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Experimental Investigation on Hybrid Fibre by Using Silica Fume and Quartz Powder

S. Sudhamsu[1], T. Naresh Kumar[2], Dr. S.M.V Narayana[3]
[1]PG-student, branch of Civil Engineering, Annamacharya Institute of technology and Sciences, Rajampet
[2]Assistant Professor, department of Civil Engineering, Annamacharya Institute of technology and Sciences, Rajampet
[3]Principal and Professor, department of Civil Engineering, Annamacharya Institute of technology and Sciences, Rajampet

Abstract: Adding fibres to concrete greatly increases the toughness of the material. The use of fibres also alters the behaviour of the fibre matrix composite after it has cracked, thereby improving its toughness Secondary cementing materials like Reactive Powder can be used to partially replace cement because of pozzolanic nature. Materials like quartz powder best suites to sand due to its physical and chemical properties, fineness etc. Also these materials are known to increase durability, resistance to sulphate attack. Our main aim is study the materials Reactive powder, Quartz powder, Silica Fume are best suitable for preparing durability of concrete for M30 Grade. In cement replaced by silica fume and quartz powder with various percentages like 5%, 10%, 15% and 20%. And additional strength purpose using crimped steel fibres and poly propylene fires with various percentages like 0.5%, 1%, 1.5% and 2%. In this study mechanical properties like compressive strength, Split tensile strength and Durability properties like Acid attack test, Sulphate attack test, Alkalinity attack test, Rapid Chloride permeability test and Water permeability test and Young's modulus test can be accomplished. And the comparative study of normal concrete and fibres concrete.
Keywords: Compressive strength, Rcpt, Alkanity ,Acid Resistance, Permeability, Crimped Fibres, Poly Propylene Fibres, quartz Powder, Silica Fume.

I. INTRODUCTION

Concrete is a composite material composed of coarse aggregate bonded together with fluid cement that hardens over time. Most concretes used are lime-based concretes such as Portland cement concrete or concretes made with other hydraulic cement such as cement found. However, asphalt concrete which is frequently used for road surface, is also a type of concrete, where the cement material is bitumen, and polymer concretes are sometimes used where the cementing material is a polymer. When aggregate is mixed together with dry Portland cement and water, the mixture forms fluid slurry that is easily poured and moulded into shape. The cement reacts chemically with the water and other ingredients to form a hard matrix that binds the materials together into a durable stone-like material that has many uses. Often, additives (such as pozzolons or super plasticizer) are included in the mixture to improve the physical properties of the wet mix or the finished material. Most concrete is poured with reinforcing materials embedded to provide tensile strength; yielding reinforced concrete .Concrete is one of the most durable building materials. It provides superior fire resistance compared with wooden construction and gains strength over time. Structures made of concrete can have a long service life. Concrete is used more than any other manmade material in the world. As of 2006, about 7.5 billion cubic meters of concrete are made each year, more than one cubic meter for every person on Earth.

The first testing of silica fume in Portland cement based concretes was carried out in 1952. The biggest drawback to exploring the properties of silica fume was a lack of material with which to experiment. Early research used an expensive additive called Fumed Silica, An Amorphous form of Silica made by combustion of Silicon Tetrachloride in a Hydrogen-Oxygen Flame. Silica Fume on The other hand, is a very fine pozzolanic, amorphous material, a by-product of the production of elemental Silicon or ferrosilicon alloys in electric arc furnaces. Before the late 1960s In Europe and The Mid-1970s in The United States, Silica Fumes were simply vented into the atmosphere. Crimped steel fibre are low carbon, cold drawn steel wire fibers designed to provide concrete with temperature and shrinkage crack control, enhanced flexural reinforcement, improved shear strength and increase the crack resistance of concrete. PSI Crimped Steel Fiber complies with ASTM C1116, Standard Specification for Fiber Reinforced Concrete and Shotcrete and ASTM A820, Type I, and Standard Specification for Steel Fibers for Fiber Reinforced Concrete. These steel macro-fibers will also improve impact, shatter, and fatigue and abrasion resistance while increasing toughness of concrete. Dosage rates will vary depending upon the reinforcing requirements and can range from 25 to 100 lbs/yd^3 (15 to 60 kg/m^3).

