
UNIT 3 CHEMICALS BONDING AGENTS

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3.1 INTRODUCTION

In Units 1 and 2 of this course, you have learnt about the cementing materials which belonged to the categories of Argillaceous, Calcareous and Carbonaceous cementing materials. However, with advances in the interdisciplinary approach in the production of materials and the need to produce mortars and grouts which could be used in widely varying situations for bonding, repair and maintenance, have led to the introduction of chemicals in a big way into building construction. While there is a wide range of chemical products, we will confine ourselves, in this unit, only to those chemicals which help in modifying mortars and concretes to develop better sealing and bonding properties. We shall cover these aspects by examining the different bonding and sealing agents, modified mortars, adhesives, non-shrink grouts and aids. We shall examine their composition, properties, applications and the procedure of application. The major chemicals used for these purposes are based on polymers which are being increasingly used in building construction. Some popular commercial products and their brand names together with their manufacturers are also included in the text for your ready reference. However, you must remember that your job in this unit is to understand the widely improved properties of polymer modified materials with an eye on their field application.

Objectives

In this unit we introduce you to bonding, sealing and grouting mortar which are polymer and epoxy based and whose uses are increasing in building construction. We shall do this by classifying these agents in different categories of bonding and sealing agents, Polymer Modified Mortars and Adhesives and **Non-shrink** Grouts. We also relate these products to the commercial brands available in the market and their manufacturer.

By the end of this unit, you should be able to

- * define and explain properties of different mortars and grouts,
- * identify their fields of applications and uses,
- * describe the application procedures for different mortars and grouts, and
- * select the right mortar or grout for a particular application.

3.2 BONDING AND SEALING AGENTS

Bonding and sealing agents are water emulsions of several organic materials either, which are mixed with cement or mortar grout for application to an old concrete surface, just prior to patching with mortar or concrete, are mixed with the topping or patching material. Their function is to increase the bond strength between the old and new concrete. This procedure is used in patching of eroded or spalled concrete or to add relatively thin layers of

resurfacing. The commonly used chemicals for bonding are obtained from natural rubber, synthetic rubber or from organic polymers. The polymers include polyvinyl chloride, polyvinyl acetate etc.

3.2.1 Bonding Agents

Bonding agents fall into two categories, namely, re-emulsifiable and non-reemulsifiable types. The latter type is better suited for external application, since it is water resistant. The emulsions are generally added to the mixture in proportions of 5 to 20 percent by weight of cement, however you must read and comply with the instructions of the manufacturer for each product while using the same. A major prerequisite for the use of these bonding agents is that the base on which they are to be applied must be clean, free from loose materials and dust. It should also be free from oils, fats and similar contaminations. There are several bonding agents and chemicals available however, most of them are based on Acrylic polymer. Acrylic not only provides excellent bonding properties but also improves abrasion resistance and compressive and flexural strengths, and imparts waterproofing properties. Two such polymer bonding agents are described below.

i) Universal Bonding Agent

This agent is generally used in the form of liquid resin for improving adhesion and strengths of all types of mortars which are in common use. It is also suitable as an admixture for concrete, cement mortars, lime and gypsum mortars for obtaining waterproof concretes and mortars. The addition of this bonding agent to the mortar/concrete improves the bond between the old surface and new mortar/concrete, increases the resistance of the toppings against wear and tear and mortars become waterproof. In addition, it improves the workability and water retaining capacity of the mortars. The properties of these agents will give you a better understanding of them.

Properties :

- 1) It provides an efficient adhesion and bonding of mortar, concrete and plaster to old hardened concrete and mortar bases.
- 2) It increases the elasticity of the mortars and concretes, thus preventing the formation of stress cracks in the hardened and set concretes and mortars.
- 3) It imparts improved workability to mortars and they can be drawn into very thin layers.

