

Admixture

Lecture - 1

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Introduction of Admixture

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Summary

Introduction

Q - What is Admixture ?



Portland Cement

Aggregates

Water

Introduction



Q - What is Admixture ?

Admixtures are other than the traditional ingredients of concrete that are added to the mixture immediately before or during mixing

Q - What are the different Types of admixtures?

Mineral Admixture

Chemical Admixture

Q - What is Mineral Admixture ?

Mineral Admixtures is defined as a Pozzolanas in IS 456: 2000. Clause 5.2.1 of IS 456 stated that; Pozzolanic materials conforming to relevant Indian Standards may be used with the permission of the engineer-in-charge, provided uniform blending with cement is ensured immediately before or during mixing.

Q - What are the different Types of mineral admixtures?

**Fly Ash (Pulverized
Fuel Ash)
*Conforming to IS
3812***

**Silica Fume
ACI 234R-96**

Rice Husk Ash

Metakaoline

**Ground Granulated
Blast Furnace Slag
IS 12089**

भारतीय मानक
कंक्रीट एडमिक्स्चर — विशिष्टि
(पहला पुनरीक्षण)

Indian Standard
CONCRETE ADMIXTURES — SPECIFICATION
(First Revision)

ICS 91.100.30

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Cement and Concrete Sectional Committee had been approved by the Civil Engineering Division Council.

Admixtures are materials added to the concrete before or during its mixing, with a view to modifying one or more of the properties of concrete in the plastic or hardened state. An important feature of the majority of admixtures for concrete is that it is difficult to quantitatively evaluate the behaviour of the concrete under various possible circumstances. Therefore, performance of an admixture is evaluated by comparing the properties of concrete with the admixture under test with those of concrete without any admixture or with a reference admixture. This standard lays down the procedure for such a relative evaluation of admixtures for concrete.

In recent time there has been a lot of development in the field of admixtures. Superplasticizers, both normal and retarding type, constitute a major group of admixtures used by site engineers now. Superplasticizers help in lowering the water/cement ratio so as to contribute to the enhancement of durability. In this first revision of the standard, first published in 1979, requirements of superplasticizers in detail and methods of determination of flow of concrete of high workability have been added.

This standard also gives uniformity tests which demonstrate that a particular consignment is similar to material that has previously been submitted to the acceptance test.

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ambient temperature and humidity conditions influence the performance of set-controlling admixtures and affect the retention of enhanced workability (slump loss) when water-reducing admixtures and superplasticizers are used. While no generalisation of these effects is possible, it is nevertheless necessary to evaluate concrete admixtures for specific use with the concrete-making materials and mix proportions to be used on the work, under field conditions. This standard also provides for such specific evaluation of an admixture, in addition to the general evaluation for conformity to the requirements of this standard.

The requirements of integral waterproofing admixtures are covered in IS 2645 : 1975 'Specification for integral cement waterproofing compounds (first revision)'.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Functions of Admixture

Functions of Admixture

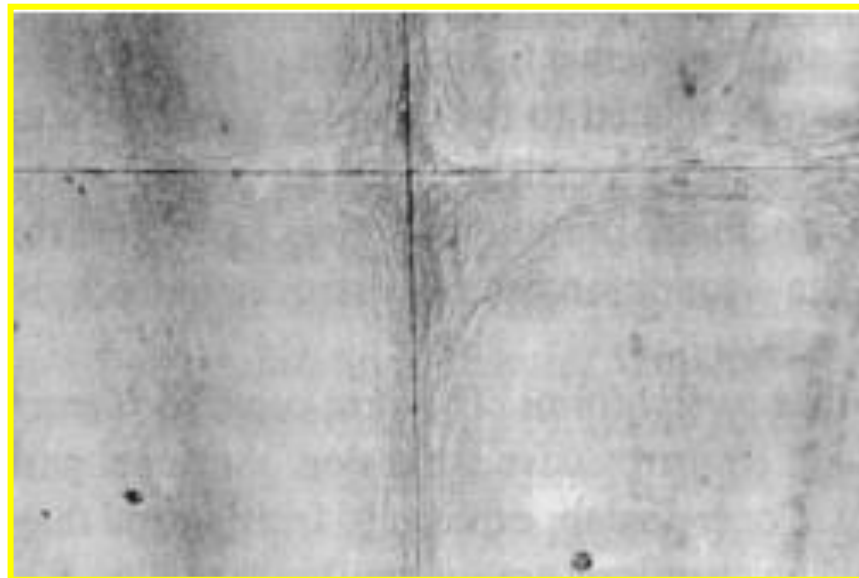
- Increase workability without increasing water
- Retard or Accelerate both Initial and Final Setting Time
- Modify the rate of capacity of bleeding
- To reduce segregation of concrete, mortar or grout
- To improve the pumpability of concrete, mortar or grout
- To reduce or retard heat generation during early hardening
- To reduce rate of strength development
- To improve Freez and Thaw Performance
- To produce colored concrete or mortar