Polypropylene Fiber Reinforced Concrete The capability of durable structure to resist weathering action, chemical attack, abrasion and other degradation processes during its service life with the minimal maintenance is equally important as the capacity of a structure to resist the loads applied on it. Although concrete offers many advantages regarding mechanical characteristics and economic aspects of the construction, the brittle behaviour of the material remains a larger handicap for the seismic and other applications where flexible behaviour is essentially required. Recently, however the development of polypropylene fiber-reinforced concrete (PFRC) has provided a technical basis for improving these deficiencies. This paper presents an overview of the effect of polypropylene (PP) fibers on various properties of concrete in fresh and hardened state such as compressive strength, tensile strength, flexural strength, workability, bond strength, fracture properties, creep strain, impact and chloride penetration. The role of fibers in crack prevention has also been discussed. Quartz, most common of all minerals is composed of silicon dioxide, or silica, SiO2. It is an essential component of igneous and metamorphic rocks. The size varies from specimens weighing a metric ton to minute particles that sparkle in rock surfaces. The luster in some specimens is vitreous; in others it is greasy or glossy.Some specimens are transparent; others are translucent. In pure form, quartz is colourless, but it is commonly coloured by impurities. Rock crystal is a colourless form of quartz occurring in distinct crystals. Rose quartz is coarsely crystalline and coloured rose red or pink. Smoky quartz occurs in crystals ranging from smoky yellow to dark brown. Amethyst, a semiprecious variety of quartz, is purple or violet.

II. LITERATURE REVIEW

A. p. c , laplante (1985)

From the results obtained on the seven field concretes under study, it is evident that silica-fume concrete exposed for 4-6 years to severe environmental conditions behaved as satisfactorily as the corresponding concrete without silicafume. No strength losses were noticed as in the case of a very high-strength concrete (85.4 MPa at 28 days) cast 4 years ago. It appears, however, that silica-fume concrete seems to suffer somewhat more from field placing and curing conditions than no silica-fume concretes. It is interesting to note that, after 4 - 6 years of field exposure, these field concretes exhibit very low chloride-ion permeability, almost in the range of latex-modified concrete, or polymer-impregnated concrete. All seven concretes will be cored every 3 years as part of the long-term performance research program of silica-fume concrete.

B. WI dodo Kushartomoa(2012)

After the experiments were carried out and comparing of RPC with glass powder of 10%, 20% and 30%, conclusion can be made as follows. The maximum of average of compressive strength value that can be achieved in this study is 136 MPa for the RPC with glass powder of 20%. The RPC with glass powder of 20% indicates also the maximum of average of split tensile strength value of 17.8 MPa and the average of flexural strength value of 23.2 MPa. The use of glass powder of 20% of the mass of cement in this study is quite good to substitute the quartz powder in the RPC in order to improve its mechanical behavior.

C. M. Pankaj (2013)

The following main conclusions can be drawn from the laboratory investigations.

Analyzing the results of the hybrid mixes in the fresh state, considering the summary amount of the fibers, it can be concluded that for the fibers volume ratio higher that 1.4% the mixes did not satisfy the passing ability requirement for the SCC. The mixes containing 0.9% of 38mm PP fibers should be analyzed as conventional concrete; A slight influence of hybrid fibers on compressive strength of the SCC matrix was noted. A significant and proportional to Of increase of flexural tensile strength and toughness with the increase of steel fibers volume ratio was observed. The flexural behaviour of the SCC matrix reinforced with only polypropylene fibers was less predictable.

D. Abdul Hussain, S. T. (2013)

The production of RPC in Gaza strip using materials available at the local markets are carried out compressive strength of 165.40 MPa at the age of 28 days at normal water curing temperature 25 ^{o} C is achieved. Also compressive strength of 191.15 MPa at the age of 28 days at curing at 90 ^{o} C for 3 days is obtained. RPC is suitable for precasting concrete and can achieve compressive strength value exceeding 191.15 MPa at heat curing. Such concretes can be produced with cement, W/C of 0.28, steel fibers 3% (by total volume) , quartz sand, crushed quartz powder, and silica fume 30% (by the weight of cement) as the mineral admixture 2.0% super plasticizer (by the weight of cement). Increasing silica fume content from 25% to 30% and then to 35% leads to a decrease in the slump flow values of the RPC.