Fields of Application :

- a) As bonding slurry between the hardened concrete and fresh toppings of concretes or mortars,
- b) bonding mortar for bonding of hard burnt bricks, asbestos, cement, natural stones, tiles etc.,
- c) repair mortars for mending damaged spots in precast industry, pipelines etc.,
- d) repair and patching mortars for efficient repairs of screeds, steps and similar damages on concrete and mortar surfaces,
- e) levelling and smoothing mortar for thin layer of applications,
- f) To bond tiles efficiently to wall and for laying tiles on floors using thin bed method,
- g) For dado mortar which is subjected to high wearing and is exposure to water, and
- h) In cement screeds, gypsum and lime mortars.

It can be well appreciated by you that this bonding agent is highly versatile and universal and will find diverse applications in building construction. However, you must take sufficient care while using these agents to obtain maximum advantage by following the application procedure.

Application Procedure :

You must first ensure that the base is clean, free from loose materials and dust. Also ensure that it is free from oils, fats, and similar contaminations. Now wet the base, in case of a smooth and uneven base, a coat of universal bond agent slurry is applied. This slurry generally consists of one part of standard cement to one part of clean sharp sand of grading 0/1 mm in dry form. Now add the bonding agent to the mixing water in the ratio of one part of agent to two parts water. This water is now added to the dry mix until a slurry is obtained. The mixing ratio will vary, depending upon the application.

Some Commercial Brands Available

- a) **Natufill** manufactured by **M. C. Bauchemie** (India) Pvt. Ltd., Bombay.
- b) **Plastocrete Admixture** for concrete repair, manufactured by **Razon Trading Corporation**, Pune.

ii) Acrylic based Bonding Agent :

This is a saponification resistant plastic co-polymer dispersion which is extremely useful as polymer component in the hydraulically setting mortars.

Properties :

- 1) It improves structural bond between existing mortars/concrete and fresh mortar.
- 2) It improves the flexibility of mortar thus avoiding stress in the repair/screed system.
- 3) The compressive and flexural strength is increased. The 28 day strengths are 5.5 N/mm² and 11.0 N/mm², respectively.
- 4) It reduces water absorption thus imparting increased waterproofing properties.
- 5) The fresh mortar being plastic and workable with low water content results in reduced degree of shrinkage.
- 6) In thin layer mortars the risk of drying out, shrinkage cracks reduces because of improved water retention value.

Fields of Application :

Keeping in view the properties mentioned above, you may find this chemical suitable for following applications.

- a) For production of structural levelling compounds and bonded screeds.
- b) For preparing repair mortar to be used in the repair and filling of structural concrete in bridges and in buildings.
- c) For making waterproofing mortar for roofs and basements etc.
- d) For strong and impermeable bonding of old and new concrete.
- e) For improvement of mechanical and technological characteristics of ready-to-use coarse and fine repair mortars for concrete repairs.

Application Procedure :

After preparing the base as mentioned for the universal bonding agent, moisten the concrete surface. Once surface dries, apply the following bond coat, of composition :

- i) 100 parts by weight (p.b.w) of mortar + 13 p.b.w of liquid consistency (1 p.b.w of agent + 1 p.b.w of water).
- ii) Now forcefully brush this bond coat into the base by brush or broom.
- iii) You should now apply in wet-on-wet condition on to the bond coat, a polymer mortar consisting of 100 p.b.w of mortar + 11 p.b.w mixing liquid consisting of 6 p.b.w of agent + 5 p.b.w. water.
- iv) The mortar should be suitably protected from rapid drying in order to ensure uniform development of strength.

Commercial Brand Available :

Natufill BB of MC-Bauchemie.

3.2.2 Sealing Agents

- i) **MC-Fix-ST** : This is a polymer modified, ready to use mortar for quick and reliable sealing and **plugging** of leaks in tunnels, shafts, basements, cellars, pipes etc.

Properties :

- 1) The mortar develops very high strengths and is stone hard within 5 to 7 minutes possesses excellent waterproofing and bonding properties and provides permanent sealing.
- 2) It sets hydraulically without shrinkage.
- 3) The mortar is chloride free, and does not saponify over a period of time.

Fields of Application :

- a) , It can be employed anywhere where a quick and reliable sealing is required, even against water pressure.

- b) It is specially useful in carrying out waterproofing jobs, where continuous seepage of water inhibits waterproofing treatment.

