JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTER

Class – 3rd Year - V Semester: B.Tech. (Civil Engineering)
Subject –Repair and Rehabilitation of Structures
Ch – Deterioration of Concrete Structures UNIT 1
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VISSION AND MISSION OF INSTITUE

Vision

To become a renowned centre of outcome based learning, and work towards academic, professional, cultural and social enrichment of the lives of individuals and communities.

Mission

M1. Focus on evaluation of learning outcomes and motivate students to inculcate research aptitude by project based learning.
M2. Identify, based on informed perception of Indian, regional and global needs, areas of focus and provide platform to gain knowledge and solutions.
M3. Offer opportunities for interaction between academia and industry.
M4. Develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders can emerge in a range of professions.

VISSION AND MISSION OF DEPARTMENT

Vision

To become a role model in the field of Civil Engineering for the sustainable development of the society.

Mission

M1. To provide outcome base education.

M2. To create a learning environment conducive for achieving academic excellence.

M3. To prepare civil engineers for the society with high ethical values.

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DETERIORATION OF CONCRETE STRUCTURES

- Deterioration of concrete structures can become a challenge for the owners of these structures. It is important to identify these defects on time, and plan appropriate repair strategies.
- Different defects can be involved in the deterioration of any given structure.
- Normally, one or a number of these defects can be seen in structures; therefore, it is necessary to identify them properly.
- One needs to understand these different defects properly in order to get more realistic evaluation of the structure.

1- SCALING

Scaling is referred to the loss of the surface portion of concrete (or mortar) as a result of the freezing and thawing. It is a physical action that usually leaves the aggregates clearly exposed. Scaling happens when the hydraulic pressure from water freezing within concrete exceeds the tensile strength of concrete. Scaling is more common in non-air-entrained concrete, but can also occur in air-entrained concrete in the fully saturated condition.

2- DISINTEGRATION

Disintegration is the physical deterioration (such as scaling) or breaking down of the concrete into small fragments or particles.

It usually starts in the form of scaling. It may be also caused by de-icing chemicals, sulphates, chlorides or by frost action.

3- EROSION

Erosion is the deterioration of concrete surface as a result of particles in moving water scrubbing the surface.

When concrete surface is exposed to the water-borne sand and gravel, the surface gets deteriorated by particles scrubbing against the surfaces. Flowing ice particles can also cause the problem. It is an indicator of poor durability of concrete for that specific exposure.

4- CORROSION OF REINFORCEMENT

Corrosion is the deterioration of steel reinforcement in concrete. Corrosion can be induced by chloride or carbonation. The corrosion can result in cracking in the concrete cover, delamination in concrete decks, etc When the concentration of chloride ions above the surface of reinforcement reaches the threshold limit (which is the amount required to break down the passive film) corrosion begins.

5- DELAMINATION

“Delamination is defined as a discontinuity of the surface concrete which is substantially separated but not completely detached from concrete below or above it.” (OSIM, 2008). Delamination is often identified by the hollow sound by tapping or chain dragging of concrete surface. The corrosion of reinforcement and subsequent cracking of the cover can cause delamination. When the rebar have small spacing, the cracking extends in the plane of the reinforcement parallel to the exterior surface of the concrete.

6- SPALLING

Spalling can be considered an extended delamination. In fact, when the delamination continues, the concrete fragments detach from a larger concrete mass. If delamination is not repaired on time, the progress of damages as a result of external loads, corrosion, and freezing and thawing can break off the delaminated pieces.

7- ALKALI-AGGREGATE REACTIONS

It is the internal cracking of concrete mass as a result of a chemical reaction between alkalis in the cement and silica in the aggregates. The AAR/ASR cracking are very famous for their crack patterns.The alkalis in the cement can react with the active silica in the aggregates to form a swelling gel. When this gel absorbs water, it expands, and applies pressure to surrounding environment which makes the concrete crack.

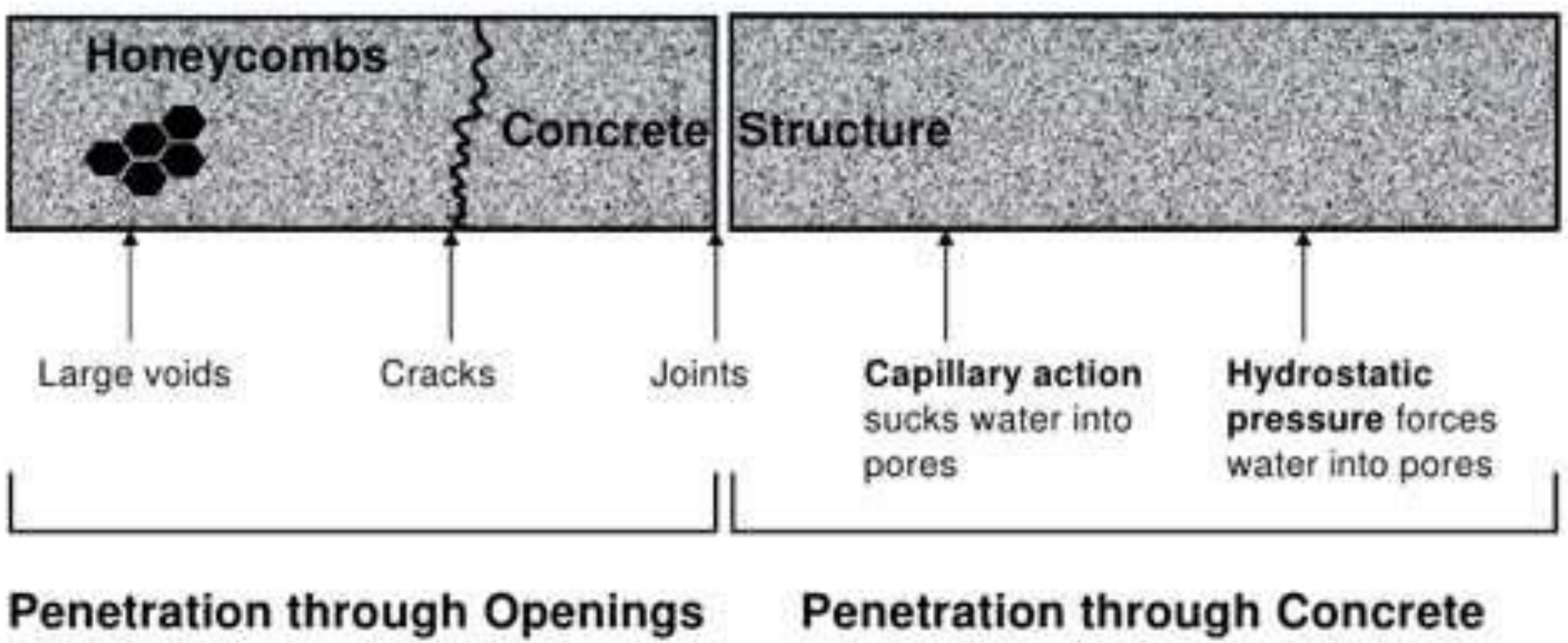
8- CRACKING OF CONCRETE

A crack is a linear fracture in concrete which extends partly or completely through the member. Some people believe that concrete is born with cracks; that its ingredients, and how it is produced – from the batching plant to pouring, setting, and curing – is influenced by so many factors that cracking of concrete does not come as a big surprise; and to a great extent, that might be true. Cracking of concrete can happen in different stages: It can happen before hardening of concrete, and it can happen in an old concrete structure.

