American Journal of Engineering Research (AJER)
e-ISSN: 2320-0847 p-ISSN : 2320-0936
Volume-8, Issue-11, pp-110-113
www.ajer.org
Research Paper Open Access

# Concrete technology ForRegular buildings and nuclear power stations

Mohamed Samir Anwar Ismail., Natalia Demitreva.
*Control manager engineer in a construction sites & Assistant Manager at ASPEC INTERSTROY Pushkinskayastreet 185, Izhevsk City, Russian Federation,Master student at construction management Program at «Izhevsk State Technical university »*
*Candidate of Science, Associate Professorindustrial and civil engineering,«Izhevsk State Technical university » Izhevsk city, Russian Federation*
*Corresponding Author: Mohamed Samir Anwar Ismail*

***ABSTRACT:*** *The article is devoted the difference between the concrete which is used in normal buildings and the concrete which we use in nuclear power plants the new concrete technology and how we can make the nuclear power plant more safe than earlier.*
***Keywords:*** *concrete technology, Evolution of Concrete Mix , Petroleum derivatives and their relationship to concrete mix, Money for safety*

Date of Submission: 02-11-2019 Date of acceptance: 20-11-2019

## I. CONCRETE… A COMPOSITE MATERIAL

Concrete may be considered as a composite material which is made up of a filler and a binder. The binder (cement paste) "glues" the filler together to form the concrete. The constituents used for the binder are cement and water, while the filler can be fine or coarse aggregate(Fig.1).
This means that the main constituents of concrete are:
1. portland Cement ;
2. aggregate - sand, gravel, crushed rock ;
3. water ;
4. admixtures - when needed .

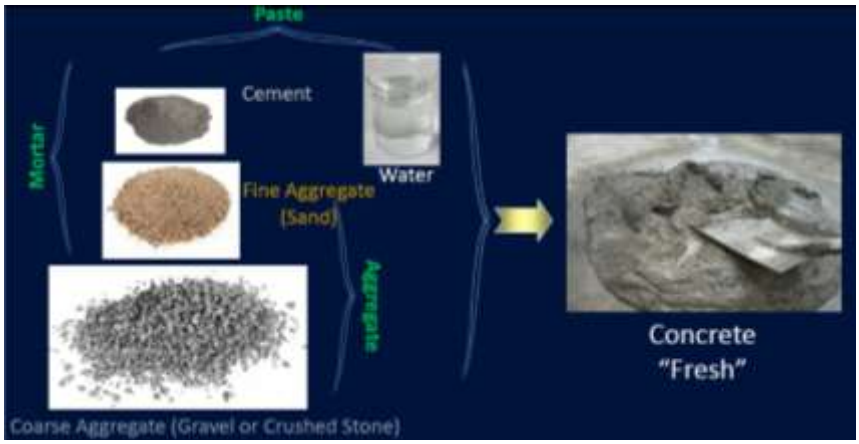


**Fig.1.** Main constituents of concrete.

**Concrete… A Composite material ≡ Numerical Concrete**
A "Numericalconcrete" is modeling the mechanical properties of concrete as a composite (Fig.2).In this model two-dimensional sections of concrete with aggregates having spherical, polygonal or other arbitrary shapes weregenerated from statistical representation of three-dimensional specimens and meshed.The finite element method is then used to calculate the mechanical properties of the samples.

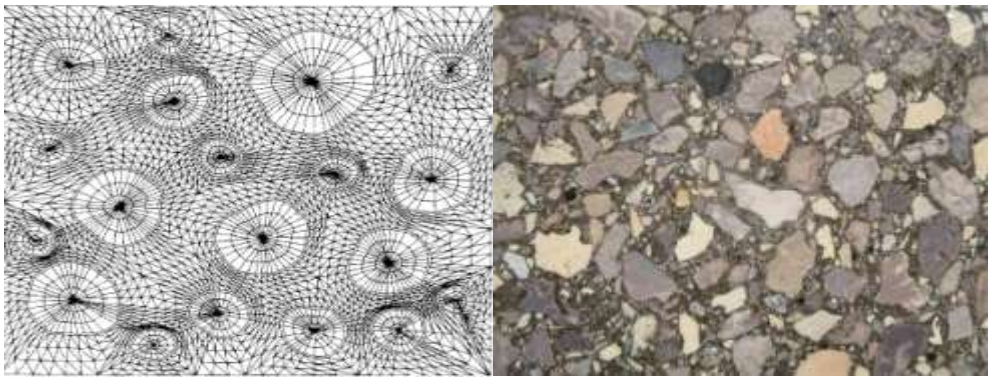

**Fig.2.** Numerical concrete.

It is important to talk shortly about the constituents of the concrete to illustrationthe importance of each component, At first the information about Portland cement:
Portland cement was named for an island in the English Channel where it was first produced in the 1800's.
The first stage of the production process for Portland cement is grinding limestone and clay.
The raw materials are proportioned, mixed, and then burned at (1000-1400 C) in large rotary kilns to produce clinker.
After the clinker cools, gypsum is added, and both materials are ground into a fine powder which is Portland cement.

