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MICRO STRUCTURE ANALYSIS OF GEOPOLYMER CONCRETE CURED UNDER AMBIENT CONDITIONS

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1. ABSTRACT

The decrease of green house gas (GHS) emanations is a standout amongst the most major issues everywhere throughout the world. The Kyoto Protocol has gone for a 5.2% lower discharge measure of GHS somewhere in the range of 2008 and 2012 contrasted and that in 1990. It is for the most part evaluated that the measure of GHS discharged from the overall creation of conventional Portland concrete (OPC) compares to roughly 7% of the aggregate GHS outflows into the Earth's environment. With an end goal to limit Co2 outflows, the solid business has contributed significant cost and work to grow all the more ecologically inviting solid which diminishes the utilization of OPC by halfway supplanting the measure of bond in cement with results materials, for example, fly fiery remains.

As of late, another class of cementitious materials delivered from an alumino-silicate activated in a high alkali solution,, has been produced known as GPC. The predominant properties of geopolymer cement can additionally upgrade the financial advantages. Be that as it may, just drawback in geopolymer solid assembling is the procedure of geoploymerisation needs heat during reaction. For the most part warm is a response quickening agent, restoring of a crisp geopolymer is done for the most part at a hoisted temperature subsequently geoploymer solid individuals requires chamber or broiler relieving and this confines the GPC applications to precast individuals as it were. Along these lines, late research on GPC is focused to examine the feasibility of beating the restoring issue in Low lime fly fiery remains based GPC by supplanting flyash with bond to draw consideration of structural Engineers to utilize this new eco-accommodating concrete included GPC for in-situ solid works also. Present investigation focuses on the micro structure study on GPC cured under ambient using XRD and SEM analysis.

INTRODUCTION

In present time, Concrete is biggest utilized synthetic material in world. After water most utilized material is bond concrete. Thousands tons of cement is created each year in development enterprises. On a normal consistently three tons of cement are devoured by every individual on the planet. Concrete is an imperative development material that will be proceeding in application far into what's to come. India, USA and China represent almost a large portion of the world‟s request. Concrete is utilized universally to construct structures, streets, runways, scaffolds and dams. This is because of the way that solid is delivered from locally accessible materials, for example, concrete, sand and total. Bond is essential for development action, so it is unequivocally connected to the world economy. Concrete making is ascending by 2.5% yearly, and is depended upon to improvement from around 2.5 billion tons in 2006 to 3.7-4.4 billion tons by 2050.

Normal Portland bond (OPC) is utilized as restricting material in cement. Two noteworthy issues are related with the generation of concrete. First is that in the assembling of OPC crisp material, for example, lime stone, earth and other common assets are required. To yield 1 ton of bond around 1.6 tons of new material are required and time taken in development of the lime stone, mud and minerals is far lengthier than the rate at people utilize it. It is accounted for that the prerequisite of bond in India is probably going to contact around 550 million tons by 2020 with a deficit of 230 million tones i.e. 58 % deficiency. Second is that in the generation of OPC gigantic measure of Carbon di Oxide (CO2) discharged. It is express that in the assembling of 1 ton OPC around 1 ton CO2 discharged. This huge measure of CO2 discharged in condition which causes ascend in CO2 level in condition, which causes an Earth-wide temperature boost. The concrete business contributes around 5-6 % of aggregate worldwide carbon dioxide outflows.

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Objectives of the study

1. To make a Concrete without utilizing cement (i.e. Geopolymer concrete).
2. To study the Micro Structure Analysis of GPC cured under ambient conditions
3. To study the compressive strength of fly based GPC
4. To study the XRD,TA, TGA and SEM analysis of GPC

2. LITERATURE REVIEW

S. Ridha, M. Akmalludin, S. S. Salehudin, et al.,(2016)

This paper looks into the quality headway of geopolymer concrete admixed with nano-silica, SiO2 assuaged under temperature of 120oC and weight of 4000 psi. It includes the microstructure change of the bond as far as pore structures.

B. Siva Konda Reddy, J. Varaprasad, K.Naveen Kumar Reddy, et al.,(2010)

This paper thinks about Geopolymer concrete arranged from low lime based fly-fiery remains and a blended soluble base activator of sodium hydroxide and sodium silicate arrangement are researched.

Xerses N. Irani, Dr Suresh G. Patil, Rampanth, et al.,(2017)

The goals of the present work is to settle the parameters, for example, Amount of cover utilized, Molarity of NaOH, Ratio of Na2SiO3/NaOH and Ratio of Liquid to Binder In the présent work, test examinations were performed, for example, compressive quality test on the encompassing relieved geopolymer concrete.

3. MATERIALS USED

Coarse aggregates

Coarse totals are particles more essential that 4.75mm anyway generally go between 9.5mm to 37.5mm in width. They can either be from essential ,optional or reused sources.

Fine aggregates

The locally open stream sand, experiencing 4.75 mm was used in this test work. The properties of fine aggregates were settled by May be: 2386-1963.

GGBS-

Granulated Blast Furnace Slag is gotten by quickly chilling (extinguishing) the liquid fiery remains from the heater with the assistance of water. Amid this procedure, the slag gets divided and changed into nebulous granules (glass), meeting the necessity of IS 12089:1987 (fabricating detail for granulated slag utilized in Portland Slag Cement). The granulated slag is ground to wanted fineness for delivering GGBS.