PERMIABILITY OF CONCRETE

- ❑Well-graded sands containing considerable graded fine material are preferable for making impermeable concrete.
- ❑The consistency of the concrete mixture should be wet enough so that it can be puddled, mixture should be well spaded against the forms to avoid the formation of pockets on the surface.
- ❑Care should be taken not to over trowel.
- ❑The use of excessive water, causes shrinkage cracks and formation of laitance-seams.
- ❑Defective workmanship can result in improper proportioning, lack of thorough mixing etc.

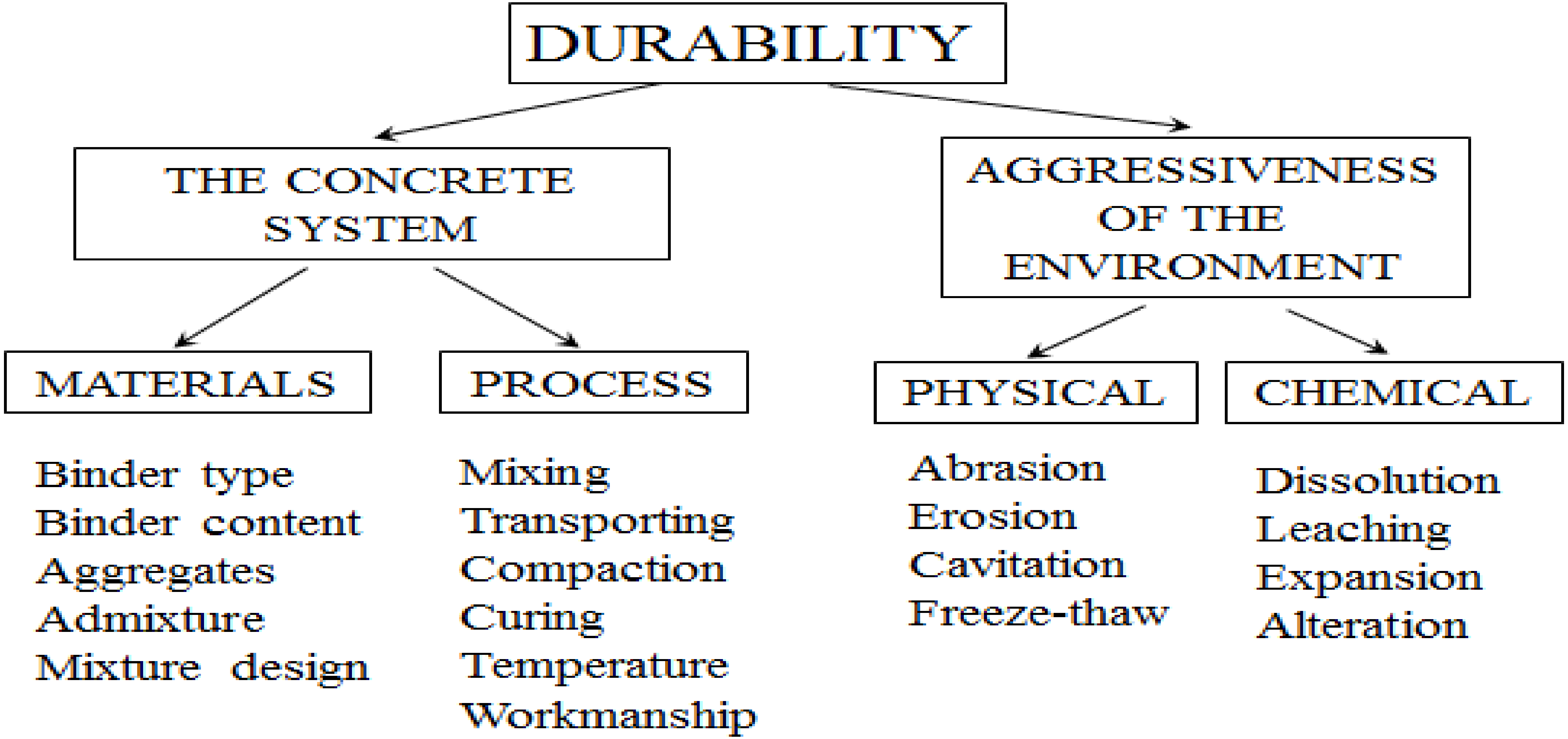
How Water can penetrate Concrete?



DURABILITY

- The service life of building is mostly determined by life period of reinforced bars in concrete. Therefore we define the term ‘durability of concrete’ to represent the life period of concrete structures.
- It represents its ability to resist weathering action, chemical attack, abrasion or any other process of deterioration.
- The consequences of its negligence on the concrete are the loss of strength of concrete, concrete liable to be easily affected by deterrent, corrosion of rebar, loss of serviceability, unpleasant appearance, danger to persons and property, poor perception of concrete as a material, poor perception of agencies involved, reduction of service life, deterioration of concrete due to attack by external agencies like weathering, attack by natural or individual liquids, gases, bacterial growth, etc.

FACTORS AFFECTING DURABILITY



SORPTIVITY TEST

This test is done to measure capillary suction in concrete. The dried sample of concrete is used in this test. One of the faces of the sample is placed in contact with the water at atmospheric pressure. And the sample is allowed to absorb water. The weight of the sample is measured on every interval of time. There is an empirical relationship between mass (or volume) of liquid absorbed per unit of surface and test period which has been derived from the observation of experimental data.