Application Procedure :

You should first chisel out the crack or leakage spot and prepare it in dove tail shape. Now remove loose particles and dust. Prepare MC-Fix-ST in small amounts with water, knead it into a paste and mould it into a plug shaped mass. You should now hold it immediately against the water leak and press it into the prepared joint and hold for 5 - 7 minutes, till it sets. You may use hot water to accelerate the setting. In case the leak is large, requiring more than one plug, then commence plugging at the top of the leak aperture and work downwards until completion. In cold temperatures below 8° C use warm water.

- ii) **Omai Seal** : This is a modern epoxy based sealing compound with excellent properties of bonding and hardening, low water absorption and high strength. Omai Seal is prepared by a combination of epoxy, resin and hardener. It is used to seal cracks in tile joints, in floors and for injecting and grouting deep cracks in concrete structures.
- iii) **Cem Seal 50** : This is a multipurpose cement primer and sealer with excellent penetrative characteristics, and has extra bonding and adhesion properties. Cem Seal 50 penetrates into the capillaries and provides an anchoring action with cold substrates in addition to sealing the capillaries. This prevents absorption of water from subsequent treatments, thus resulting in adequate hydration and freedom from efflorescence and surface maintenance. It is polymer based and fully compatible with conventional grouts, polymer cement concrete and mortars. It eliminates the need for expensive and cumbersome hacking of sub-surfacing, thereby saving labour, because of excellent bonding properties.

Properties

- 1) It can be used on damp surfaces.
- 2) It provides good adhesion and bonding properties.
- 3) It maintains the same cement cover of R.C.C.
- 4) It is ready to use and easy to apply.
- 5) It prevents the water absorption in highly absorptive sub-surfaces.
- 6) It provides mechanical key when used in conjunction with strewn sand.
- 7) It is suitable for use with cement paints, tile mortars and water proofing slurries.
- 8) It provides outstanding resistance to dirt and dust collection.

Fields of Application

You may consider it highly useful for :

- a) Base coat for cement paints, lime washes, and gypsum plasters,
- b) Bonding coat for old and new surfaces of concretes and mortars,
- c) Primer coat for plasters, renderings and screeds,
- d) Sealer for highly absorbent surfaces, and
- e) Application on asbestos, hollow blocks and bricks.

Application Procedure :

The surface is prepared as described earlier. Now bonding slurry comprising 1 part by volume (p.b.v.) of fresh and good quality of portland cement, 15 p.b.v of clean, fine dry and well graded sharp sand mixed with Cem Seal 50 is prepared. You should apply this slurry on the base and comb gently with a wire brush to ensure penetration and, hence good bonding key.

- iv) **Tech Seal** : This is a two-component poly sulphide based sealant consisting of base compound of liquid poly sulphide polymer and an accelerator containing a chemical curing agent. The material cures after mixing, to form a strong rubber like substance.

Properties :

- 1) It has excellent adhesion to common building materials like concrete, brick, wood, glass, aluminum and steel.
- 2) It is resistant to weathering and ozone.
- 3) It is flexible both at high and low temperatures varying from 40°C to 80°C.
- 4) It is inert to a wide range of chemicals, including solvents and fuels.

Fields of Application :

Techseal is extensively used for

- a) Joints in water-retaining structures,
- b) Joints in bridges, roads, car parks,
- c) Joints in basements, subways and retaining walls,
- d) Joints in roofs of steel and concrete, and
- e) Joints in glazing frames and windows and in curtain walls, ceilings.

Application Procedure :

After preparing the base, apply a primer coat. Now mix the base and accelerator of the sealant thoroughly till a uniform grey colour is obtained. Pour directly from the container into the joints. The setting time varies from 72 hours at 5°C to 18 hours at 35°C, while the curing time varies from 8 weeks at 5°C to 12 days at 30 - 35°C.

Techseal is manufactured by Choksy Chemical Pvt. Ltd., Bombay.

3.3 POLYMER MODIFIED MORTARS AND ADHESIVES

In this section, we will study polymer modified mortars and adhesives, which help in the repairing of damages caused to the construction.