Sodium hydroxide

The most well-known basic activator utilized in geopolymerisation is a blend of sodium hydroxide (NaOH) or potassium hydroxide (KOH) and sodium silicate (Na2Sio3) or potassium silicate (K2SiO3). The sort and convergence of salt arrangement influence the disintegration of Pozzolanic material. It is a white strong and very burning metallic base and soluble base salt which is accessible in pellets, drops, granules, and as readied arrangements at various diverse focuses. Sodium hydroxide frames an around half (by weight) immersed arrangement with water.

Sodium silicate

Sodium silicate is the normal name for mixes with the recipe Na2(SiO2)nO Concrete treated with a sodium silicate arrangement serves to fundamentally decrease porosity in most brick work items, for example, concrete. A compound response happens with the abundance Ca(OH)2 (portlandite) present in the solid that for all time ties the silicates with the surface, making them unmistakably tough and water repellent.

4. EXPERIMENTAL INVESTIGATION

Manufacture of Fresh Concrete and Casting

Geopolymer cement can be produced by receiving the regular strategies utilized in the make of Portland bond concrete. In the lab, the fly fiery debris and the totals were first combined for 3 minutes. The totals were set up in soaked surface dry condition. The stomach settling agent plan was then added to the dry materials and the mixing continued for further around 4 minutes to make the fresh bond.

Curing of Geopolymer concrete

Encompassing alleviating of low calcium fly powder based geopolymer concrete is all things considered recommended. Encompassing restoring generously helps the concoction response that happens in the geopolymer glue. Both restoring time and relieving temperature impact the compressive quality of geopolymer concrete.

Curing of Test Specimens

Subsequent to throwing, geopolymer solid examples were relieved promptly. Two kinds of relieving were utilized in this examination, i.e. Stove restoring and Ambient relieving. For Oven relieving, the test examples were restored in the stove and for Ambient restoring, they were held under surrounding conditions for relieving at room temperature.

Tests to be conducted on concrete

Compressive strength of concrete

This test was directed according to ([9] IS516-1959). The 3D squares of standard size 150x150x150mm were used to find the compressive nature of bond. Models were determined to the bearing surface of CTM, of breaking point 200T without flightiness and a uniform rate of stacking associated till the failure of the 3D shape. The most extraordinary load was noted and the compressive quality.

MICRO STRUCTURAL ANALYSIS

Scanning Electron Microscopy (SEM) Analysis

It is utilized successfully in microanalysis and disappointment examination of strong inorganic materials. Electron microscopy is performed at high amplifications, creates high-goals pictures.

X-Ray Diffraction (XRD) Analysis

In the following stage X-Ray Diffraction (XRD) examination is performed to decide the silica period of the powder solid examples. The examples are examined by a X-Ray diffractometer which is appeared in Figure