$$\boldsymbol{i = S * \sqrt{t}}$$

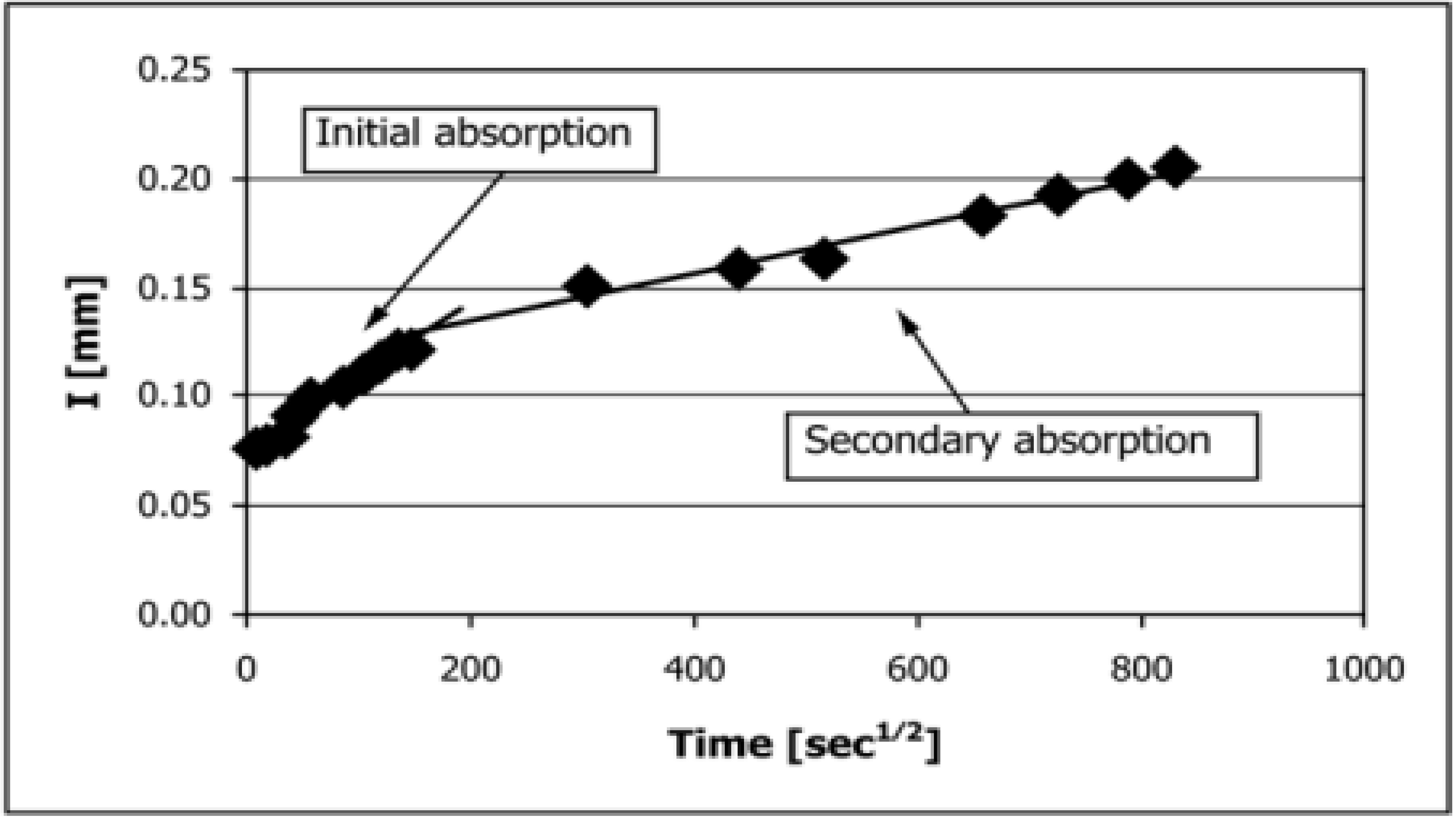
Where,

i- mass (or volume) of liquid absorbed per unit of surface ($gm2\ orm3m2$)

t- Test period (normally in between 4 hrs. and 24 hrs.)

S – Proportionality constant

This equation holds well only for porous materials or in the early stage of capillary action. In fact, for lower value of w/c, the above equation is changed to power law with exponent lower than 0.5. The constant S is expressed in $g/m2*$sec ^0.5 (if mass changed is determined) or m/s^0.5 (if volume change is determined) and is used to represent the characteristic of the concrete regarding the capillary action. Typically values of S vary from 5 g/(m^2.s^0.5) for normal strength concrete to 0.7 g/(m^2.s^0.5) for high-strength concrete.

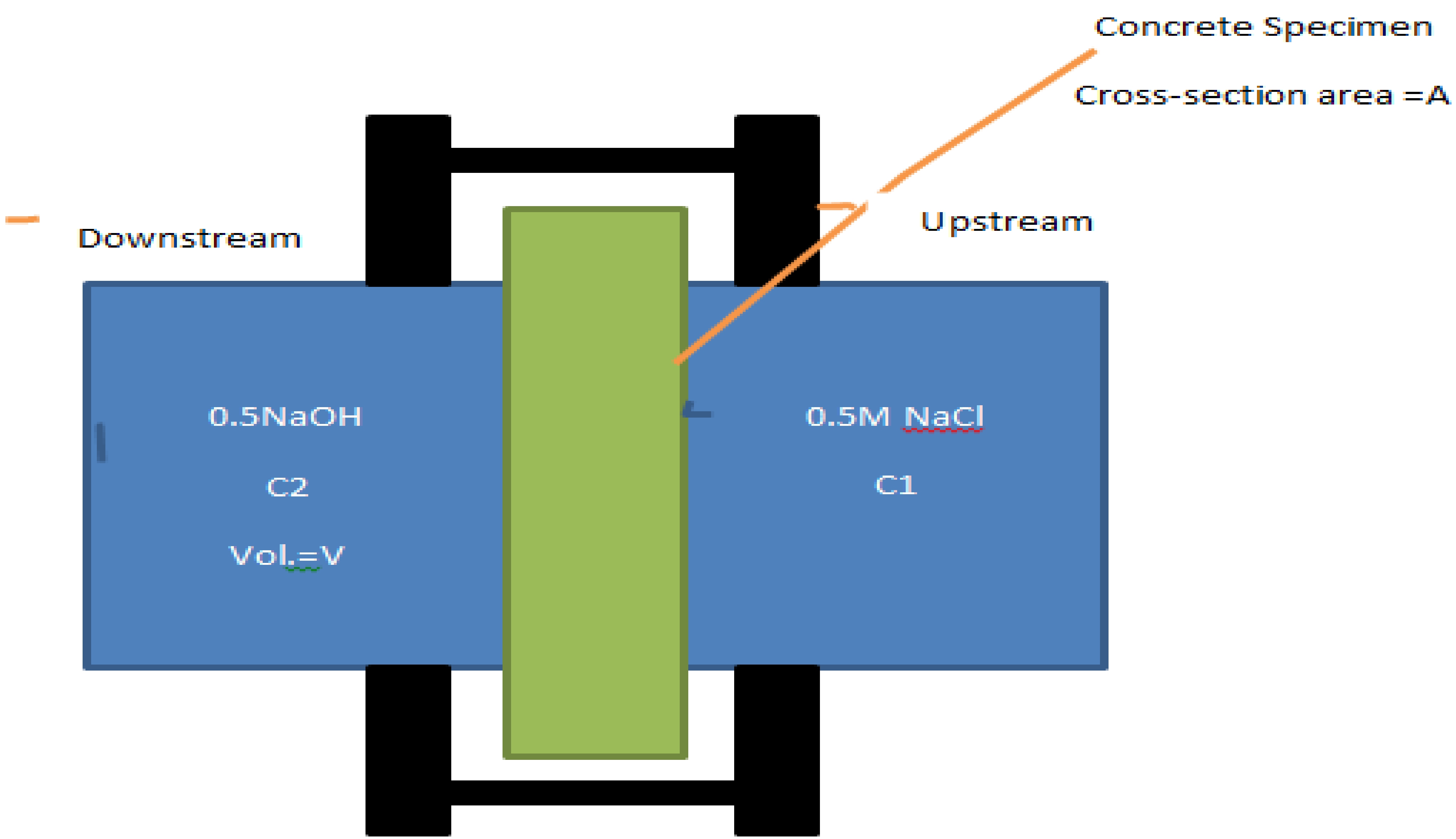


Initial absorption
Secondary absorption
I [mm]
Time [sec1/2]
0.25
0.20
0.15
0.10
0.05
0.00
0
200
400
600
800
1000

DIFFUSION

The flow of fluids and ions inside the concrete due to concentration gradient across the specimen. It depends on the property of solute's interaction with the solvent. The diffusion is more effective in saturated pores than in partially saturated pores. There are two types of diffusion. Stationary diffusion and Non-Stationary diffusion

Typical example of result and Set-up for steady state diffusion cell



AAR (Alkali Silica Reaction)

Reaction:- Alkali from cement + reactive silica (from aggregates) → AS gel

Si-OH + $OH^{-} + Na^{+} \longrightarrow$ Si-O-Na + H2O

Si-O-Si +$2OH^{-} + 2Na^{+} \longrightarrow$ 2(Si-O-Na) +H2O

It is cancer of concrete. The continuous growth of Silica gel in the Interfacial Transition Zone (ITZ) exerts osmotic pressure within the concrete which causes cracking and bulging of concrete. When relative humidity is greater than 80% then AAR takes place.