3.3.1 Polymer Mortars for Repair and Maintenance

The reinforced concrete is a versatile building material, but, rapid damage can occur to it due to environmental stress and repeated use.

There are three types of mortars available in this category, which can be used by you for repairs and maintenance of structures.

i) Ready to use Hydraulically setting Fine Mortar

This mortar can be used to repair, level, smoothen and finish concrete and fair-faced concrete as well as for filling of blow holes. In this mortar, a polymer component is added to improve its mechanical and technological properties. One such mortar is marketed under the brand name of Zentrifix F82, in which Natufill BR2 is added to the mixing liquid in the ratio of 1:4.

Properties :

- 1) It can achieve quite high adhesive strength in tension.
- 2) It is workable for about 30 minutes at normal temperatures.
- 3) It is non-inflammable.
- 4) It has high resistance against the diffusion of carbon dioxide.

Fields of Application

You can use this mortar for :

- a) Large area fine filling.
- b) Full surface fine filling to a depth of 1 to 6 mm.
- c) Repair and filling of smaller defects, cavities, holes.

Application Procedure :

First, prepare the surface which should be free from loose or sundry particles and impurities. Now, you should lightly moisten the surface. Prepare the mortar as follows :

100 parts by weight (p.b.w) Zentrifix F 82 + 20 p.b.w. mixing liquid consisting of 1 p.b.w. Natufill BB2 + 4 p.b.w. water. This mixture should be free from lumps, and only such quantity should be prepared which can be used within 30 minutes. You must ensure that curing of this mortar begins as soon as the initial setting takes place.

ii) Ready to use Fine Repair Mortar :

In order to overcome the damages to concrete due to carbon dioxide which causes carbonation, leading to corrosion of reinforcement, this fine repair mortar is used. It provides a protective coat, and you can also use it for cosmetic repair. It is a ready to use and one such polymer modified mortar available in the market is called Nafuquick ; which comes in powder form.

Properties :

Its major properties are that it

- 1) is easy to mix and apply,
- 2) has excellent bonding properties, and
- 3) is resistant to carbonation

Fields of Application :

You could use this mortars in the following fields :

- 1) To repair, smoothen and level fair-faced concrete and precast elements.
- 2) To repair small holes as well as large surface areas, and
- 3) To provide a thin surface protective layer on light weight concrete and other concretes.

Application Procedure :

As you have noticed earlier, the initial surface preparation is very important, and is similar as for earlier mortars. The surface should be damp but not soaked.

The gauging water is first mixed with another agent called **Natufill** BB2, by volume in the ratio of 3:1. Now this water is mixed with Nafuquick and stirred to obtain a fairly stiff mortar. The ratio is 1 part by weight (p.b.w.) gauging water : 4 to 5 parts of Nafuquick.

The mixed mortar should be used within 20 to 25 minutes. Once the mortar starts setting, it should be smoothened and cured with water or any curing compound.

- iii) **Polymer modified Mortar for Concrete Repairs :** This mortar is a hydraulically setting polymer modified mortar, which is specially suited for coarse and thicker repair work. One such mortar available in the market is called Zentrifix AS.

Properties :

It possesses

- 1) excellent adhesion properties, even in overhead applications and on projecting corners.
- 2) very good stability under load and allows early loading.

Fields of Application :

Most usefully applied in coarse and thicker repair work on concrete and precast concrete.

Application Procedure :

After preparing the surface as before, you should not forget to lightly moisten it.

Firstly a bond coat as prepared below is applied firmly on the surface :

100 p.b.w Zentrifix AS + 25 p.b.w mixing liquid consisting of 1 p.b.w Natufill BB2 + 2 p.b.w water.

Now the polymer modified mortar, similar to above mixture but having 15 p.b.w of mixing liquid is applied on the bond coat .

The application time is about 20 minutes at - 20°C and it must be cured. A compressive strength of 29.7 N/mm² and flexural strength of 5.0 N/mm² can be achieved at 2 days.

Let us now have a look at the chemical resistant bonding mortars and study their properties and applications. Three prominent types are described, in the following section.