The aggregates are characterized by follows (Fig.3):
Relatively Cheap Materials
Hard material
Reduce volume changes
Provide abrasion resistance

**Fig.3. Aggregate - Fine aggregate (Sand)**

**Thirdly the Water:**
It is needed for two purposes:
1. Chemical reaction with cement
2. Workability.

Only 1/3 of the water is needed for chemical reaction and extra water remains in pores and holes resulted in porosity.

On the first hand Water is good for more hydration and for preventing plastic shrinkage cracking but on the other hand it is bad for permeability, strength, durability (Fig.4).

**Fig.4.** voids in concrete.

**Fourthly The admixture:**
**Chemical:**
Set retarders
Set accelerators
Water reducing
Air entraining

**Mineral:**
Fly ash
Silica fume
Slags

Admixture is the basis of the principle of concrete technology because by adding material to the concrete mix we can develop new properties of concrete.

To improve the efficiency of concrete, we used technology to develop concrete components to obtain radiation-resistant concrete, which is used to build nuclear reactors and nuclear power plants , this type of concrete is called high density concrete

The density of this concrete varies from 3360 kg/m3 to 3840 kg/m3, whereas the density of normal concrete is of the order of 2400 kg/m3.

The density of light weight concrete is about 1900 kg/m3 and that of normal concrete about 2400 kg/m3. Thus the density of high density concrete is about 50% more than the density of conventional concrete. However this concrete can be produced of density up to 5200 kg/m3 using iron as both fine and coarse aggregate.

With the advent of the nuclear energy, there is a considerable demand of the concrete technologists in the market. Due to the use of nuclear energy producing reactors, large scale production of penetrating radiation and radioactive materials also has taken place.

Thus all nuclear energy producing units such as nuclear reactors, particle accelerator, industrial radiography, x-ray and gamma ray therapy units require nuclear shielding material for the protection of the operating personnel against the biological hazards such as radiation. The normal as well as high density concrete is effective and economical for the construction of permanent shield against radiation.

Types of Radiation in High Density Concrete:
The radiation can be classified into two groups as follows:
1. Electro-magnetic waves.
2. Nuclear particles.

Shielding Ability of High Density Concrete:
1. It has sufficient capacity to absorb the radiation both of neutron and gamma rays, reducing the radiation to a very weak state.
2. It has good mechanical properties as strength and durability.
3. When green, it can be molded into any shape. Thus the ease of construction makes concrete aespecially suitable material for radiation shielding.
4. Its initial and maintenance cost is also relatively low.

Disadvantages:
1. As the sections of the structure are heavy, they need more space. Thus the use of concrete as shielding against radiation needs more space.

**The weight of shielding concrete is very high in the range of 3360 to 3840 kg/m3.**
In the case of high density concrete, we use the basic concrete mix as before, while changing the type of aggregates used in the mix
Types of aggregates used in high density concrete:
Barite
Magnetite
Ilmenite
Limonite
Hematite etc.

**Requirements of Radiation Shielding Concrete:**
1. High density of the concrete - the higher the density of the concrete, higher the absorption of radiation. The radiation shielding quality of concrete can be increased by increasing its density.
2. The other important requirement of radiation shielding concrete is its structural strength even at high temperature.

## LIST OF SOURCES

[1]. Cement Data Book, Walter H. Duda,French & European Publications, Incorporated, 1988.
[2]. Lea's Chemistry of Cement and Concrete, 1988 Fourth Edition.
[3]. Concrete Admixtures Handbook second edition, V.S. Ramachandran 1996.
[4]. Proceedings of the Workshop on High Strength Concrete,Surendra P. Shah 1980.
[5]. Cement Manufacturer's Handbook Book by Kurt E.Peray 1979.
[6]. www.engineeringenotes.com.

Mohamed Samir Anwar Ismail "Concrete technology ForRegular buildings and nuclear power stations" American Journal of Engineering Research (AJER), vol. 8, no. 11, 2019, pp 110-113