X-Ray Diffractometer

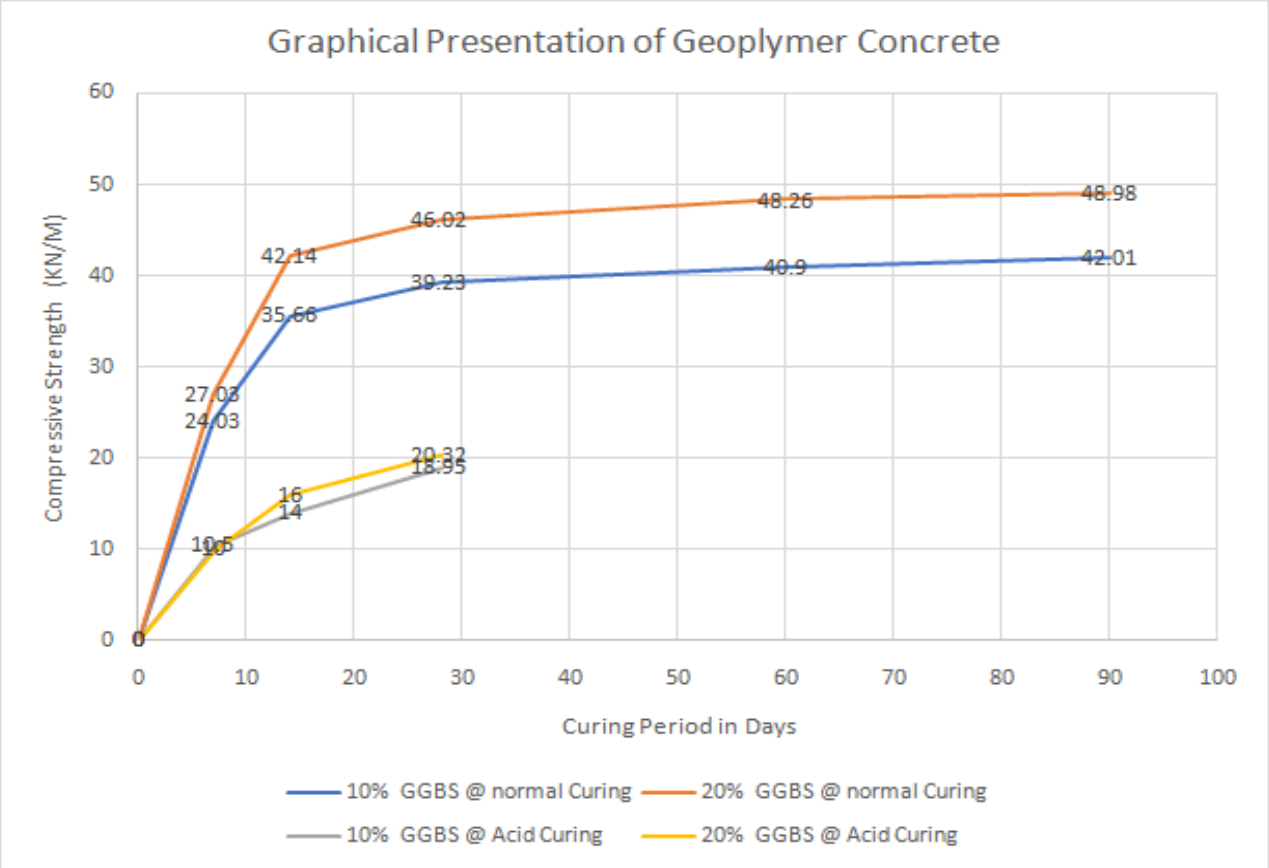
5. RESULTS AND ANALYSIS

Compressive strength of concrete
Atmospheric curing

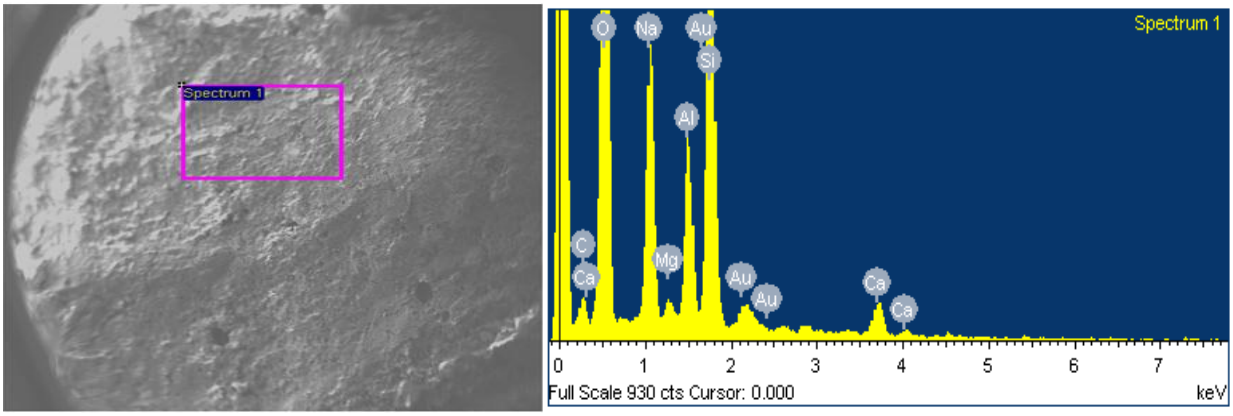
S.No	Period of curing (Day)	Result of Mix proportions	
		90% Fly Ash & 10%GGBS (KN / M)	80% Fly Ash & 20%GGBS (KN / M)
1.	7	24.03	27.03
2.	14	35.66	42.14
3.	28	39.23	46.02
4.	60	40.9	48.26
5.	90	42.01	48.98

After Removing from 28 days Acid curing

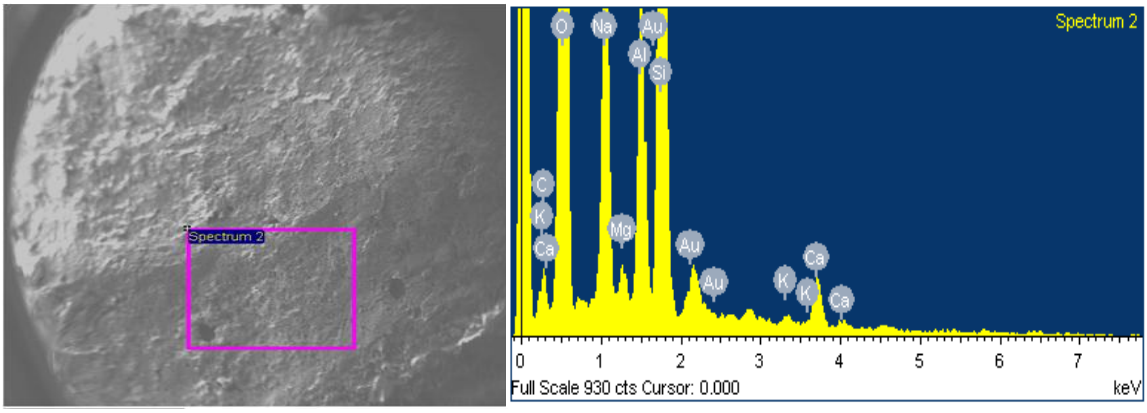
S.No	Period of curing (Day)	Result of Mix proportions	
		90% Fly Ash & 10%GGBS	80% Fly Ash & 20%GGBS
1.	28	18.95	20.32