3.3.2 Chemical Resistant Mortars

i) **Resin Type Chemical Resistant Mortar :**

There are a wide variety of resins which can be used in such mortars. They are Phenolic, **Furane**, **Epoxy**, Polyester and Cashewnut shell liquid.

Properties

- 1) Fairly good resistance to **non-oxidizing** mineral acids.
- 2) Fairly resistant to inorganic alkalis.

Fields of Application :

The selection of bonding material has to be entirely based on the particular problem at hand. However IS- 4443-1967 has given chemical resistance of different types of resins mortars in Table 1 and 2 which will help you in choosing the right type of resin mortar for different applications in the field. They find applications in resisting acids, alkalis, salt solutions, solvents, gases, minerals, oils and vegetable oils and fats.

Application Procedure :

While detailed procedure is given under IS-4443- 1967 a brief outline is given here for your easy comprehension:

- i) Prepare the surface on which the chemically resistant bricks or tiles are to be laid.
- ii) Apply a coat of bitumen primer followed by a uniform coat of bitumen.
- iii) Now, the resin type mortar is spread on the back of tile or brick to a thickness of 6 to 8 mm and upto 4 to 6 mm on the sides. The tile is now pressed into the bed and excess mortar is trimmed off.
- iv) Resin mortars are normally self curing. They should not be put to use for 48 hours in case of furane, epoxy polyester resin type mortars. In case of phenolic and cashewnut shell, curing period could be extended as per manufacturer's instructions. However, with heat treatment curing period can be reduced.

ii) Sulphur Type Chemical Resistant Mortar :

Sulphur is an inorganic product consisting of an intimate mixture of sulphur and inert fillers like carbon or silica flour. Sometimes, small amounts of chemically resistant inert modifying agents may be added.

Properties :

- 1) Good resistance to most of acids except concentrated oxidizing acids.
- 2) Poor resistance to alkalis.

Fields of Application :

Table 1 in IS:4442 - 1967 gives recommendations regarding use of sulphur type chemical resistant mortars for different chemicals like acids, alkalis and solvents. Sulphur types mortars are applied effectively against resistance to situations involving acids.

Application Procedure :

The application procedure is as follows :

- i) The surface is prepared as for resin type mortar described at 3.3.2 (i).
- ii) First spacer chips, 6mm thick made of sulphur mortar, are made on the surface. Now chemical resistant tile or brick is placed on spacer chips covering at least 3 chips.
- iii) Then molten sulphur mortar is poured in the space between the floor and the tile avoiding air pockets, till it completely fills the joints.
- iv) Paraffin wax, paper may be used to protect the tile or brick.
- v) These floors are not used till 8 hours after laying.

iii) Silicate Type Chemical Resistant Mortar :

This mortar consists of a chemically inert solid filler, a setting agent usually contained in the filler and a liquid silicate binder. A workable mortar is formed on mixing of filler and binder which then hardens by the chemical reaction between the setting agent and the binder.

Properties :

Silicate Type Chemical Resistant mortars have following properties :

- 1) This mortar is resistant to most acids except hydro-fluoric and concentrated ortho-phosphoric acids.
- 2) It is resistant to alkalis of any concentration or to boiling water and steam. It is likely to deteriorate by continued exposure to water or frequent washing with water.

Properties :

- 1) Higher adhesion and bonding strengths which are 3.5 to 4 times of conventional tiling,
- 2) Prewetting and batting not necessary,
- 3) Quicker, cleaner, economical and labour saving,
- 4) Non-shrink, no loss of strength,
- 5) Curing of tiled surfaces not necessary, and
- 6) Avoids fungus growth and is waterproof.

Fields of Application :

The above mentioned could be used for the following purposes.

- a) Fixing of glazed, ceramic, mosaic and other tiles in bathrooms, kitchens and facades,
- b) Fixing tiles on floors, walls etc.,
- c) Fixing of foam concrete blocks, insulation boards, polystyrene boards, gypsum boards,
- d) As a slurry coat before tiling on absorbent surfaces,
- e) Levelling and repairing of cementitious surfaces, and
- f) For tile **fixing** in **swimming** pools and water tanks.

