Experimental work on analysis of samples containing self curing agent

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ABSTRACT

In Concrete, moisture plays a major role. It makes the concrete to retain its strength by curing. Concrete can be cured by water curing and by self curing agent. Moisture mitigation issues in the concrete can be found by testing methods. The self curing agent Polyethylene Glycol (PEG) and fly ash used in the concrete mix can yield moisture. Concrete is one of the widely used construction materials in the world. This paper predicts the changing moisture content in the concrete during drying by emission of water vapour. The SEM test, EDAX test and XRD test are analyzed. By this tests we can obtain the results of chemical characterization, internal structure. In this compression test on mortar cubes are also analyzed.

Keywords - PEG, flyash, cement

I. INTRODUCTION

1.1 INTRODUCTION TO MOISTURE IN CONCRETE

Water or other liquid diffused in a small quantity as vapour, within a solid, or condensed on a surface. The movement of moisture through a porous medium is known as moisture movement. Retaining moisture in concrete is a good thing if the ultimate goal is a good curing condition, for to install finished flooring materials requiring low concrete relative humidity (RH). In this case, the slab to dry out as soon as possible. But drying can be a slow process and contractors often find themselves in conflict with construction schedules. Under these schedule pressures, finished floor surfaces are sometimes installed when the RH of concrete is too high, frequently resulting in expensive testing, legal action, and repairs.

II. LITERATURE REVIEW

BONALDO, CASTRO-GOMES (2002) The performance of the structural system (repaired structure) depends on the sound bond behavior between old and new concretes. Frequently, adhesives based on epoxy resins provide this liaison. In this work the behavior of three different types of based epoxy adhesives was observed in the bonding of different strength concrete class. Samples for backscattered scanning electron microscopy (BSE) were prepared from extracted pieces - containing the bonding layer - of non reinforced concrete slabs overlaid with bonded thin steel fiber reinforced concrete (SFRC) layer. Different features of each bonding layer epoxy resin type which may explain differentiate mechanical pull-off results as well as failure modes were observed. Micrographs obtained with BSE give clearly bond layer arrangement and minimum and maximum thickness, typical air voids porosity, presence of hydrated cement paste embedded in epoxy layer, mineral admixtures contained in epoxy, and also relevant micro fissures existing in concrete substrate.

BARLUENGA(2010) An experimental research was carried out on the design and development of a self-levelling cement mortar substituting up to 75% of the cement by grounded slate from quarrying wastes. In a first stage, the formation of stable reactive binding products of slate–cement pastes was confirmed, using Vicat needle test and Scanning Electron Microscopy and Energy Dispersive Spectroscopy analysis (SEM/EDAX). In addition, mortar mixtures with different amounts of grounded slate have been studied. Fresh state consistency, shrinkage measurements in wet and dry conditions and physical and mechanical properties in the hardened state of these mortars have been assessed. Finally, mortar shrinkage was controlled according to the selected application, including admixtures and glass fibers in the mortar composition, to achieve the flowability and strength required, without segregation.

VIDIVELLI AND MAGESWARI (2010) Increasing the performance of concrete with the partial replacement of mineral admixture using flyash along with chemical admixtures eliminates these drawbacks besides enhancing durability characteristics. This paper reports the investigation carried out on concrete with partial replacement of cement by flyash. Concrete mixes, viz. conventional concrete mixes with varying percentages of flyash (10, 20,30 and 40%) as cement replacement material were investigated. The compressive strength, tensile strength of cubes and cylinders and flexural strength test were carried out on 4 concrete mixes at the ages of 28,45,60,90 and 180 days. The effect of fllyash as cement replacement material on mechanical properties were analyzed and compared with conventional cement concrete. This paper briefly presents the compressive strength, tensile strength of cubes and cylinders and flexural strength of all the concrete mixes investigated at the age of 28,45,60,90 and 180 days. The SEM analysis of the flyash concrete is studied in detail.