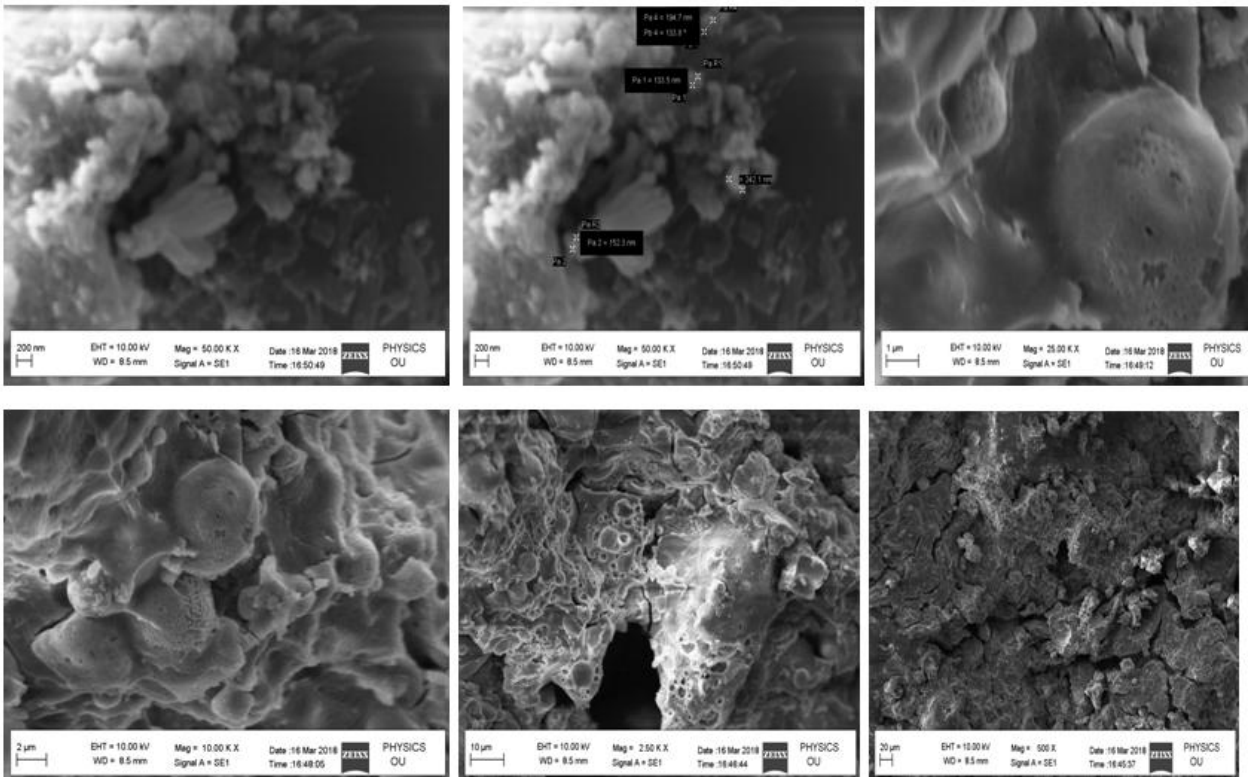
SEM Analysis
10% GGBS After 28 days



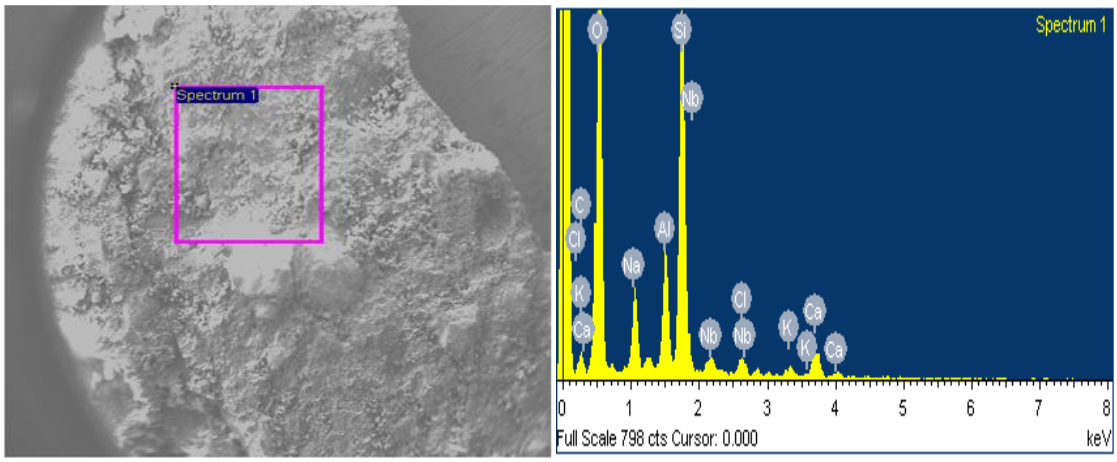
Electron image ..... Spectrum 1



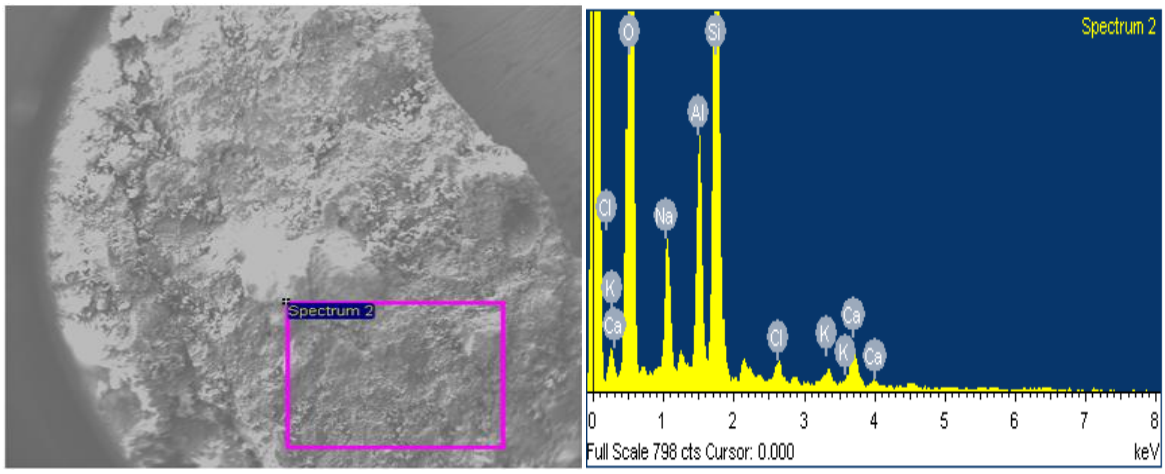
Electron image Spectrum 2



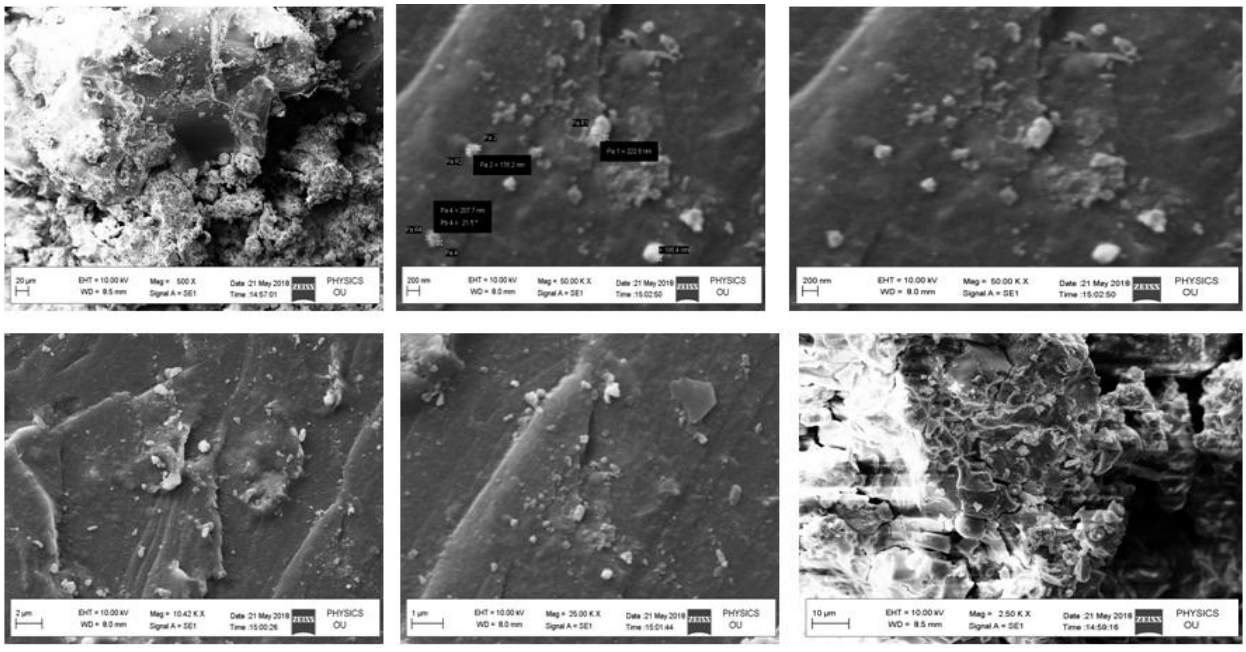