Note

Air Entraining Admixture



An admixture that cause the *development of a system of microscopic air bubbles* in concrete, mortar, or concrete paste during mixing, usually to *increase* its *workability* and *resistance to freezing and thawing*.



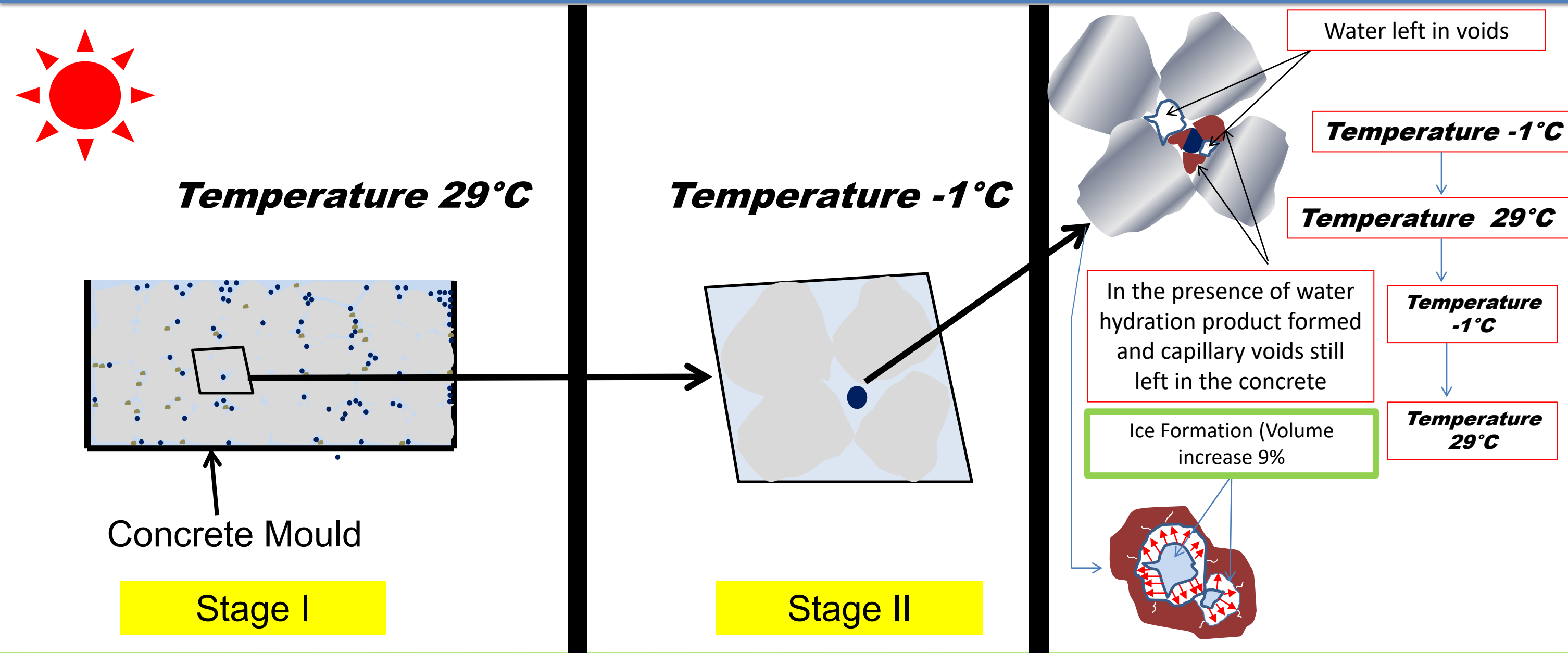
(Left image) severe D-cracking along longitudinal and transverse joints of a 9-year-old pavement; (Right Image) scaling of a concrete surface.