Application Procedure :

- i) **First** you should ensure proper preparation of the surface as discussed earlier. If the surface is too rough, you may use a smoothing plaster.
- ii) Prepare **paste** like consistent mortar by adding Zentrival PL to water and allow 5 to 10 minutes for polymers to react.
- iii) Apply to the surfaces by plain trowel **upto** 1.5 square meters at a time in thickness of **1 to 2 mm**. Place this in position and adjust them within 25 to 30 minutes.
- iv) The joints can be filled with a joint mortar which is described at serial iii), which follows.

In case spot bonding method is to be used, then provide at least 8 spots of **4cm** diameter per square meter area.

The consumption of this mortar is only 1.5 to **2.3 kg/m²** and 7 day strength is 1.7 **N/mm²**.

ii) Ready to Use Adhesive for Bonding of Tiles, Marbles, Granites, Stones :

This mortar is also polymer based and ready to use and has no loss of strength over time. However, it has **one** big advantage that there is total avoidance of iron staining of marbles which is a common occurrence when conventional cement based adhesive is used. Also the common feature of using 15 to **20mm** bed thickness with poor adhesion in **case** of conventional cement mortar is totally replaced by this mortar by **high** its bonding strength and thin bed. One such mortar is known as **Zentrival HS**.

Properties :

- 1) High bonding and adhesion in strength
- 2) No loss of strength over time
- 3) Tile over tile can be **fixed**
- 4) Better workability and flexibility to counteract thermal stress
- 5) Permanent bond leading to low maintenance costs
- 6) No pre wetting or batting of tiles
- 7) , Avoids iron staining of marble slabs
- 8) Avoids fungus growth

Fields of Application :

- a) Most useful for bonding heavy marble, granite and stone slabs for exterior **claddings**.

- b) Fixing of tiles on plaster, marine plywood, cement bound and other absorbent and non-absorbent surfaces.
- c) Bonding of tiles for vertical, horizontal and overhead surfaces.
- d) Bonding of polystyrene and other insulation boards by thin bed as well as by spot bonding.
- e) For fixing marble, mosaics and ceramics for murals.

Application Procedure :

- i) The surface is prepared in the manner described earlier and is lightly moistened.
- ii) This mortar is in ready to use paste form, and is applied by smoothing trowel in a thin layer of about 2 mm. The surface is combed to obtain a ribbed pattern which saves material.
- iii) The tile is then placed on this mortar before the film forms on the surface which takes about 25 to 30 minutes depending upon prevailing temperature.
- iv) If temperature is high you may use it in small pockets of 1 sq meter area at a time.

In case of heavy stones and marble slabs, as well as for overhead tiling operations and in situations where a quick hardening and adhesion is required, 10 to 20% of fresh portland or white cement can be added to Zentrival HS.

iii) Polymer Modified Waterproof Joint Mortar and Tile Grout

Whenever the mortar mentioned at serial i) above is used, the joints are filled with this polymer modified joint mortar which is ready to use, and only requires the addition of water at site. One commercial brand available is Zentrival FM.

Properties :

- 1) Grout is colour fast,
- 2) Grout is non-shrink type and is water proof, and
- 3) Fungus resistant.

Fields of Application :

- a) Suitable as joint grout for all types of tiles, and
- b) Suitable for internal as well as external applications.

Application Procedure :

- i) The joints should be clean, free from oil and grease and other contaminants. The joints are slightly wetted prior to filling.
- ii) Add Zentrival FM 2.5 parts to one part of water by volume and stir till paste like consistency is obtained.
- iii) Apply this paste in the joints one day after fixing of the tiles by the bedding mortar described at serial i).
- iv) The joints widths are generally 2 mm to 6 mm. and one litre of this mortar covers 65 running meters of a 3mm wide joint.
- v) Exposed surfaces require proper curing.

3.4 NON-SHRINK GROUTS

All industries employ machines or equipment for manufacture. There should be stable and permanent under static and dynamic loads. Usually, during the main building construction, the base concrete for these machines is already laid and the machines, on arrival, are connected to them by means of anchor bolts. These are mounted in the recesses in the concrete and then filled up by grouting under a suitable base plate. This grouting must be compatible and ensure a permanent connection as well as to the machine foundation, which withstand both static and dynamic forces. However, the conventional grouts have a tendency to shrink and thus provide a loose connection. To overcome this problem non-shrink grouts have been evolved for machine foundations and for filling of cavities and cracks.