10% Acidic condition SEM Analysis



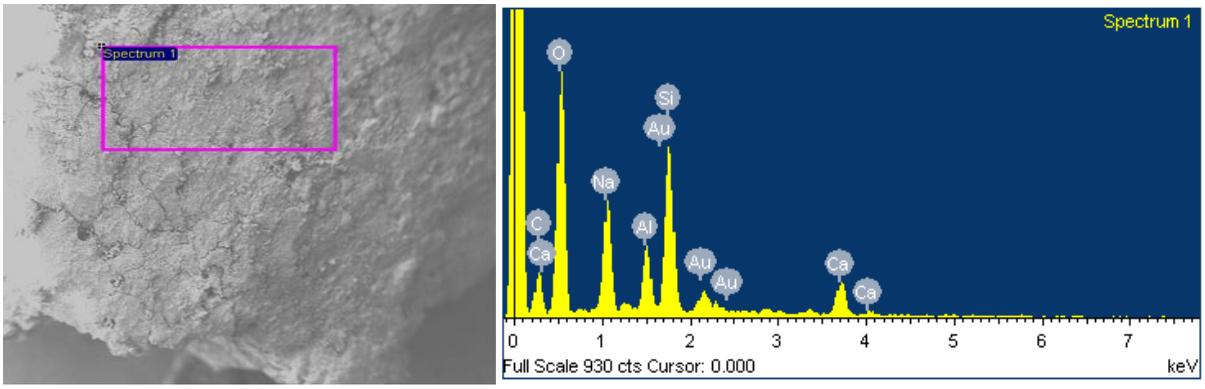
Electron image **Spectrum 1**



Electron image **Spectrum 2**



20% GGBS After 28 days



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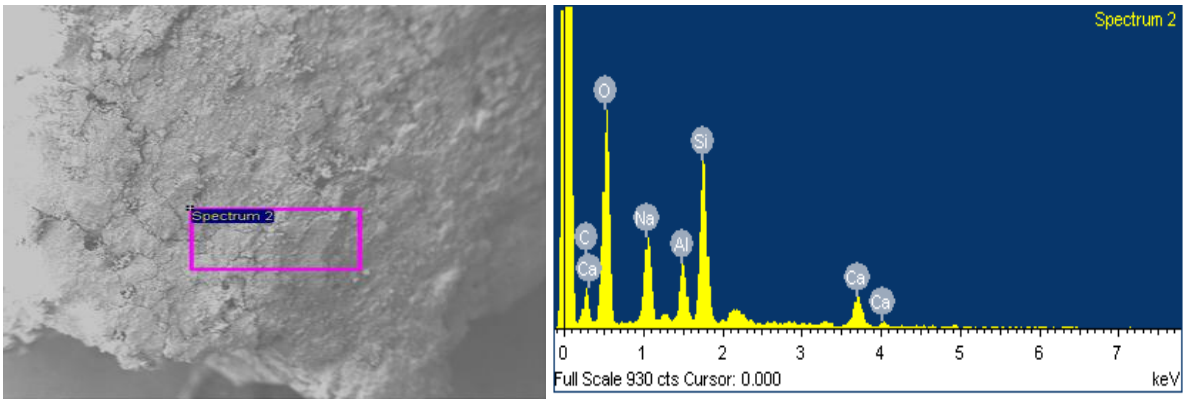