Air Entraining Admixture



AEA are primarily used to stabilize *tiny air bubbles* in concrete that *protect* against *damage* from repeated *frizzing and thawing cycle*. Until the mid 1990s the most commonly used air entraining admixture for concrete was *neutralized wood resin*. Newer formulation may instead be formulated from synthetic

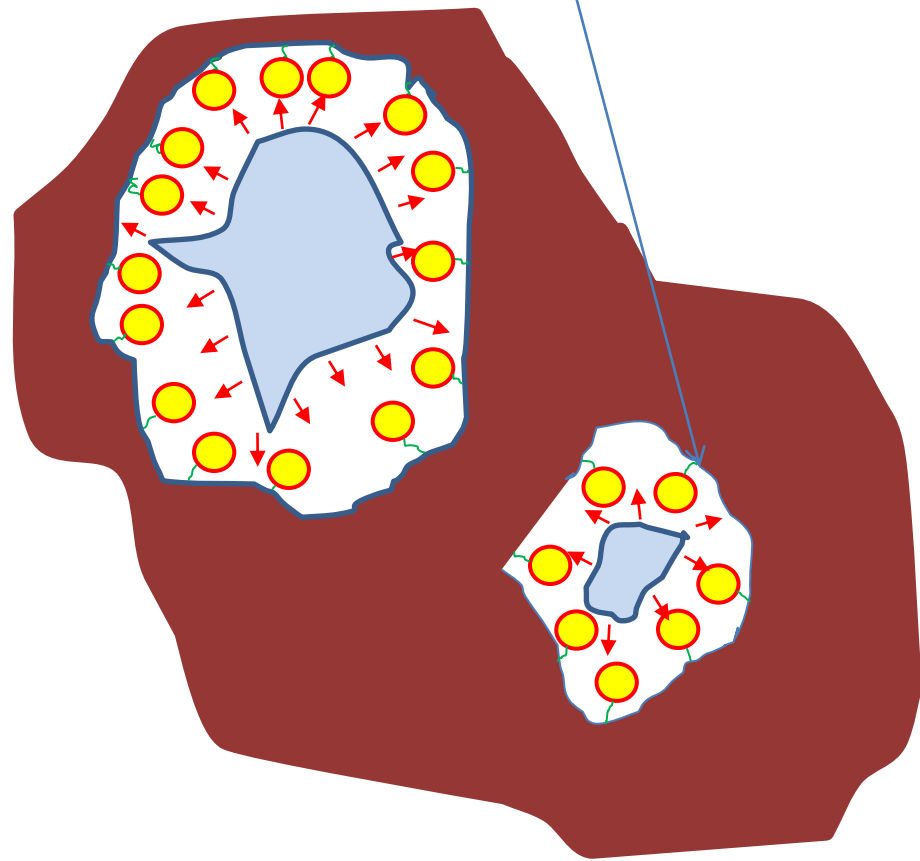
Air Entraining Admixture



The cyclic freezing and thawing increase the tensile stresses in the vicinity and crack initiate and propagate