III. MATERIAL

3.1. CURING AGENT

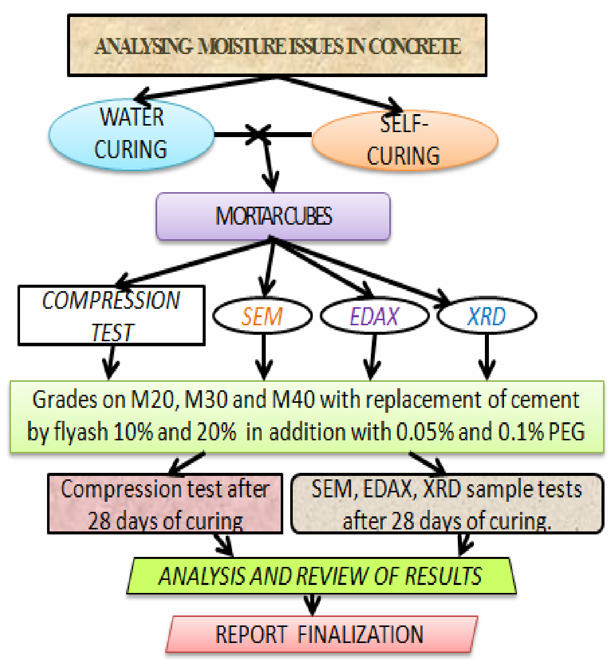
The effects of polyethylene glycol on the setting reactions of hydrating Portland cement and on the eventual structure of the hydrated cement paste have been studied. When ethylene glycol (EG) is solidified with cement, the EG appears to occupy different kinds of sites, characterized by different extractability. The polyethylene glycol (PEG), used as a self-curing agent as 0.05% and 0.1%. Water--soluble polymers Polyethylene Glycol (PEG) are investigated as self--curing agents for ordinary Portland cement (OPC).

3.2CEMENTIOUS MATERIAL

The Cementious material used is the fly ash. Fly Ash is a byproduct of coal-fired furnaces at power generation facilities and is the non-combustible particulates removed from the flue gases. Characteristic of fly ash can vary significantly depending on the source of the coal being burnt. The percentage of fly ash used as 10% and 20%.

IV. EXPERIMENTAL WORK

4.1 METHODOLOGY



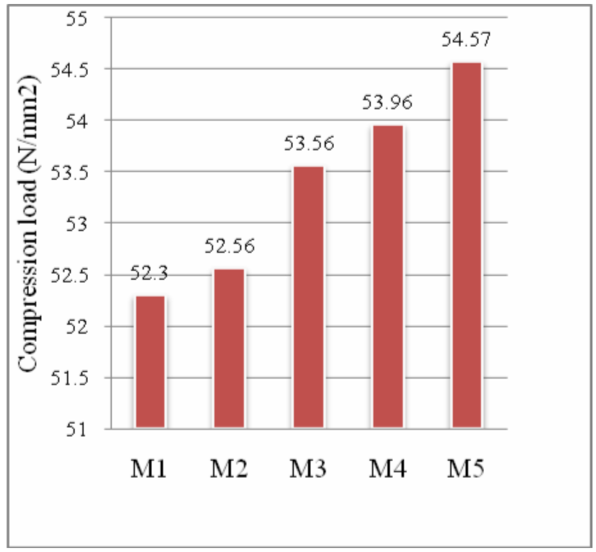
4.2 MORTAR CUBES

The mortar cubes were designed and casted for M20, M30 and M40 grades at the standard size of 706 mm x 706 mm x 706 mm. The cubes were casted with PEG and the replacement of flyash and without PEG and without the replacement of flyash. The PEG percentage used was 0.05% and 0.1% with 10% and 20% in replacement of flyash. After 28days of curing the compression test were taken and the cubes were crushed and powder samples were taken for the sample tests. The samples were given to the laboratory, Nano technology, Karunya University and the results were obtained for SEM test (Scanning Electron Microscope), EDAX test (Energy dispersive X-ray spectroscopy) XRD test (X-Ray Diffraction Analysis).

	Mortar cubes	Mix -M
1	Sample mix of 1:3 cement mortar	M1
2	Sample mix of 1:3 cement mortar with 10% replacement of cement with flyash and addition of 0.05% PEG	M2
3	Sample mix of 1:3 cement mortar with 10% replacement of cement with flyash and addition of 0.1% PEG	M3
4	Sample mix of 1:3 cement mortar with 20% replacement of cement with flyash and addition of 0.05% PEG	M4
5	Sample mix of 1:3 cement mortar with 20% replacement of cement with flyash and addition of 0.1% PEG	M5

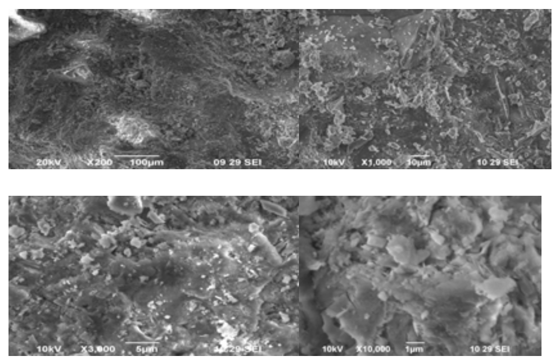
V. RESULT

Compression test on Mortar cubes:

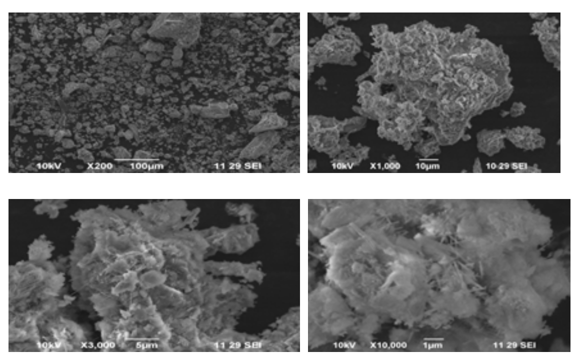


5.1 SEM ANALYSIS

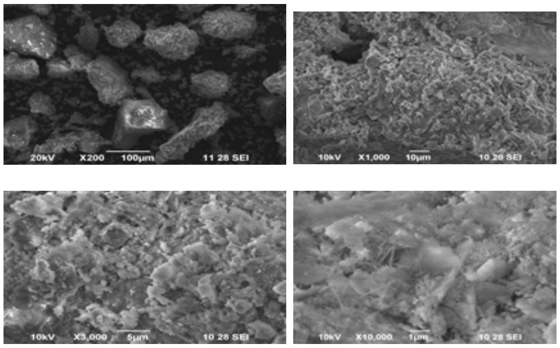
1) M1



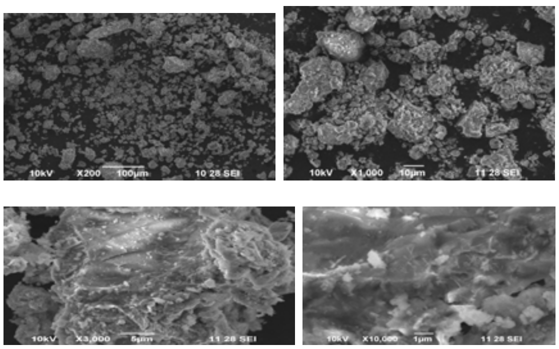
2 M2



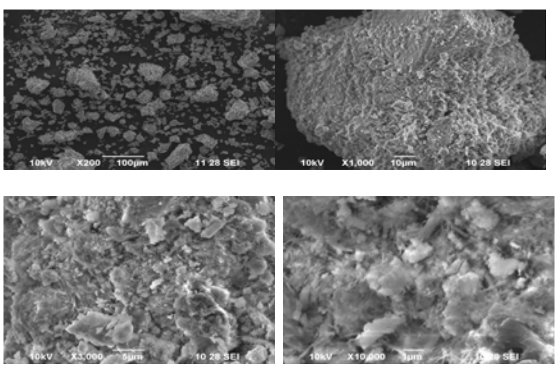
3) M3



4) M4



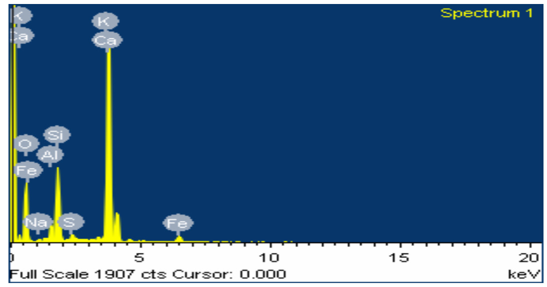
5) M5



5.2. EDAX TEST

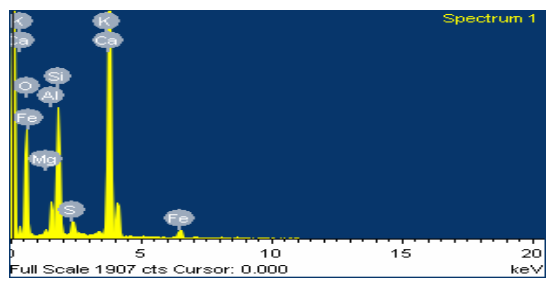
Standard:
O SiO2 1-Jun-1999 12:00 AM
Na Albite 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
S FeS2 1-Jun-1999 12:00 AM
K MAD-10 Feldspar 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