CARBONATION

Carbon dioxide in air or dissolved in water reacts with hydrated cement systems.

The main concern is the reaction of carbon dioxide with the lime (CH) - phase. It gives rise to calcium carbonate;

$Ca(OH)_2 + CO_2 = CaCO_3 + H_2O$.

In severe cases, the C-S-H phase, which gives strength, can also be attacked.

In all such reactions, OH^- is consumed, thus lowering down the Ph of concrete. If pH is lowered very much, protection to steel reinforcement against corrosion may be lost.

Carbonation is highest in pH between 50 to 80 percent.

CHLORIDE ATTACK

Chloride attack is one of the most important aspects while dealing with durability of concrete. It primarily causes corrosion of reinforcement. Statistics have indicated that over 40% of failure of structures is due to corrosion of steel.

CONCRETE AND THE PASSIVE LAYER

The strongly alkaline nature of $Ca(OH)_2$ (pH of about 13) prevents the corrosion of the steel by the formation of a thin protective film of iron oxide on the metal surface. This protection is known as passivity. If the concrete is permeable to such an extend that soluble chlorides penetrate right up to the reinforcement and water & oxygen is also present, then the corrosion of steel will take place. This layer can also be lost due to carbonation.

ROLE OF CHLORIDE IONS

- Chloride enters the concrete from the cement, water, aggregate and sometimes from admixtures. This can also enter by diffusion from environment if concrete is permeable.
- The Bureau of Indian Standard had specified the maximum chloride content in cement as 0.1%.
- The amount of chloride required for initiating corrosion is partly dependent on the pH value of the pore water in concrete. At a pH value less than 11.5 corrosion may occur without the presence of chloride.

SULPHATE ATTACK

- Most soils contain sulphate in the form of calcium, sodium, potassium and magnesium.
- They occur in soils or ground water. Ammonium sulphate is frequently present in agricultural soil and water from use of fertilizers or from sewage and industrial effluents.
- Decay of organic matters in marshy lands, shallow lakes often leads to formation of H2S which can be transformed into sulphuric acid by bacterial action.
- Therefore sulphate attack is common occurrence in natural and industrial situations.

The main reactions of sulphate attack on concrete are as under;

1. Formation of sulphoaluminates (ettringite) by reaction of sulphate salts and the C3A - phase in cement;

C3A + 3 CS H2 + 26 H → C3A(CS)3H32

Increase in volume of reaction products causes expansion and spalling.

2. Formation of calcium sulphate (gypsum) in reaction with lime (CH) formed by hydration of cement

NS + CH + 2H → NH + CS H2

Increase in volume of reaction products causes expansion and spalling.

3. Magnesium sulphate is more aggressive than sodium or calcium salts.

4. There are some other reactions also.

METHODS OF CONTROLLING SULPHATE ATTACK

- Use of Sulphate resisting cement: Use cement with low C3A content is most effective method. Use sulphate resisting cement which contains less C3A.
- Quality Concrete : A well designed, placed and compacted concrete exhibit higher resistance to sulphate attack.
- Use of air-entrainment: Use of air-entrainment to the extend of about 6% has beneficial effect on sulphate resisting quality. This is probably due to reduction of segregation, improvement in workability, reduction in bleeding and in general reduction in permeability of concrete.
- Use of pozzolona : Use of pozzolanic materials reduce the permeability.
- High Pressure Steam Curing: This improve the resistance of concrete to sulphate attack.
- Use of High Alumina Cement: Use of High Alumina Cement improves the resistance of concrete to sulphate attack.

ALKALI-AGGREGATE REACTION

Chemical reactions between aggregate containing certain reactive constituents and alkalis (sodium and potassium salts) and hydroxyl ions released by the hydration of cement can have deleterious effects on concrete.

- **Granite, granite gneiss and schist, quartzite and sandstone, containing strained quartz are among the reactive rocks found in India.**

CORROSION

Corrosion is termed as the ‘chemical or electrochemical reaction between a material and its environment that leads to deterioration of the material and/or its properties.

- Extreme environments could be the high temperature, corrosive environments radiation and/or operating/residual stress.
- Generally corrosion is classified as
- Pitting corrosion
- Crevice corrosion
- Galvanic corrosion
- Intergranular corrosion
- Stress crack corrosion

CORROSION

- Corrosion is the destruction or deterioration of metals and alloys in the presence of an environment by chemical or electrochemical means.
- It costs the society in three ways; viz, it is extremely expensive, it is extremely wasteful of natural resources at a time of increased concern over damage to the environment and it causes inconvenience to human beings and sometime loss of life.
- The greatest consumer to metals is corrosion. It is an oldest problem found most frequently in the industries.
- Corrosion is an irreversible interfacial reaction of a material (metal, ceramic, polymer) with its environment which results in its consumption or dissolution into the material of a compound of the environment.

CORROSION RESISTANT METALS

Austenitic Stainless Steel

- Grade type – 304, 316, 304L,316L
- Have a face-centered-cubic (fcc) structure
- Nonmagnetic, tough, ductile

Martensitic Stainless Steel

- Grade type is 410
- 6 – 18% Cr, upto 2% Ni
- Strong, hard and magnetic
- Used for mild corrosive env.
- Used for razor blades, knives, bearings.

Ferritic stainless steel

- 12 – 25% Cr with 0.1% C
- Exhibit magnetic properties
- Easy to machine
- Resistance to stress crack corrosion

Duplex stainless steel

- 50% Austenitic and 50% Ferritic
- Strength is more than austenitic and ferritic
- Resistant to intergranular corrosion
- Good formability and weldability

MAJOR CAUSES OF CORROSION

- ❑Nature of the metal or alloy.
- ❑Presence of inclusions or other foreign matter at the surface.
- ❑Homogeneity of the metallic structure.
- ❑Nature of the corrosive environment.
- ❑Incidental environmental factors such as variations in the presence of dissolved oxygen, of temperature, and in the velocity of movement either of the environment or of the system itself.
- ❑Other factors such as stress (residual or applied, steady or cyclic).
- ❑Presence of deposits on surfaces.
- ❑Fayed surfaces and the possibility of corrosion crevices.
- ❑Incidental presence of stray electrical currents from external sources

TYPES OF CORROSION

- It is classified in different ways, such as Chemical and electrochemical, High temperature and low temperature, Wet corrosion and dry corrosion.