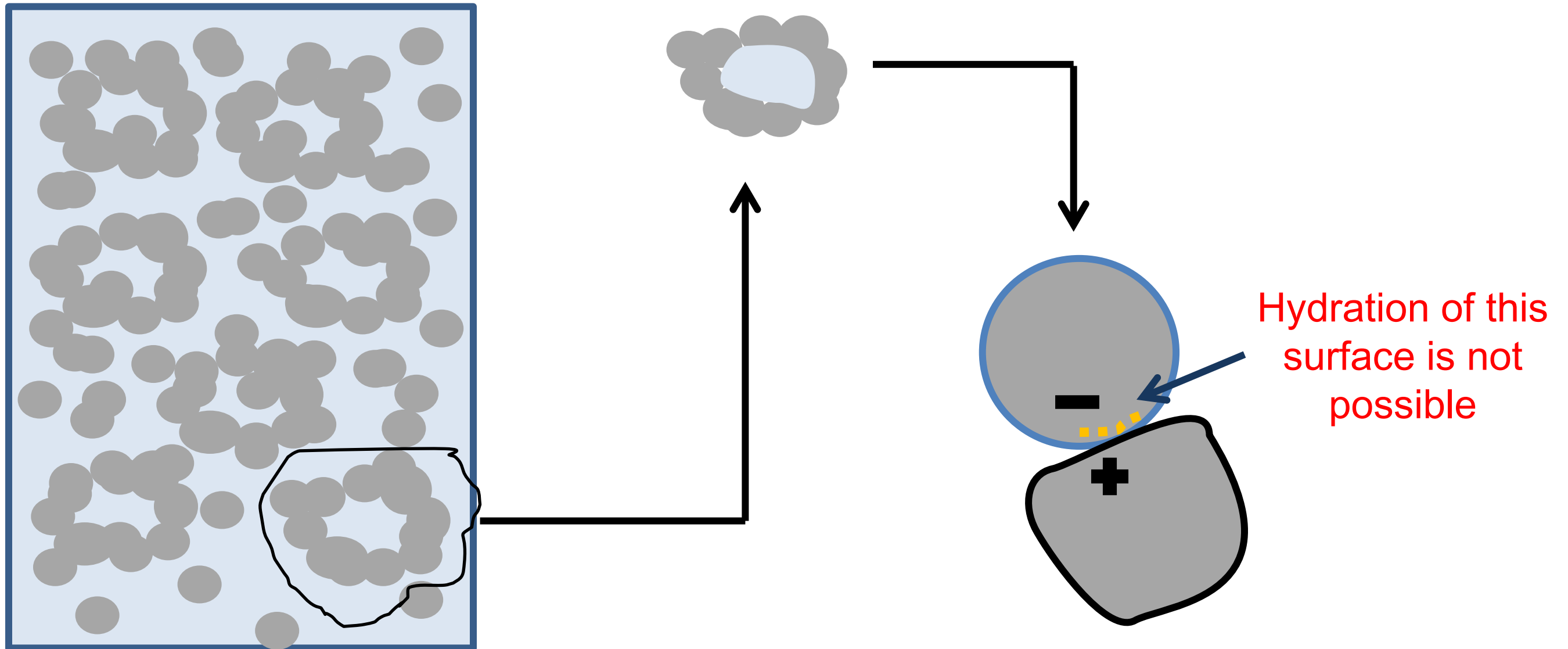
Air Entraining Admixture

Ice Formation (Volume increase 9%)