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2) Increasing the steel fibers content will slightly decrease the slump flow values of the RPC. For example at silica fume content 30 % the slump flow decrease about 2.45%,4.11% and 5.53% at 1.0%, 2.0% and 3.0% steel fiber by total volume on the RPC.
3) Increasing silica fume content from 25% to 30% leads to a slight increase in the V funnel time, which results in decreasing the RPC viscosity, but concrete still being classified as self-compacted concrete?
4) Increasing silica fume percent to 35% leads to an increase in the V-funnel time which results in decreasing the RPC viscosity, and concrete cannot be classified as self compacted concrete any more.

E. W. Kushartomo (2014)

After the experiments were carried out and comparing of RPC with glass powder of 10%, 20% and 30%, conclusion can be made as follows. The maximum of average of compressive strength value that can be achieved in this study is 136 MPa for the RPC with glass powder of 20%. The RPC with glass powder of 20% indicates also the maximum of average of split tensile strength value of 17.8 MPa and the average of flexural strength value of 23.2 MPa. The use of glass powder of 20% of the mass of cement in this study is quite good to substitute the quartz powder in the RPC in order to improve its mechanical behavior.

III. MATERIALS

A. Cement

Cement is a binder material, which is used to binds the other material together. Ordinary Portland Cement of 53 grade manufactured by Zuari company confirming ISO 5001:2011 is used. The main benefit is the faster rate of development of strength. The specific gravity of cement is 3.00 and fineness modulus is 225kg/m^3.

B. Aggregates

After cement, the aggregate is the basic material used in any concrete to comprise the body of concrete for increasing the strength to the material quantity, and to minimize the consequential volume change of concrete. The fine and coarse aggregates generally occupy 60% to 75% of concrete volume and strongly influence the concrete freshly mixed and hardened properties, mixture proportions and economy.

C. Coarse aggregates

In this research investigation crushed grained aggregate of 20mm size was used. The specific gravity of coarse aggregate is 2.72.

D. Fine aggregates

The quantity of the fine aggregate important is main to fill the voids present in coarse aggregate. In this research natural sand was used as fine aggregate. The specific gravity of sand is found to be 2.7

E. Silica fume:

Known as micro silica, (CAS number 69012-64-2, and EINECS number 273-761-1) is an amorphous (non-crystalline) polymorph of silicon dioxide, silica. It is an ultrafine powder collected as a by-product of the silicon and ferrosilicon alloy production and consists of spherical particles with an average particle diameter of 150 nm. The main field of application is as pozzolanic material for high performance concrete. Silica fume is an ultrafine material with spherical particles less than 1µm in diameter, the average being about 0.15 µm. This makes it approximately 100 times smaller than the average cement particle. The bulk density of silica fume depends on the degree of densification in the silo and varies from 130 (unidentified) to 600 kg/m^3. The specific gravity of silica fume is generally in the range of 2.2 to 2.3. The specific surface area of silica fume can be measured with the BETmethod or nitrogen adsorption method. It typically ranges from 15,000 to 30,000 m^2/kg.