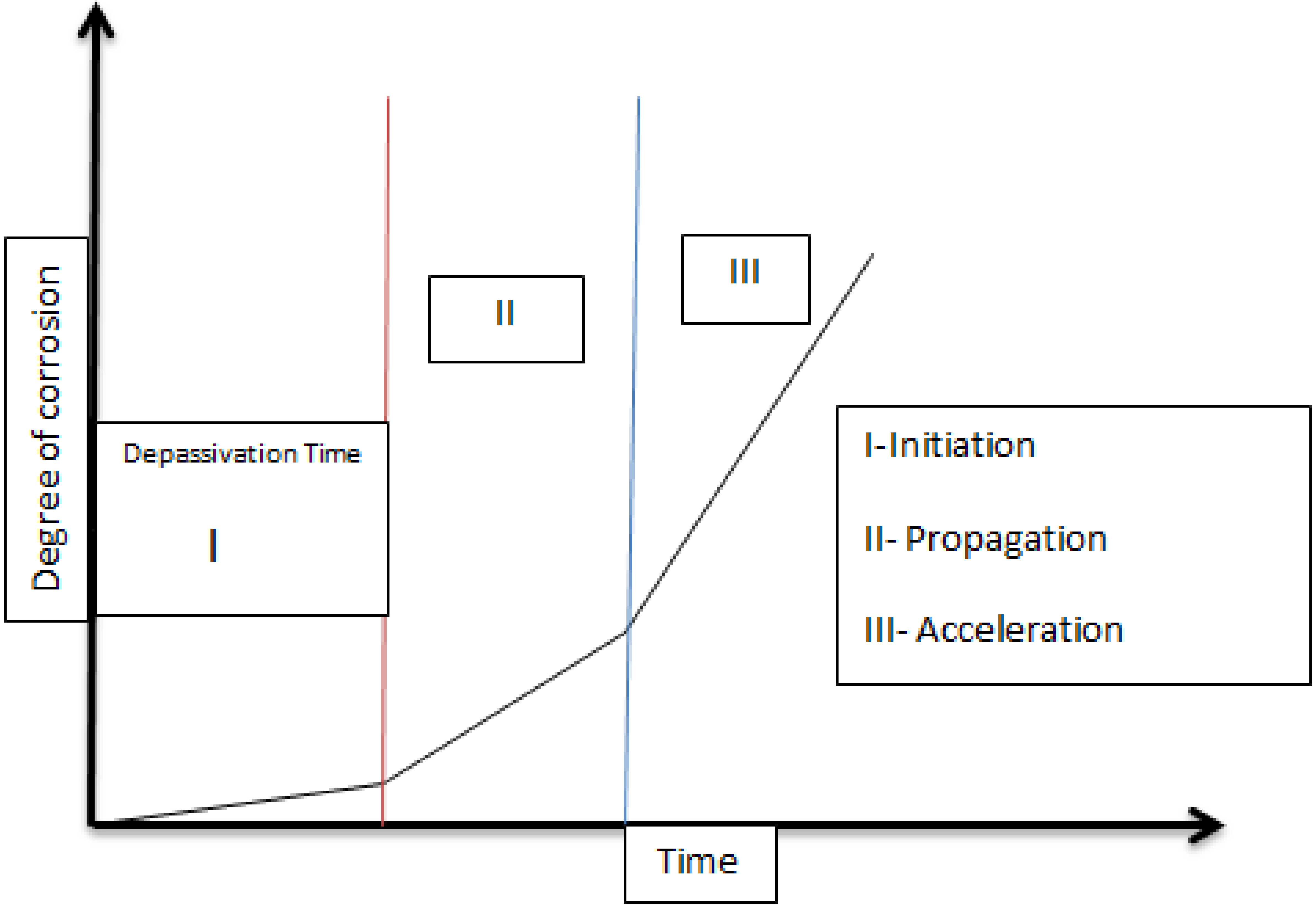
- As per ASM (American Society for Microbiology) the classification of corrosion types is shown in below table

General Corrosion:	Localized Corrosion:	Metallurgically Influenced Corrosion:	Mechanically Assisted Degradation:	Environmentally Induced Cracking:
Corrosive attack dominated by uniform thinning • Atmospheric corrosion • Galvanic corrosion • Stray-current corrosion • General biological corrosion • Molten salt corrosion • Corrosion in liquid metals • High – temperature corrosion	High rates of metal penetration at specific sites • Crevice corrosion • Filiform corrosion • Pitting corrosion • Localized biological corrosion	Affected by alloy chemistry & heat treatment • Intergranular corrosion • Dealloying corrosion	Corrosion with a mechanical component • Erosion corrosion • Fretting corrosion • Cavitation and water drop impingement • Corrosion fatigue	Cracking produced by corrosion, in the presence of stress. • Stress – Corrosion Cracking (SCC) • Hydrogen Damage • Liquid metal embrittlement • Solid metal induced embrittlement

(Ref: Sully J R, Taylor D. W, Electrochemical Methods of Corrosion Testing, Metals Hand Book. Vol 13, 1987.)

MODEL OF CORROSION

- The initiation of pitting corrosion takes place when the chloride content at the surface of the reinforcements reaches a threshold value The initiation time is characterized by an averaged sustained corrosion rate higher than 2mA/m^2.
- During the initiation phase of the corrosion CO2 and Chloride ions depassivate the steel as they penetrate from the surface into the bulk of concrete. The CO2 decreases the pH of and make the passive film more unstable and as the chloride content rises above its threshold value, it destroys the protective layer.
- During the propagation phase of corrosion, O2 and water reach the surface of reinforcements and starts corrosion, i.e the reinforcements start loosing of its mass. The corrosion rate helps to determine the service life of the structure. The corrosion rate mainly depends on Relative Humidity and temperature and it is expressed as the penetration rate


Degree of corrosion
Depassivation Time
I
II
III
I-Initiation
II- Propagation
III- Acceleration
Time

FOUR COMPONENTS OF CORROSION CELL

Anode – A metal electrode in contact with the electrolyte which corrodes.

Cathode - A metal electrode in contact with the electrolyte which is protected against corrosion.

Electrolyte – A solution or conducting medium such as soil, water or concrete which contains oxygen and dissolved chemicals.

Metal Path – An external circuit that connects the anode and the cathode

SACRIFICIAL ANODE

- In the usual application, a galvanic anode, a piece of a more electrochemically "active" metal, is attached to the vulnerable metal surface where it is exposed to the corrosive liquid. Galvanic anodes are designed and selected to have a more "active“ voltage (more negative electrochemical potential) than the metal of the target structure (typically steel). For effective CP, the potential of the steel surface is polarized (pushed) more negative until the surface has a uniform potential.
- Metals like (Zn,Al,Mg) are used for making anode because they have very low electrochemical potential as compared to steel hence more ‘active’. These metals act as anode and get corroded.
- For this purpose of increasing electrical contact, the active metal is placed in back fill (coal and NaCl). When it is consumed completely then replaced by a newer one.