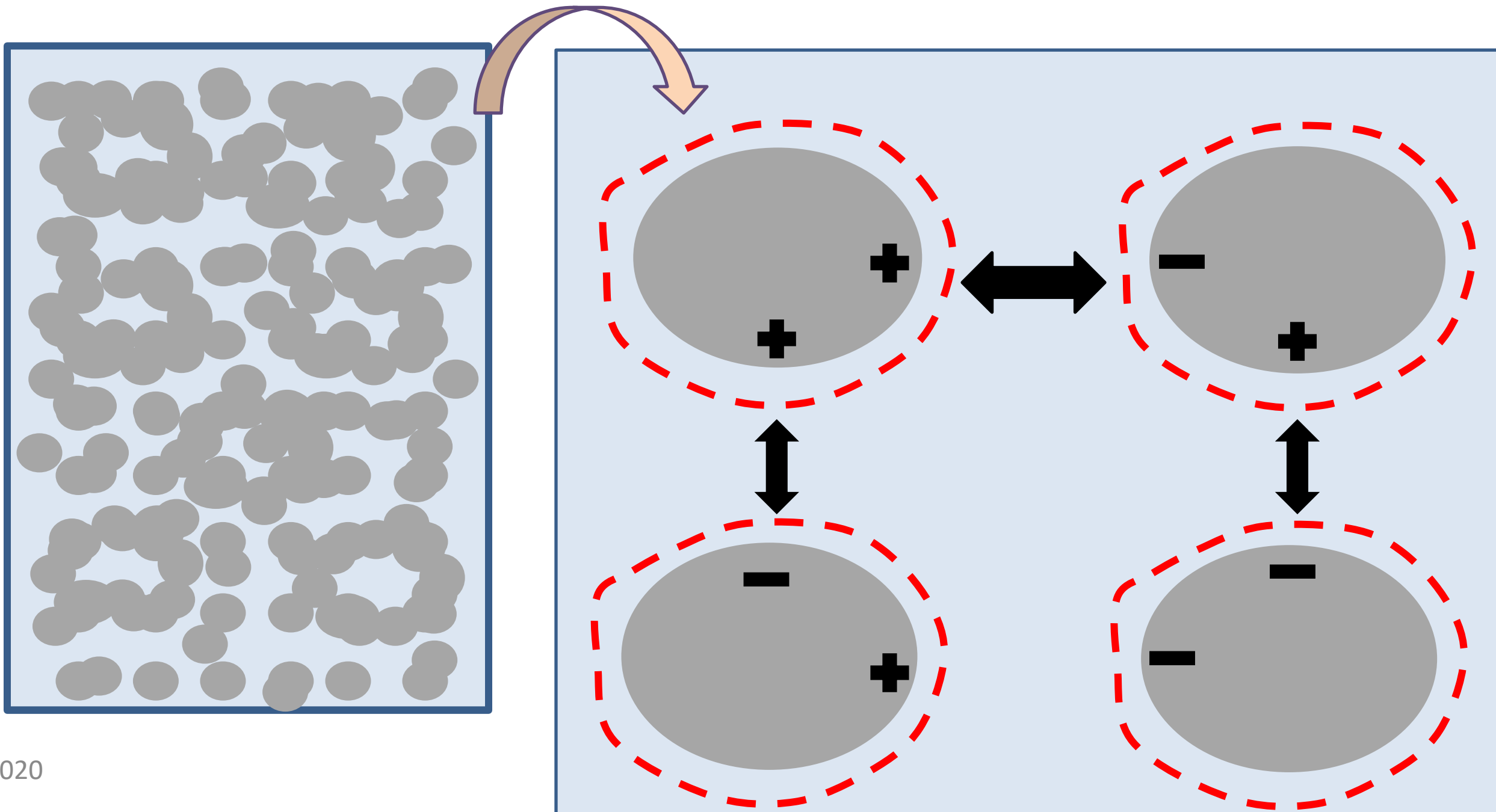


The cyclic freezing and thawing increase the tensile stresses in the vicinity and crack initiate and propagate

Water Reducing Admixture/Plasticizer



Water Reducing Admixture



Water Reducing Admixture



- ✓ When plasticizers are used, they get adsorbed on the cement particles.
- ✓ The adsorption of charged polymer on the particles of cement created particle to particle repulsive forces which overcome the attractive forces. The repulsive force is called Zeta potential, which depends on the base, solid content, quantity of plasticizer used.
- ✓ The overall result is that the cement particles are deflocculated and dispersed. When cement particles are deflocculated, the water trapped inside the flocs gets released and now available to fluidify the mix.

Water Reducing Admixture



- ✓ When cement particles get flocculated there will be inter-particles friction between particle to particle and floc to floc. But in the dispersed condition there is water in between the cement particle and hence the inter-particle friction is reduced.

Water Reducing Admixture



The basic products constituting plasticizer are as follows:

- ✓ Anionic surfactants such as lignosulphonates and their modifications are derivatives, salts of sulphonates hydrocarbons.
- ✓ Nonionic surfactant, such as polyglycol esters, acid of hydroxylated carboxylic acids and their modifications and derivatives.
- ✓ Other products, such as carbohydrates etc.

Water Reducing Admixture



- ✓ Among these, calcium, sodium and ammonium lignosulphonates are most used. Plasticizers are used in the amount of 0.1% to 0.4% by weight of cement. At these doses, at constant workability the reduction in mixing water is expected to be of the order of 5% to 15%. This naturally increases the strength. The increase in workability that can be expected, at the same w/c ratio, may be anything from 30 mm to 150 mm slump, depending on the dosage, initial slump of concrete, cement content and type.

Summary

- ✓ Importance of admixture in concrete industry
- ✓ Function of admixture
- ✓ Air Entraining and Water Reducing Admixture

THANK YOU