3.4.1 Ready to use, Freeflow, Non-shrink Grout

One such grout available in the market is called Emcekrete.

Properties

- 1) Good **pourability** and **trowellability**,
- 2) High initial and final strengths, 1 day compressive strength **340kg/cm²** and 28 day compressive strength of **730 kg/cm²**,
- 3) Excellent bonding strength,
- 4) . Non-shrink, change of volume and shape after loading is negligible, and
- 5) Free from harmful chlorides and aggressive constituents. Adjacent steel areas are permanently protected against corrosion.

Fields of Application :

The grouts are used for machine foundations.

Application Procedure :

- i) Remove all **contaminations**, fats, oils, dust, loose cement from the surface to be connected.
- ii) The **concrete** base surface must be thoroughly wetted.
- iii) After the **machine** has been placed and adjusted, provide a tight shuttering which should extend 5 cm above the bottom edge of the machine.
- iv) Prepare mix of 25 kg of Emcecrete and 3.35 liters of water, for thickness up to 5 cm. For greater thickness, add quartz aggregate of grain size 4 to 8 mm.
- v) This grout is poured from one side or it can be pumped. Air pockets are to be avoided.
- vi) Do not apply vibrations till 2 hours after placing of this grout. Use this grout **within 30 minutes** of preparation.
- vii) Exposed surfaces of grout should be cured like concrete.

3.4.2 Ready to Use, Polymer Modified Waterproof Non-Shrink Grout for Injections, Filling of Cracks and Cavities

The crack's, crevices and cavities are undesired elements in any structure. They create a number of problems and may affect its functioning. However, with advances in **material** science, materials like Epoxy and Polyurethane, etc, have **enabled** us to find solutions to such problems. Though **such** solutions may be expensive but then it helps us in making full use of the structure and prevents any further damage. Such a grout is now available which is waterproof, non shrink, ready-to-use and free flowing for injections into cracks, filling of cavities, voids and crevices. One such product is called **Centricrete** .

Properties

- 1) Waterproof with non-shrinking properties.
- 2) Grout is **pumpable** and does **not** segregate even under pressure.
- 3) Possesses high dispersion and does not settle when mixed with water and remains in suspension.
- 4) Develops high compressive and flexural strengths compared to the normal cement grouts.
- 5) Due to alkaline nature, it prevents carbonation of concrete.
- 6) Water repellent.
- 7) Improves **imperviousness** and resistance to aggressive industrial effluents.
- 8) Prevents water penetration and rising damp.

Fields of Application :

- 1) In foundation rafts and construction joints in basements.
- 2) **Sealing** of cracks and cavities in tunnels, canals, water tanks **etc.**
- 3) **As** injections in brickwork, porous concretes for waterproofing.
- 4) Voids and fissures grouting in brick and masonry structures.
- 5) Grouting of cracks in roofs and joints between parapet walls and slabs.
- 6) In **general**, anywhere, where a cementitious injection is required..

Application Procedure :

- i) The surface must be firm and should be properly cleaned to remove loose particles, dirt, grease, oil and any other contaminations.

crevices and recesses. Besides this they are prone to chemical attacks and the gain of strength is slow. Their preparation involves transportation of material like aggregate and sand and their workability and flowability does not suit all situations. Water proofing admixtures are needed to be added.

On the other hand, the polymer or epoxy modified mortars and grouts are very versatile and possess properties, which are far superior compared to these of the conventional cement mortars. This is evident from the table 1 given below :

Table 1 : Typical Properties of Cement Mortar and Epoxy Mortar

Property	Cement Mortar (28 days curing)	Epoxy, Polymer Mortar (7 days curing)
Curing Time	7 days to 28 days at Room Temperature	24 hours to 7 days at Room Temperature
Compressive Strength N/mm ²	40	90
Flexural Strength N/mm ²	6	45
Tensile Strength N/mm ²	4.5	16
Adhesive Strength		
a) Tensile N/mm ²	0.2	10
b) Shear N/mm ²	—	8

Also, the polymer modified mortars are self-levelling, pourable, of trowellable consistency and can resist acids and corrosive chemicals. They are, generally two component type, and can be applied on damp surfaces. Their bond strengths are very high and permanent in nature, and can be used to bond any types of material like concrete, tiles, marbles, granite, stone slabs, polyurethane boards, etc.