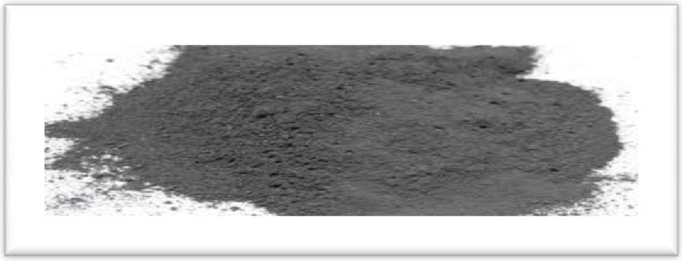

Fig 1: silica fume

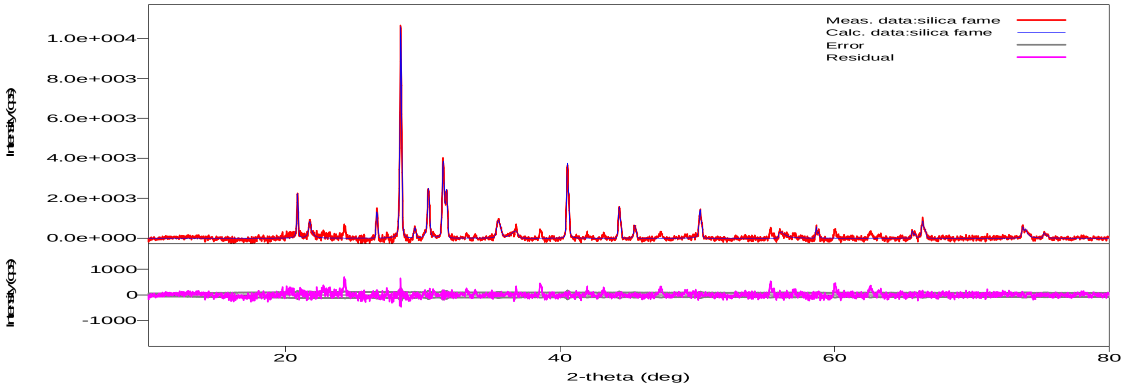

Fig 2 –XRD results for Silica Fume

F. Quartz powder

Quartz, most common of all minerals is composed of silicon dioxide, or silica, $SiO2$. It is an essential component of igneous and metamorphic rocks. The size varies from specimens weighing a metric ton to minute particles that sparkle in rock surfaces. The luster in some specimens is vitreous; in others it is greasy or glossy. Some specimens are transparent; others are translucent. In pure form, quartz is colourless, but it is commonly coloured by impurities. Rock crystal is a colourless form of quartz occurring in distinct crystals. Rose quartz is coarsely crystalline and coloured rose red or pink. Smoky quartz occurs in crystals ranging from smoky yellow to dark brown. Amethyst, a semiprecious variety of quartz, is purple or violet.

Fig 3: Quartz Powder

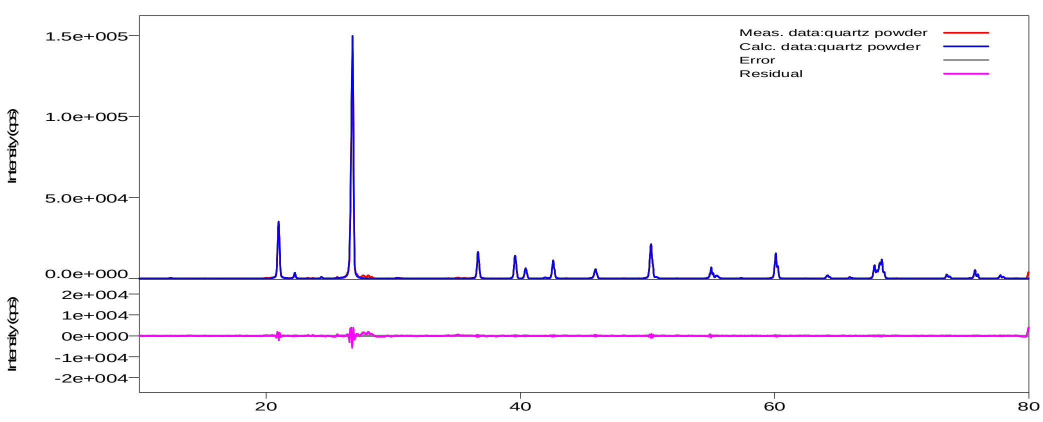

Fig 4 –XRD results for Quartz powder

G. Polypropylene Fibers

The raw material of polypropylene is derived from monomer C_3H_6 which is purely hydrocarbon. Its mode of polymerization, its high molecular weight and the way it is processed into fibers combine to give polypropylene fibbers. The fibers are manufactured either by the pulling wire procedure with circular cross section or by extruding the plastic film with rectangular cross-section. They appear either as fibrillated bundles, mono filament or microfilaments. The properties of these three types of PP fibers are given the fibrillated polypropylene fibers are formed by expansion of a plastic film, which is separated into strips and then slit. The fiber bundles are cut into specified lengths and fibrillated. In monofilament fibers, the addition of buttons at the ends of the fiber increases the pull out load. Further, the maximum load and stress transfer could also be achieved by twisting fibers.