1) M1



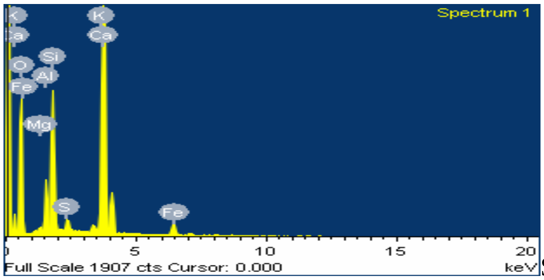
Spectrum processing:
Peak possibly omitted: 4.500 keV
Processing option: All elements analyzed (Normalized)
Number of iterations = 4
Element App Intensity Weight% Weight% Atomic%
Conc. Corrn. Sigma
O K 16.02 0.4182 49.53 1.06 69.34
Na K 0.31 0.6607 0.61 0.18 0.60
Al K 1.23 0.7695 2.06 0.18 1.71
Si K 5.39 0.8519 8.18 0.31 6.52
S K 0.42 0.9082 0.60 0.13 0.42
K K 0.40 1.1466 0.45 0.13 0.26
Ca K 28.42 1.0193 36.04 0.81 20.14
Fe K 1.59 0.8117 2.53 0.32 1.02
Totals 100.00

2 M2



Spectrum processing:
Peak possibly omitted: 8.040 keV
Processing option: All elements analyzed (Normalized)
Number of iterations = 5
Element App Intensity Weight% Weight% Atomic%
Conc. Corrn. Sigma
O K 30.12 0.4751 53.26 0.80 72.01
Mg K 0.32 0.6534 0.41 0.12 0.37
Al K 2.27 0.7729 2.47 0.16 1.98
Si K 9.78 0.8483 9.69 0.28 7.46
S K 1.05 0.8902 0.99 0.12 0.67
K K 0.44 1.1180 0.33 0.10 0.18
Ca K 36.33 1.0088 30.25 0.57 16.33
Fe K 2.52 0.8122 2.61 0.24 1.01
Totals 100.00

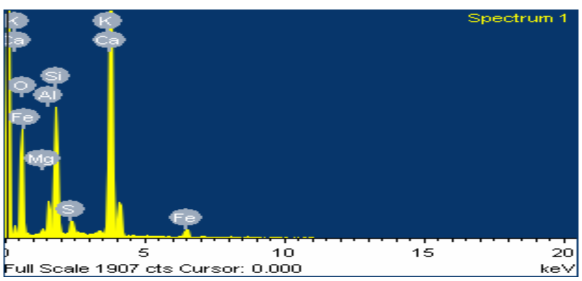
3) M3



Spectrum processing:

Peak possibly omitted: 8.020 keV
Processing option: All elements analyzed (Normalized)
Number of iterations = 5
Element App Intensity Weight% Weight% Atomic%
Conc. Corrn. Sigma
O K 37.59 0.4988 54.97 0.71 73.21
Mg K 0.33 0.6549 0.37 0.11 0.32
Al K 3.72 0.7744 3.50 0.17 2.77
Si K 10.42 0.8377 9.07 0.25 6.88
S K 0.97 0.8873 0.80 0.11 0.53
K K 1.14 1.1120 0.75 0.10 0.41
Ca K 38.82 1.0049 28.18 0.50 14.98
Fe K 2.62 0.8121 2.36 0.23 0.90
Totals 100.00

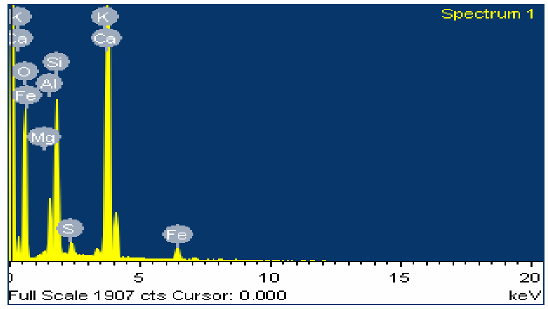
4) M4



Spectrum processing:

Peak possibly omitted: 8.030 keV
Processing option: All elements analyzed (Normalized)
Number of iterations = 5
Element App Intensity Weight% Weight% Atomic%
Conc. Corrn. Sigma
O K 37.59 0.4988 54.97 0.71 73.21
Mg K 0.33 0.6549 0.37 0.11 0.32
Al K 3.72 0.7744 3.50 0.17 2.77
Si K 10.42 0.8377 9.07 0.25 6.88
S K 0.97 0.8873 0.80 0.11 0.53
K K 1.14 1.1120 0.75 0.10 0.41
Ca K 38.82 1.0049 28.18 0.50 14.98
Fe K 2.59 0.8076 2.31 0.63 1.21
Totals 100.00