Several firms in India are now manufacturing and marketing these bonding agents and products under different brand names. In order to enable you to refer to these products and their manufacturers, a list is produced below for your ready reference. This list cannot be exhaustive, you can keep adding to it as new products enter the market.

Name of the Manufacturer	Name of the Product
Greenboro Polychem Pvt. Ltd., 199 Defence Colony, New Delhi - 100 024	a) Polydee floor patch b) Groutfast c) Polydee bond
Forsoc Chemicals (I) Ltd, IV Floor, Shankar House 1418, Raj Mahal Vilas Extn, Mekhri Circle, Bangalore - 80.	a) Brush Bond b) Nitotile SP
Asian Laboratories India Ltd., 88, New Okhla Industrial Complex, Phase II, New Delhi 110020	Non-shrink Grouts
MC-Bauchemie India Pvt. Ltd., Sangli Bank Bldg., 5th floor, 296 Perin Nariman Street, Fort, Bombay - 400 001	a) Natufil c) MC-Fix-ST e) Zentrifix F82 g) Zentrifix AS i) Zentrival HS k) Emcecrete
Choksey Chemical Pvt. Ltd., 111 Industrial Area, Sion, Bombay 400022	Techseal
Razon Trading Corporation 660, Taboot Street, PO Box 239, Pune 411001.	a) Epoxy Mortar c) Crackseal d) Joint filler compound
	b) Natufi BB-2 d) Cemseal 50 f) Nafuquick h) Zentrival PL j) Zentrival FM l) Centricrete
	b) Plastocrete

(It maybe noted that list of brand names and manufactures are not exhaustive)

The above list is ever expanding, with new products coming on the horizon. Since some of you may already be practising engineers, it should be your endeavour to update it regularly

and add additional information, like cost per unit. So in this Unit, your **Activity** will be to prepare an exhaustive list of Chemical bonding agents being manufactured in India and abroad.

3.6 KEY WORDS

Admixture	An agent added to modify the properties
p.b.w.	Parts by Weight.
p.b.v.	Parts by Volume
R.C.C.	Reinforced Cement Concrete
Mortar	Intimate mixture of cement, sand, water and chemicals.

3.7 FUTHER READINGS

Literature published by MC-Bauchemie (India) and other cement companies mentioned after the activity

IS:4441 - 1967 **Code of Practice for Use of Silicate Type Chemical Mortar.**

IS:4442 - 1967 **Code of Practice for Use of Sulphur Type Chemical Mortar.**

IS:4443 - 1967 **Code of Practice for Use of Resin Type Chemical Mortar.**

3.8 ANSWERS TO SAQs

SAQ 1 :

Compare your Answer with the preceding text

SAQ 2 :

- 1) A bonding agent is a water emulsion of several organic materials which is mixed with cement or mortar grout for application to an old concrete surface, just prior to patching with new mortar or concrete. Its function is to increase bond strength between the old and new concrete.
- 2) They are
 - a) This sealing agent develops very high strengths **and** is stone hard in about 5 to 7 minutes and possesses excellent water-proofing and bonding properties.
 - b) It provides permanent sealing.
 - c) It sets hydraulically without shrinkage.
 - d) The sealing mortar is chloride free and does not saponify over a period of time.
- 3) The three important fields of application are
 - a) For bonding of tiles, marbles, granites and stone slabs **&** for exterior cladding.
 - b) Fixing of tubes on plastic, marine plywood, cement bound and other absorbent and non-absorbent surfaces.
 - c) For fixing marbles, mosaic and ceramics in murals.
- 4) The base should be clean, free from loose materials, dust, oils and fats. It should be slightly moistened.