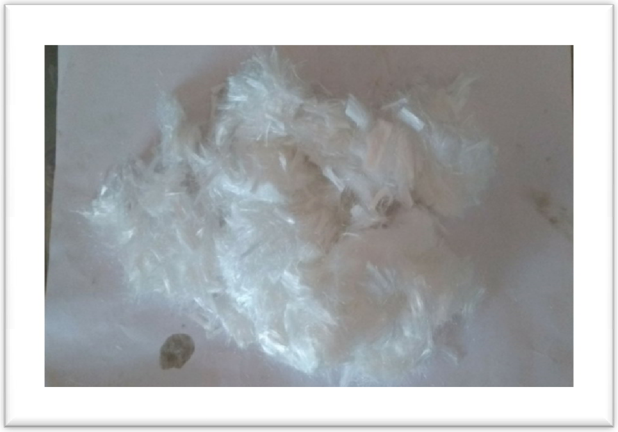

Fig 5 : Poly Propylene Fibers

H. Crimped steel fibbers

It is low carbon, cold drawn steel wire fibers designed to provide concrete with temperature and shrinkage crack control, enhanced flexural reinforcement, improved shear strength and increase the crack resistance of concrete. PSI Crimped Steel Fiber complies with ASTM C1116, Standard Specification for Fiber Reinforced Concrete and Shortcrete and ASTM A820, Type I, Standard Specification for Steel Fibers for Fiber Reinforced Concrete. These steel macro-fibers will also improve impact, shatter, fatigue and abrasion resistance while increasing toughness of concrete. Dosage rates will vary depending upon the reinforcing requirements and can range from 25 to 100 lbs/yd^3 (15 to 60 kg/m^3).

Fig 6 : Crimped steel Fibers

IV. EXPERIMENTAL PROCEDURE

A. Mix proportions

In this research M_{30} grade concrete is used with a constant W/C ratio of 0.5. Concrete mixes were placed by various the percentage of replacement of cement with silica fume and quartz powder with the addition of crimped steel fibers and polypropylene fibers 0.5% , 1% , 1.5%, 2%.

B. Casting specimen

IS standard size of cube 150mm × 150mm × 150mm size cubes, standard size of cylinders 300mm × 150mm dimensions were casted. The compressive, split tensile tests for casting for 7days, 14days, and 28days. Concrete was prepared using drum mixer with capacity of 0.25m^3. Dry mixing of the aggregates and cement was done for two minutes and then water was added gradually in the rotating mixer and allowed to mix for 15 minutes.

At last the fresh concrete was located in oiled moulds and compacted accurately in three layers, each layer individual tamped 35 times using a tamping rod. After the initial setting of concrete, the surface of the specimen was finished smooth.

C. Mix proportion for Normal concrete

The present study was carried out as per IS 10262-2009 for M_{30} grade concrete**.** The mix proportion of normal concrete is given below

Table no 1: Mix Proportions

Mix	Cement (kg/m^3)	Fine aggregate (kg/m^3)	Coarse aggregate (kg/m^3)	Water
M30	391.1	677.89	1189.2	176
M30	1	1.73	3.04	0.45

Mix Proportion	Proportions of Supplementary materials
A1	100% cement
A2	5%silica fume, quartz powder and 0.5% crimped steel fiber ,polypropylene fiber
A3	10%silica fume, quartz powder and 1% crimped steel fiber ,polypropylene fiber
A4	15%silica fume, quartz powder and 1.5% crimped steel fiber ,polypropylene fiber
A5	20%silica fume, quartz powder and 2% crimped steel fiber ,polypropylene fiber

V. EXPERIMENTAL RESULTS

A. Compressive Strength

The Compressive strength of M_{30} grade of concrete by replaces in ordinary Portland cement with Natural silica fume and quartz powder like 5%,10%,15%,20.andby Adding the percentages of Crimped steel fibers and polypropylene fibers like 0.5%,1%,1.5%,2% The results of compressive strength of A1, A2, A3,A4, and A5 concrete mixtures tested at 7days, 14days, 28days and 60days and 90 days the data are presented in the given below table and graphical presentation compressive strength

Tale no 2 compressive strength test results

Mix Proportions	Compressive strength N/mm^2				
	7-Days	14-Days	28-Days	56 days	90 –Days
A1	22.76	28.53	30.92	32.56	34.76
A2	27.76	30.68	32.51	35.65	39.47
A3	29.63	31.52	34.76	38.15	42.76
A4	31.73	34.15	37.65	40.79	46.73
A5	26.85	29.69	30.78	33.94	37.35

