P ratio for plaster is 0.5 that is 50 ml of water for 100 gm of plaster powder. W/P ratio for stone is 0.3, W/P ratio for die stone is 0.2, The difference in the W/P ratio is due to the difference in the bulk volume of the powder. The water is measured and put in a clean rubber bowl then the powder is stiffed on it gradually, allow the powder to settle then mix with clean spatula for 1 min. until creamy mix is obtained.

Factors affecting the setting time:

1. W/P ratio: The more water is used for mixing, the fewer the nuclei there will be per unit volume, and consequently the setting time will be prolonged.

2. Fineness: The finer the particle size of the hemihydrate, the faster the mix will harden. The rate of the solution of the hemihydrate will be increased, also the gypsum nuclei will be more numerous and therefor more rapid crystallization will occur.

3. Mixing: The longer and more rapidly the plaster is mixed, the shorter is the setting time. When powder is brought into contact with the water, some gypsum crystals will be formed. As mixing begins, more particles will be exposed to water and thus form more crystals at the same time the crystals are broken up by mixing and they are distributed through the mixture and result in the formation of more nuclei for crystallization thus the setting time is decreased.

4. Temperature: There is little change in the setting time between 0 – 50 °C but if the temperature exceeds 50 °C the setting time will be retarded. As the temperature approaches 100°C, no setting will take place.

5. Impurities: If the manufacture adds gypsum, the setting time will be shortened because of the increase in the potential nuclei for .crystallization

Retarders & accelerators: The addition of retarders and accelerators -6 are the most effective and practical way to control the setting time. Retarder is the chemical material added to the gypsum product to increase the setting time ex. Glue, Borax, and Gum Arabic. It will reduce the dissolution of the hemihydrates and might deposit on the nuclei of crystallization and effectively reduce the rate of crystallization and so retard setting time. Accelerator is the chemical material added to the gypsum product to decrease the setting time ex. Sodium Chloride and Potassium Sulfate in a certain concentration. These salts increase the rate of hemihydrate dissolution and thus the saturation of the solution occur more rapidly.