SACRIFICIAL ANODIC PROTECTION METHOD

- In this method, Metallic structure is connected to more anodic metal.
- Hence the corrosion is concentrated at the active metal only.
- And the active metal gets corroded slowly.
- The parent structure (cathodic part) is thus protected.
- The more active metal so employed is called sacrificial anode.
- Sacrificial anodes are commonly as Mg, Zn, Al and their alloys.

APPLICATIONS OF SACRIFICIAL METHOD

- Protection of buried pipelines.
- Underground cables.
- Marine structures.
- Ship hulls.
- Water tanks.
- Pipes.

WATER PROOFING

Building water-proofing is a process which is designed to prevent water from penetrating a building.

- Usually extensive waterproofing measures are added to a building at the time of construction, to provide moisture control from the start
- Waterproofing may also be done after a building is built, to address problems as they emerge or as part of a building retrofit.

NATURE OF WATER PROOFING MATERIALS

- Full adhesion to substrate: To prevent lateral migration of water between the water proofing material and substrate.
- Factory controlled uniform thickness: variance in thickness may lead to variable performance.
- Flexibility over cracks: able to withstand substrate movement.
- Resistance to high hydrostatic pressure
- Positive drainage and protection of the waterproofing: Quality system should include prefabricated drainage.
- Track record: The system should be proven by time.

MATERIALS USED FOR WATER PROOFING

Cement : Ordinary Portland cement is used for all waterproofing works
Sand : Clean river sand should be used for waterproofing work. If muddy, the sand should be washed before use.
Metal : Hard angular metal of sizes varying from 12mm to 20mm is used for water-proofing works.
Brick bat: Brick bats should be well burnt pieces of brick having proper thickness. Underburnt or overburnt brick bats should not be used for water-proofing work.
Water-proofing chemical/powder : A number chemicals and water-proofing compounds in powder form are available in the market. Some chemicals include -tar/bitumen based compounds
-inorganic compounds with little percentage of chlorides and sulphates.

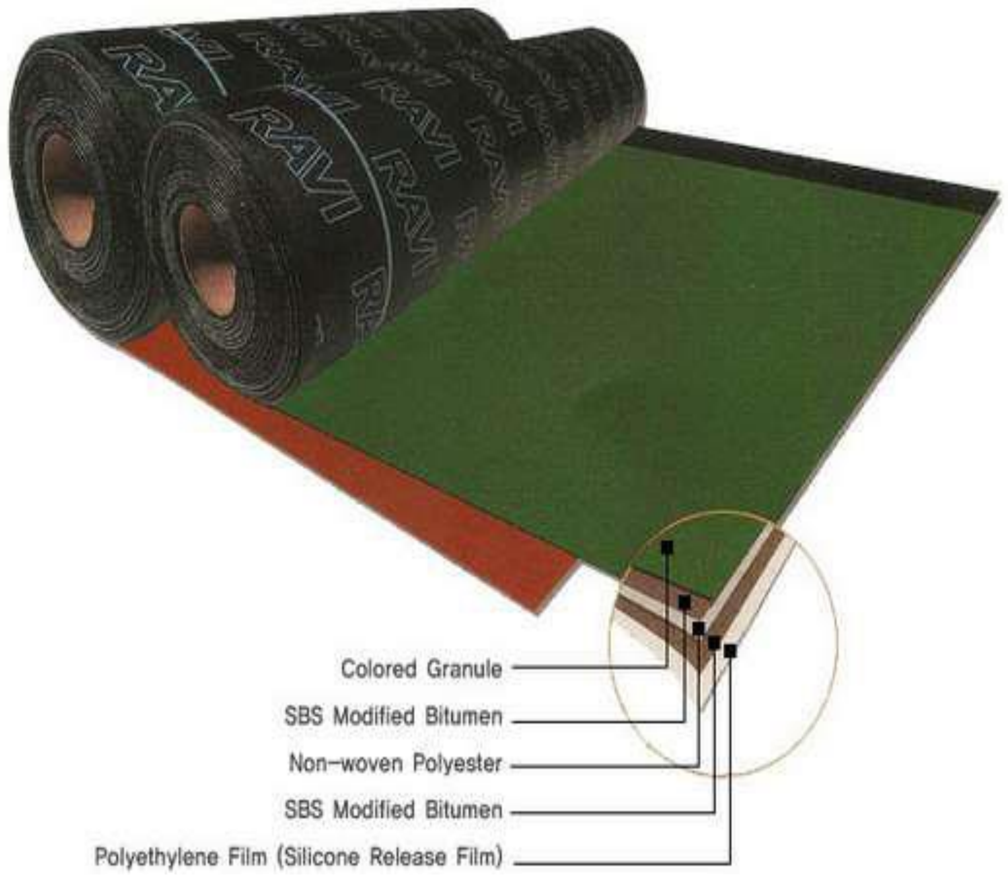
WATER PROOFING CHEMICALS

- **Bitumen -** Mixed with a filler component such as limestone or sand. Polymers are added to the bitumen such as APP (atactic polypropylene) a plastic additive that gives rigidity and tear resistance, or SBS (styrene butadiene styrene) a rubber additive that gives more elastic benefits.

- **Base Products** - Polyester, fiber glass, rag fiber (hessian), and paper. These products are bought in roll format and are pulled through the bitumen mixes on huge rollers. The base product becomes saturated in huge tanks by the tar like bitumen substance, creating rolls of waterproof material.

WATER PROOFING MEMBRANES

- Waterproofing membrane systems include both negative and positive side waterproofing.
- Positive side waterproofing systems are applied to the face of the element that is directly exposed to moisture, the exterior face.
- Negative side waterproofing systems are applied to the surface of the element opposite the surface exposed to moisture.
- Positive systems are available in numerous materials and forms. Negative systems are limited to cementitious systems.



WHAT IS QUALITY WATER PROOFING

- A waterproofing system which prevents the passage of liquid water in the presence of hydrostatic pressure.
- Protection as necessary.
- A drainage system that reduces hydrostatic pressure.
- Accessory products which complement, attach and detail the waterproofing and drainage.