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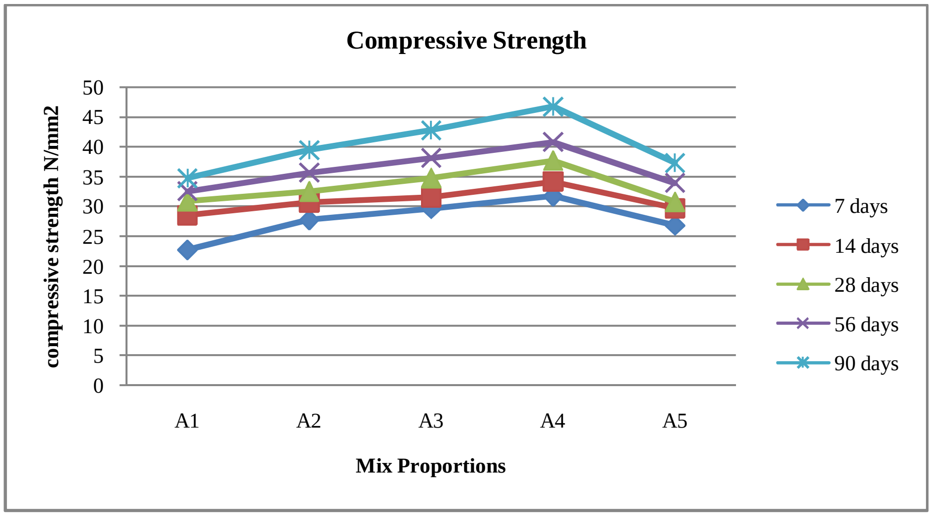

Fig no 7 compressive strength

In this compressive strength at 28 days strength 0.5%steel+5% silica fume and quartz powder is using 5.14% increase and 1%steel+10% silica fume and quartz using 12.41% increase and 1.5% steel+15% silica fume and quartz using 21.76% increase and 2% steel +20 silica and quartz using 10% increase when compared to conventional concrete the max strength at 1.5% steel+15%silicafume and quartz 21.76% increase compare to conventional concrete..the 56 days 25.27%and 90 days 34.43% increase when compare to the conventional concrete

B. Split Tensile Strength:

The Split Tensile strength of M_{30} grade of concrete by replaces in ordinary Portland cement with Natural silica fume and quartz powder like 5%,10%,15%,20.andby Adding the percentages of Crimped steel fibers and polypropylene fibers like 0.5%,1%,1.5%,2% The results of Split Tensile strength of A1, A2, A3,A4, and A5 concrete mixtures tested at 7days, 14days, 28days and 60days and 90 days the data are presented in the given below table and graphical presentation Split Tensile Strength.

Table no 3: Split tensile Strength Test Results

Mix Proportions	Split Tensile strength N/mm^2				
	7-Days	14-Days	28-Days	56 days	90 –Days
A1	2.1	2.78	3.10	3.29	3.30
A2	2.65	2.98	3.35	3.40	3.68
A3	2.74	3.25	3.53	3.72	3.97
A4	3.20	3.45	3.68	4.1	4.43
A5	2.59	2.89	3.01	3.21	3.5

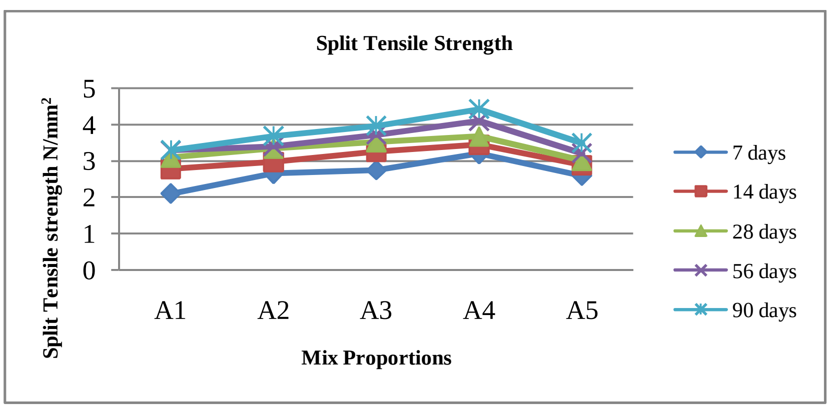

Fig no 8: Split Tensile strength

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In this split tensile strength at 28 days strength 0.5%steel+5% silica fume and quartz powder is using 8.06% increase and 1%steel+10% silica fume and quartz using 13.87% increase and 1.5% steel+15% silica fume and quartz using 18.70% increase and 2% steel +20 silica and quartz using 10% increase when compared to conventional concrete the max strength at 1.5% steel+15%silicafume and quartz 18.70% increase compare to conventional concrete..the 56 days 24.6%and 90 days 34.24% increase when compare to the conventional concrete

C. Young's Modulus

The Young's Modulus test of M_{30} grade of concrete by replaces in ordinary Portland cement with Natural silica fume and quartz powder,5% 10%,15%,20% and crimped steel fiber and polypropylene fiber 0.5%,1%,1.5%,2%. The results of Young's Modulus at 28 days and 60 days are presented.