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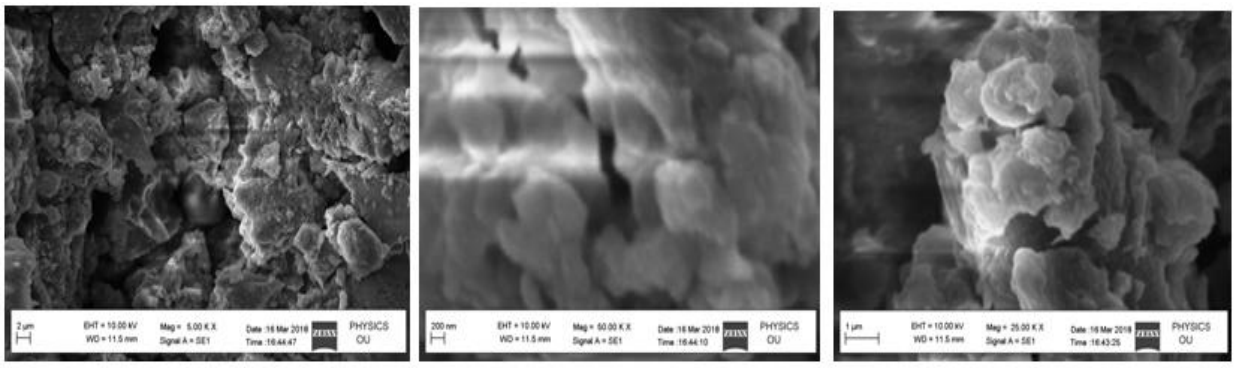
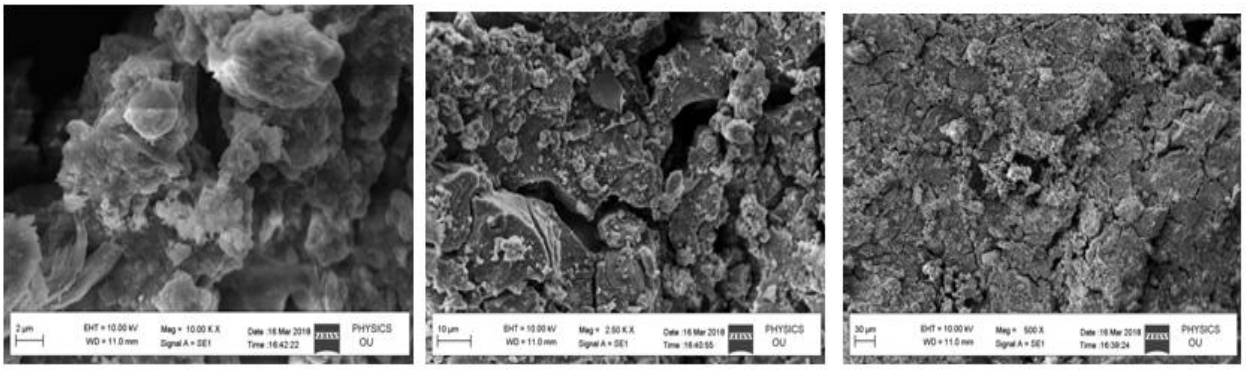
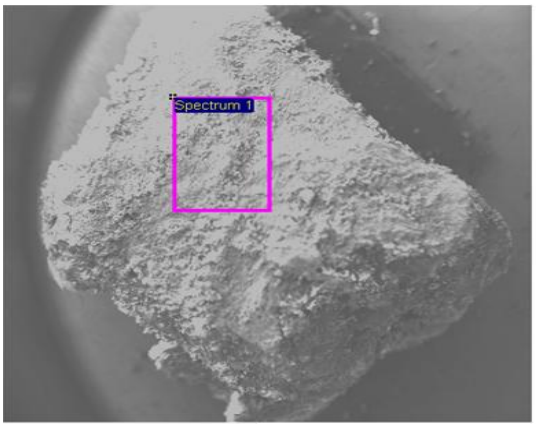
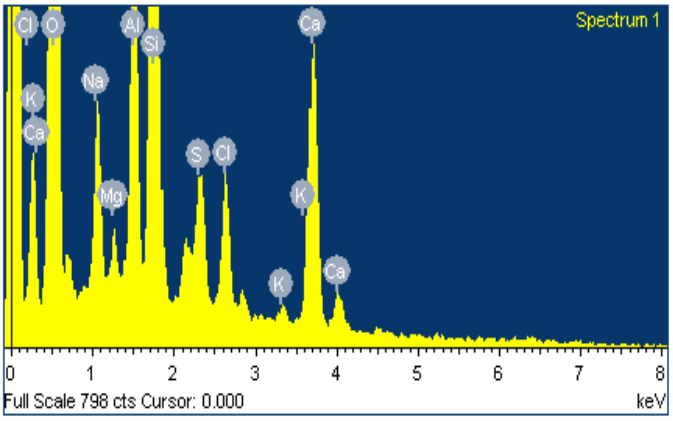