WATER PROOFING V/S DAMP PROOFING

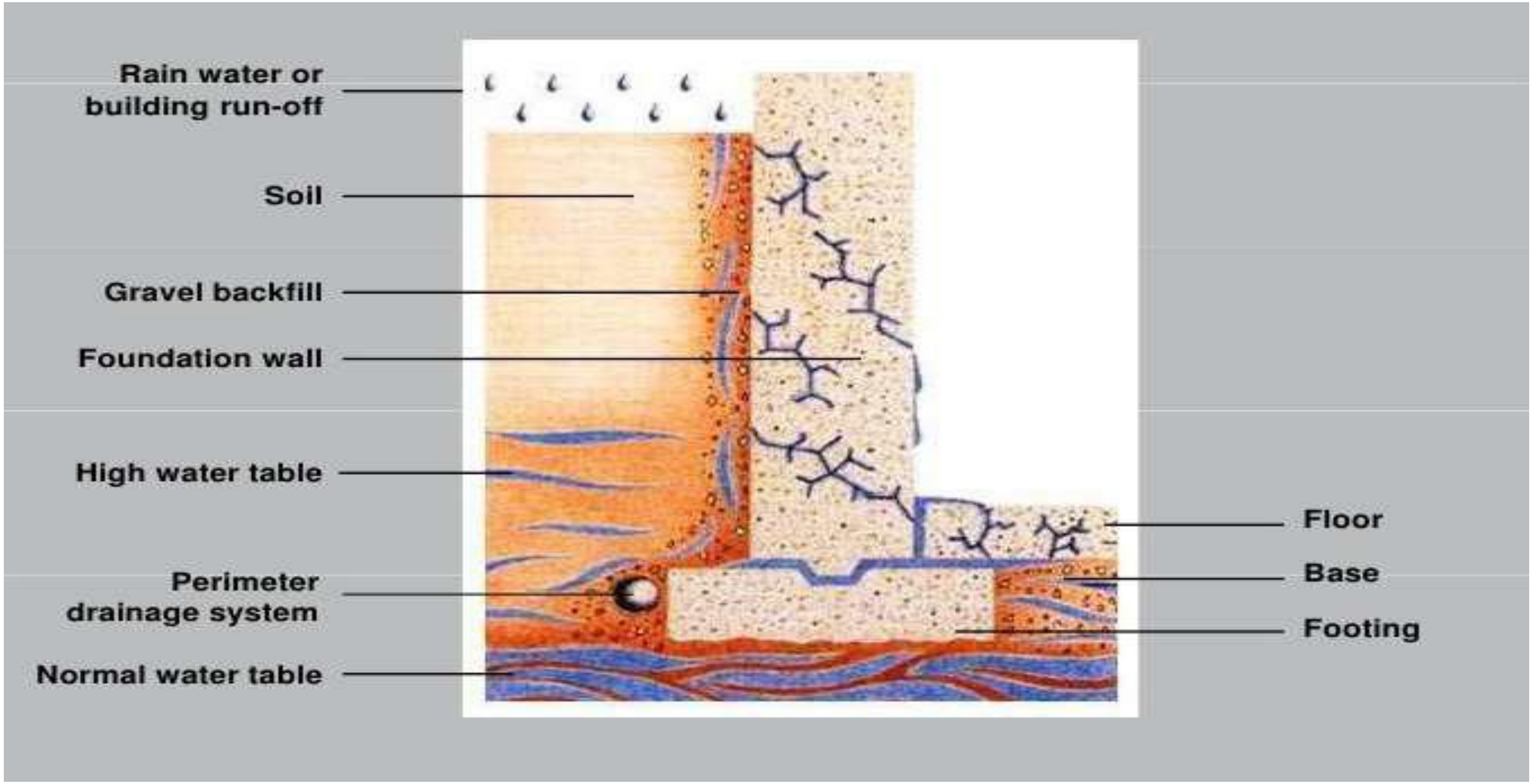
WATERPROOFING:

Waterproofing is the treatment of a surface to prevent the passage of liquid water in the pressence of hydrostatic pressure.

DAMP-ROOFING:

Damp-proofing is the treatment of a surface to retard the absorption of moisture in the absence of hydrostatic pressure.

WHY WATERPROOF A STRUCTURE?



WHERE IT IS USED?

Positive Side Waterproofing: Positive side is same side of the structure as the source of the water. Designed to stop water before it has a chance to enter the structure and cause structural damage.

Negative Side Waterproofing: Interior side opposite the water pressure side of the structure Most commonly used in

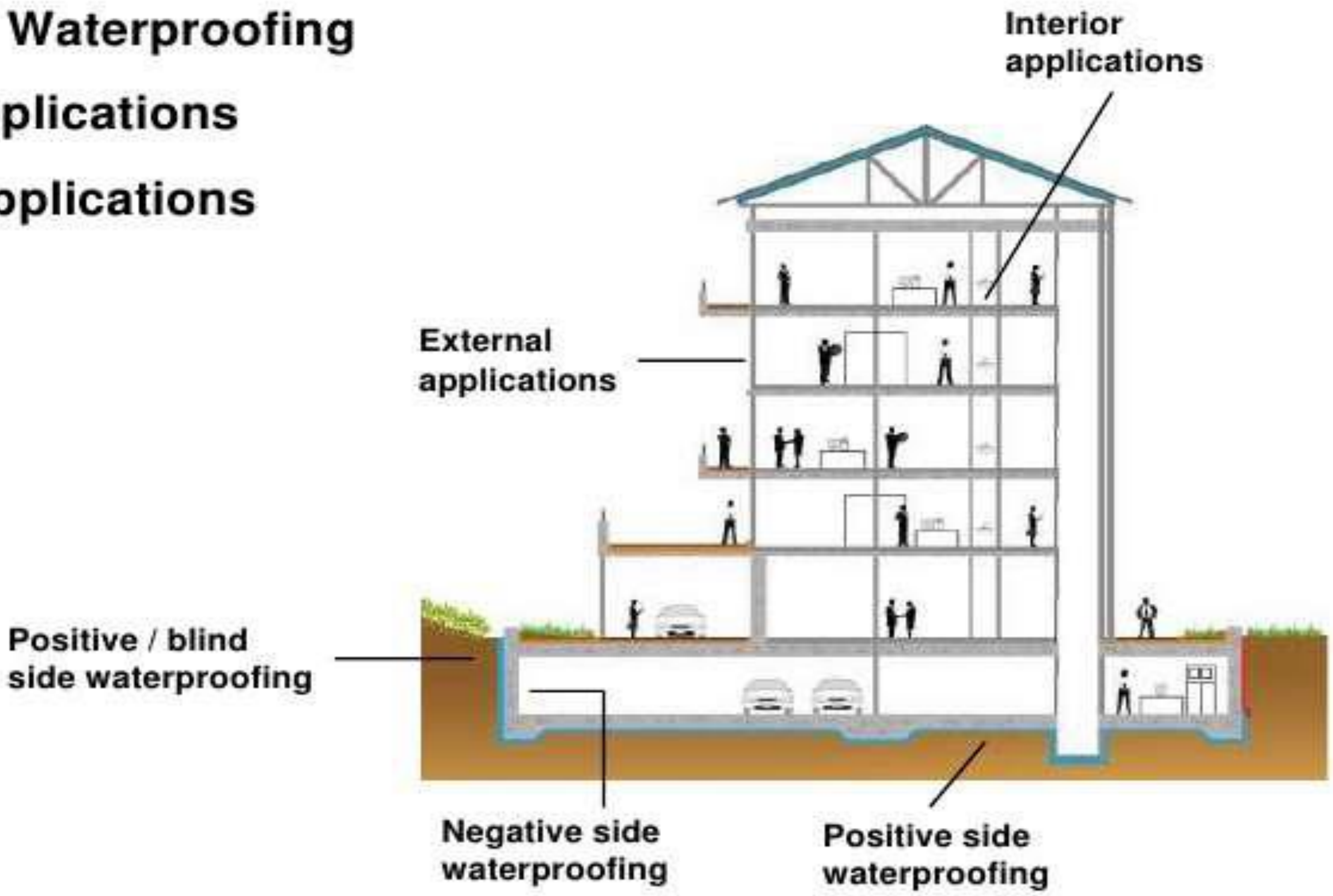
- Remedial work
- Elevator pits
- Tank liners

Blind Side Waterproofing: Positive side applied prior to installing the structural walls or slabs.

ide Waterproofing

r Applications

or Applications



TYPES OF WATER PROOFING

1. Sheet Membrane Waterproofing
- Lose laid – PVC, HDPE, etc.
- ❑Bonded – self-adhesive, hot applied

2. Liquid Waterproofing
- One or two component
- Applied by hand, by spray
- Hot applied, cold applied

3. Bentonite Waterproofing
4. Metal Oxide Waterproofing
5. Cementitious Waterproofing

1. SHEET MEMBRANE WATERPROOF

First surface is cleaned .