Table no 4: Young's Modulus Test results

Mix Proportions	Young's Modulus at 28 days (MPa)	Young's Modulus at 60 days (MPa)
A1	20347.2	24416.54
A2	15972.16	18367.9
A3	22314.7	25661.9
A4	29166.6	33541.59
A5	24999.7	29999.6

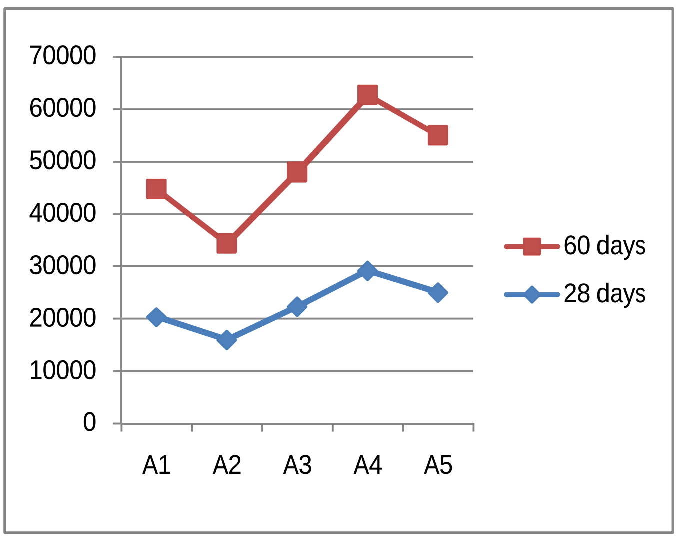

Fig no 9: Young's Modulus Results

In this young's modulus strength at 28 days strength 0.5%steel+5% silica fume and quartz powder is using 21.50%decrease and 1%steel+10% silica fume and quartz using 9.66% increase and 1.5% steel+15% silica fume and quartz using 43.34% increase and 2% steel +20 silica and quartz using 22.86% increase when compare to conventional concrete the max strength at 1.5% steel+15%silicafume and quartz 43.34% increase compare to conventional concrete..the 60 days 37.37% increase when compare to the conventional concrete

D. Acid Attack Test

The Acid Attack test of M_{30} grade of concrete by replaces in ordinary Portland cement with Natural silica fume and quartz powder like 5%,10%,15%,20.andby Adding the percentages of Crimped steel fibers and polypropylene fibers like 0.5%,1%,1.5%,2% The results of compressive strength of A1, A2, A3,A4, and A5 concrete mixtures tested at 60days and 90 days the data are presented in the given below table and graphical presentation for Acid Attack Test

Table no 5: Acid Attack Test Results

Mix proportions	Compressive strength (N/mm^2)	
	56 DAYS	90 DAYS
A1	26.73	21.87
A2	30.15	23.73
A3	32.40	26.42
A4	35.95	29.86
A5	29.15	22.67