5) M5



Spectrum processing:
Peak possibly omitted: 8.010 keV
Processing option: All elements analyzed (Normalized)
Number of iterations = 5
Element App Intensity Weight% Weight% Atomic%
Conc. Corrn. Sigma
O K 37.59 0.4988 54.97 0.71 73.21
Mg K 0.33 0.6523 0.37 0.11 0.32
Al K 3.72 0.7744 3.50 0.17 2.77
Si K 10.42 0.8377 9.07 0.25 6.88
S K 0.97 0.8873 0.80 0.11 0.53
K K 1.14 1.1120 0.75 0.10 0.41
Ca K 38.82 1.0049 28.18 0.50 14.98
Fe K 2.47 0.8078 2.64 0.23 0.97
Totals 100.00

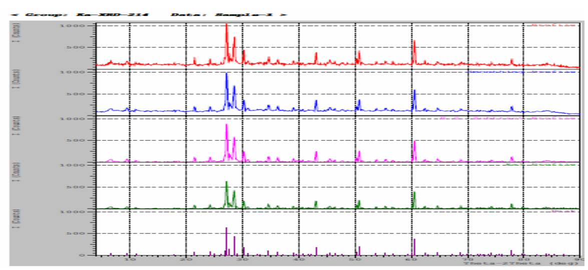
5.3.X-RAY DIFFRACTION ANALYSIS (XRD)

1) M1

<2Theta> < I >

4.0000 92

to 90.0000 32

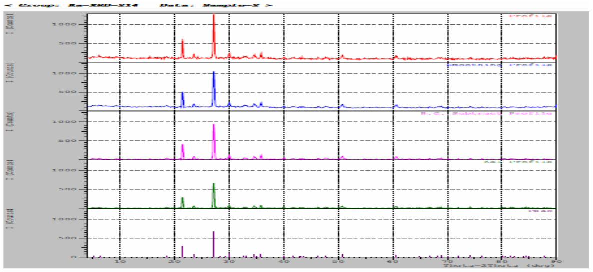


2) M2

<2Theta> < I >

4.0000 124

to 90.0000 182

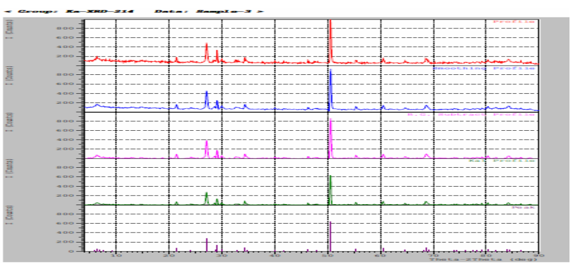


3) M3

<2Theta> < I >

4.0000 114

to 90.0000 42

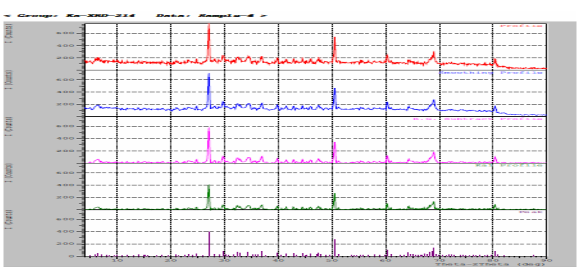


4) M4

<2Theta> < I >

4.0000 152

to 90.0000 30

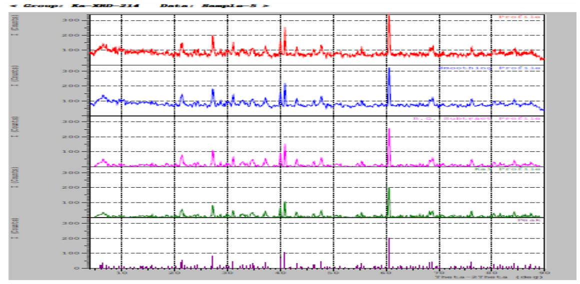


5) M5

<2Theta> < I >

4.0000 90

to 90.0000 38



VI. CONCLUSION

By analyzing all the results above, the structure of each element was identified. Crystalline structure was obtained from the tests. The peaks indicate calcium hydroxide, calcite, and calcium silicate hydrate in concrete. Chemical characterizations of the samples were analyzed.

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