- Surface is covered with Bituminous coating.
- After that second layer of bituminous coating
- Polybelt sheet is layer is placed over hot bituminous.
- Then again second layer of polybelt sheet is placed.
- Similarly third layer of bituminous and polybelt sheet is placed.
- Then finally covered with geotic sheet layer.
- Then protection layer of 100mm thick PCC is poured
- For horizontal waterproofing polybelt sheet is used

LIQUID WATER PROOFING

Substrate preparation(surface is cleaned and made suitable for further application)

- Primer is applied by roller or brush.
- Proofing -then resin is applied.
- Surface will be rainproof after 30mins.
- Decorative covering
- A hard course providing additional protection and colour options

ADVANTAGES O USING LIQUID WATER PROOFING

- Minimum disruption
- Ease and speed of installation
- Cost effective
- Compatible with most substrates and easily detailed
- Proven and guaranteed performance
- Long life
- Technologically advanced
- Range of specifications to suit all needs
- Range of finishes including solar reflectives

TAPECRETE

TAPECRETE is an acrylic based Polymer Modified Cementitious Composite coating system.

Use of Tapcrete

- TAPECRETE is used for surface treatment, protecting, waterproofing and repairing concrete and masonry.
- Waterproofing of basements, toilets, terraces, roofs, swimming pools, water towers etc.
- General concrete repairs.
- Protection of concrete against corrosion, salt attack etc.

CEMENTITIOUS WATERPROOFING

Method

- surface is cleaned.
- surface is made smooth with the layer of tape crete and pop
- left for 2 hrs
- then coating of priemer.
- then 1st coating of tapecrete left for 1 day.
- then another coating of tapecrete.then protection plaster(1:4)to protect layer of tapecrete.

METAL OXIDE WATER PROOFING

Used in steel structures.

• Add metal-oxide compound to portland cement, sand, and water to produce a slurry consistency . Blend together .

• Clean masonry surfaces

• Clean concreate surfaces

• Dampen surface for several hours prior to application with water and maintain damp condition until applying waterproofing.

• Number of Coats: One bond coat and sufficient waterproof coats to make the surface absolutely waterproof.

• Do not apply waterproofing when temperature is forecast to be 40 deg F or less within 24 hours of application.

3. BENTONITE

- The ability to expand and contract as it absorbs and expels water. It can expand and contract an infinite number of times.
- It can swell to 10 to 20 times its volume.
- It is inorganic and does not break down with time.
- The ratio of their surface area to physical volume is large and this characteristic enables them to absorb large quantities of water.

3. BENTONITE WATER PROOFING

Bentonite is a type of clay having the unusual characteristics of cohesion, binding, sealing, and thickening.

- When installed below grade as a waterproofing membrane, it becomes hydrated with the moisture that is naturally present in the soil and forms an impermeable barrier that absorbs and expels water .
- can expand and contract and is capable of absorbing seven to 10 times its own weight in water, swelling up to 18 times its dry volume.
- to function properly as a waterproofing barrier, it is extremely important that this barrier remain under a constant minimum pressure of 30 to 60 pounds per square foot .

DIFFERENT TYPES OF PROTECTIVE COATINGS USED

Coxcoating offers solutions for the abrasion resistance, impermeable layers, and resistance to the containment of energy explosion of hazardous materials, armor, waterproofing, weapons, chemical resistance, flooring, energy efficiency, thermal insulation, structural reinforcement, tank lining, and corrosion control, fire resistant and thermal barrier coating services in Melbourne.

TYPES OF PROTECTIVE COATINGS

1. CORROSION CONTROL
2. INDUSTRIAL COATING
3. WATERPROOFING
4. HEAT PROOFING
5. UV PROTECTION
6. NON SLIP FINISH

1. CORROSION CONTROL

Corrosion control is the general wear and tear determined from a layer of epoxy resin that can take things, but it is particularly important when the coating on a surface that should be used on
a lot of doors. It measures the overall rate of the epoxy resin to deterioration of time and to avoid abuse in general. Better corrosion control marks generally takes precautions of coating
for more general.

2. INDUSTRIAL COATING

Industrial coating is also called as chemical coating is an index of the degree of protection against epoxy resins, solvents, acids and other chemicals that when applied directly to a coating of least resistance for chemical protection. The resin is dissolved and less likely damages measures. Superior Industrial coating scores are very important in cases in which the materials and objects that are coated with epoxy are expected from these meetings can be corrosive. Industrial coating is a general classification, as a rule but there are also special epoxy resins available, usually for industrial purposes, the counter to incorporate the effects of certain corrosive chemicals. If the epoxy resin is expected to find exposure to these chemicals, for the brands that seek to epoxy them.

3. **WATER PROOFING**

Generally, humidity also adds to the overall deterioration of a layer of epoxy. High sealing prevents this happening. This is particularly important are coated in some cases materials are particularly susceptible to water damage, such as certain types of wood or metal. In addition, there are special impermeable layers of epoxy designed for underwater objects to protect, if the coating for this company, like a wooden boat. It is recommended to receive an epoxy coating and Industrial coating sealant.

4. HEAT PROOFING

Natural heat contributes to damage of the epoxy, in fact, sodium and makes it brittle. Although this principle is used in most epoxy resins, to harden for the long-term exposure to high levels of heat stress, the fragile layer of epoxy resin to be sold in chips, so that the devices susceptible to wind and weather protected again. High-temperature test results are used in areas in which we expect the coating materials with the resin at high temperatures are recommended.

5. UV PROTECTION

This differs somewhat from the heat proofing materials; it’s a unique form of it. In particular, ultraviolet or UV-shielding is designed to protect against the sun. The impact of the deterioration of the epoxy coatings that are suffering as a result of prolonged exposure to UV damage are very different from the normal heat to the qualification of protection within a few layers of epoxy to earn. This is chiefly imperative when the stuff to be coated is expected on a lot of doors.

6. NONSLIP FINISH

While there is a classification of the epoxy in itself, it remains a function that you are considering. Briefs are terminated and designed to reduce the friction that sometimes accompanies to give everything to prevent a layer of epoxy resin.

CORROSION INHIBITORS

A corrosion inhibitor is a chemical compound that, when added to a liquid or gas, decreases the corrosion rate of a material, typically a metal or an alloy, that comes into contact with the fluid. The effectiveness of a corrosion inhibitor depends on fluid composition, quantity of water, and flow regime.

A common mechanism for inhibiting corrosion involves formation of a coating, often a passivation layer, which prevents access of the corrosive substance to the metal. Permanent treatments such as chrome plating are not generally considered inhibitors, however: corrosion inhibitors are additives to the fluids that surround the metal or related object.

REFERENCES

JECRC Foundation

JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTRE

Thank you!

STAY HOME, STAY SAFE