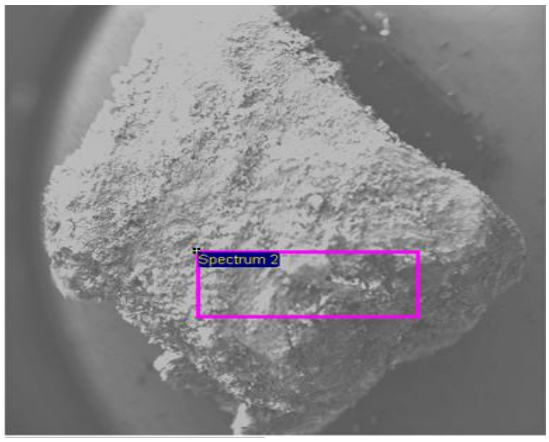


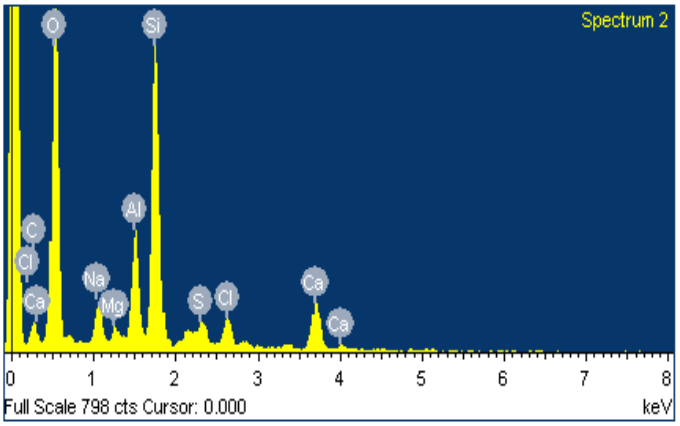
20% Acidic condition SEM Analysis



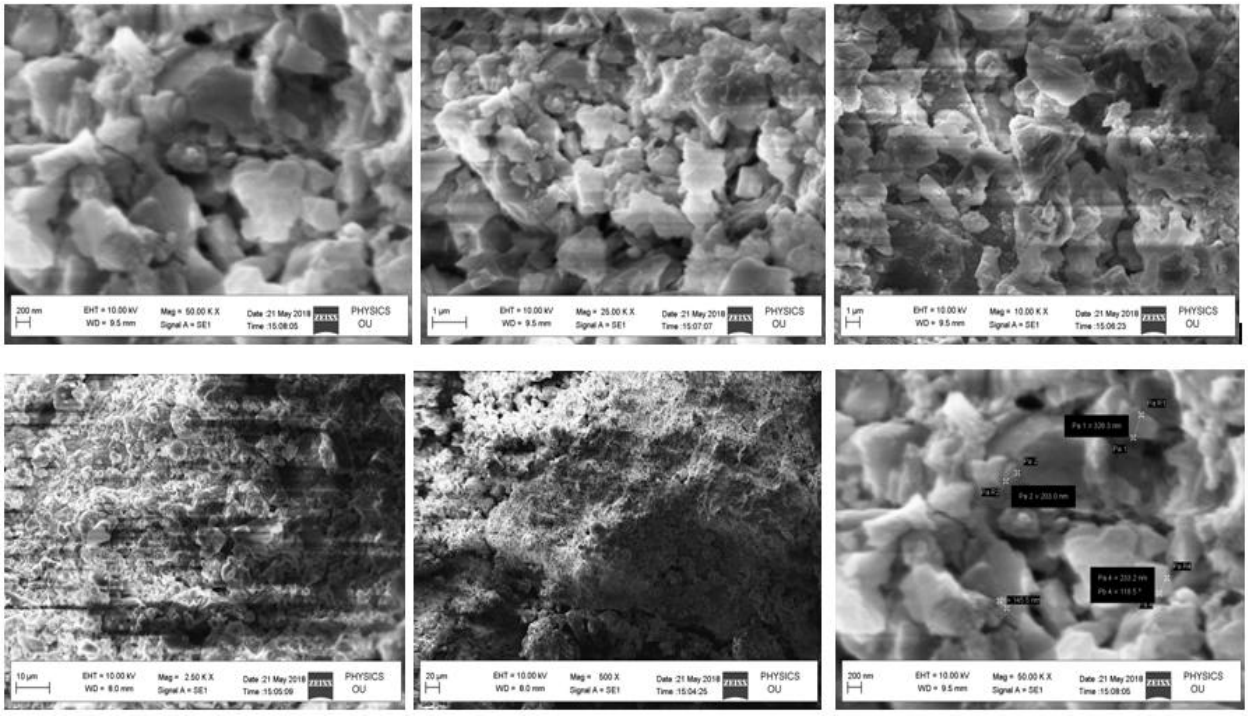


Electron image …… Spectrum 1

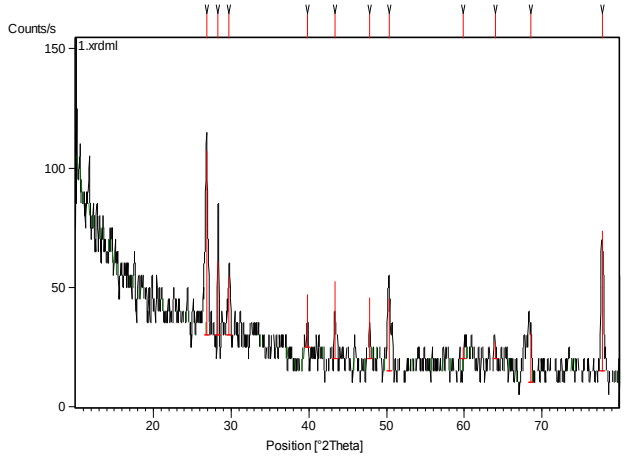




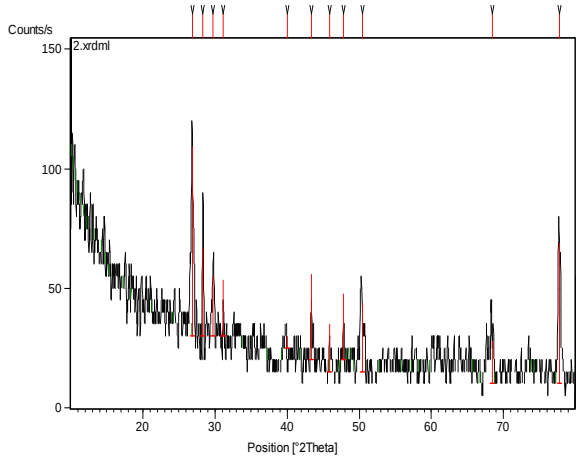
Electron image …… Spectrum 2



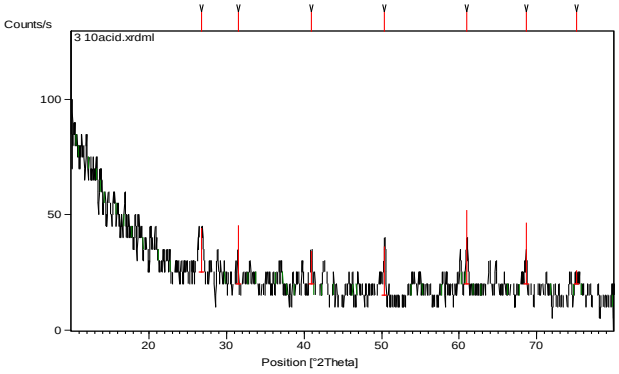
XRD Analysis



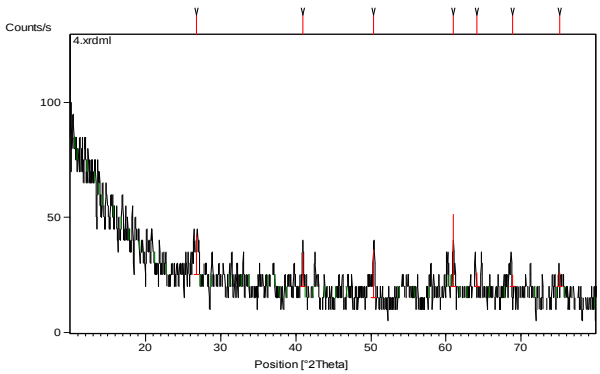
GPC with 10% GGBS



GPC with 20% GGBS



GPC with 10% GGBS in Acidic Condition



GPC with 20% GGBS in Acidic Condition

6. CONCLUSIONS

From this study the following conclusions were made

1. The compressive strength of the GPC was observed to be has higher incentive for 20% GGBS that 10% GGBS
2. The outcomes found that nano-silica diminished the thickness of geopolymer bond because of its low particular weight when contrasted with fly Ash, class G cement and silica fumes..
3. Development on nano-silica results in a generous addition in compressive strength. As exhibited in XRD examination that the extension of nano-SiO2 change the Portland cement (CH) to calcium silicate hydrate (C-S-H) and tobermorite at High Pressure and High Temperature condition.
4. The occurrence help with avoiding strength retrogression and gives low penetrability.
5. Moreover, it add to fills the void spaces between particles which result in uniform, less
6. Voids and boding. GPC has potential application in trading traditional OPC for construction work.

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