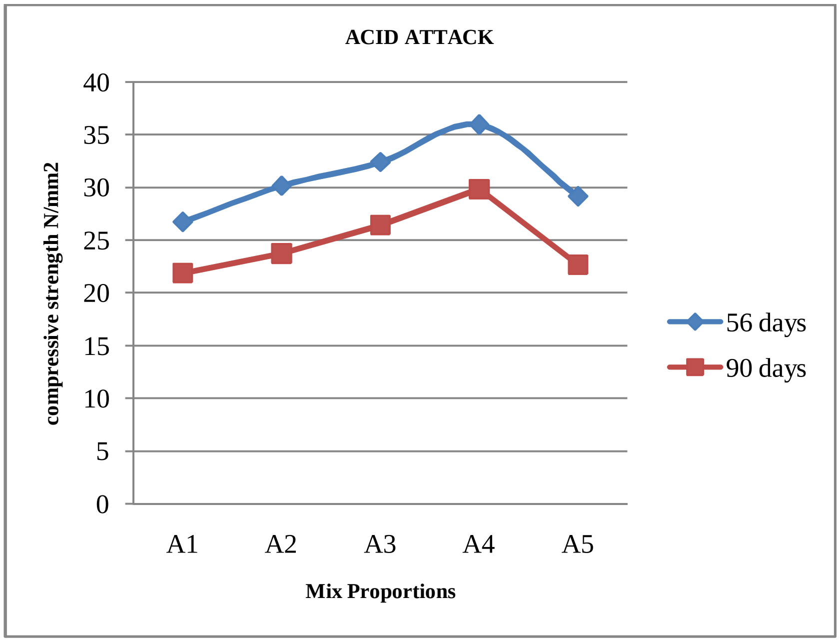

Fig no 10: Acid Attack Test

In this Acid Attack Test strength at 56 days strength 0.5%steel+5% silica fume and quartz powder is using 12.79%increase and 1%steel+10% silica fume and quartz using 21.21% increase and 1.5% steel+15% silica fume and quartz using 34.49% increase and 2% steel +20 silica and quartz using 10% increase when compare to conventional concrete the max strength at 1.5% steel+15%silicafume and quartz 34.49% increase compare to conventional concrete..the 90 days 36.53% increase when compare to the conventional concrete

E. Attack Test

The Sulphate Attack test of M_{30} grade of concrete by replaces in ordinary Portland cement with Natural silica fume and quartz powder like 5%,10%,15%,20.andby Adding the percentages of Crimped steel fibers and polypropylene fibers like 0.5%,1%,1.5%,2% The results of compressive strength of A1, A2, A3,A4, and A5 concrete mixtures tested at 60days and 90 days the data are presented in the given below table and graphical presentation for Sulphate Attack Test

Table no 6: Sulphate Attack Test Results

Mix Proportions	Compressive Strength N/mm^2	
	56 days	90 days
A1	29.35	23.78
A2	33.46	26.76
A3	35.63	28.27
A4	39.2	31.65
A5	31.19	25.80

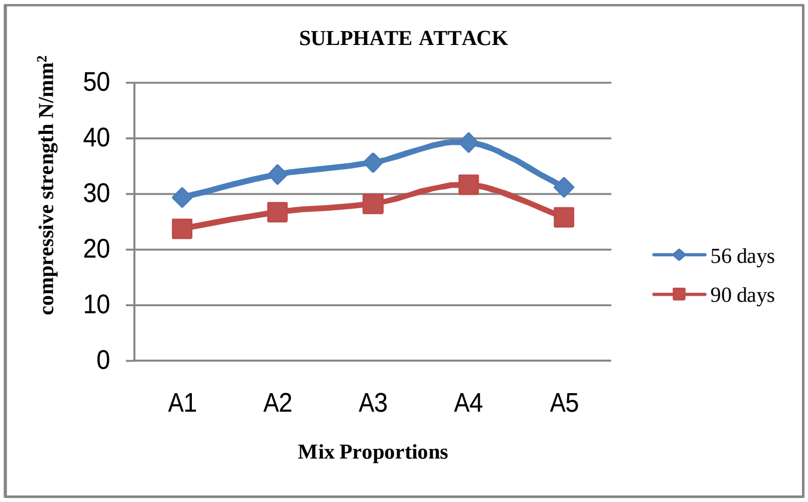

Fig no 11: Sulphate test results

In this Sulphate Attack Test strength at 56 days strength 0.5%steel+5% silica fume and quartz powder is using 14%increase and 1%steel+10% silica fume and quartz using 21.39% increase and 1.5% steel+15% silica fume and quartz using 33.5% increase and 2% steel +20 silica and quartz using 7% increase when compared to conventional concrete the max strength at 1.5% steel+15%silicafume and quartz 33.5% increase compare to conventional concrete..the 90 days 33.09% increase when compare to the conventional concrete

F. Alkalinity Attack Test

The Alkaline Attack test of M_{30} grade of concrete by replaces in ordinary Portland cement with Natural silica fume and quartz powder like 5%,10%,15%,20.andby Adding the percentages of Crimped steel fibers and polypropylene fibers like 0.5%,1%,1.5%,2% The results of compressive strength of A1, A2, A3,A4, and A5 concrete mixtures tested at 60days and 90 days the data are presented in the given below table and graphical presentation for Alkaline Attack Test

Table no 7: Alkalinity Attack Test

Mix Proportions	Compressive Strength N/mm^2	
	56 days	90 days
A1	25.54	20.65
A2	28.70	23.40
A3	32.55	26.52
A4	37.15	31.21
A5	25.46	21.21

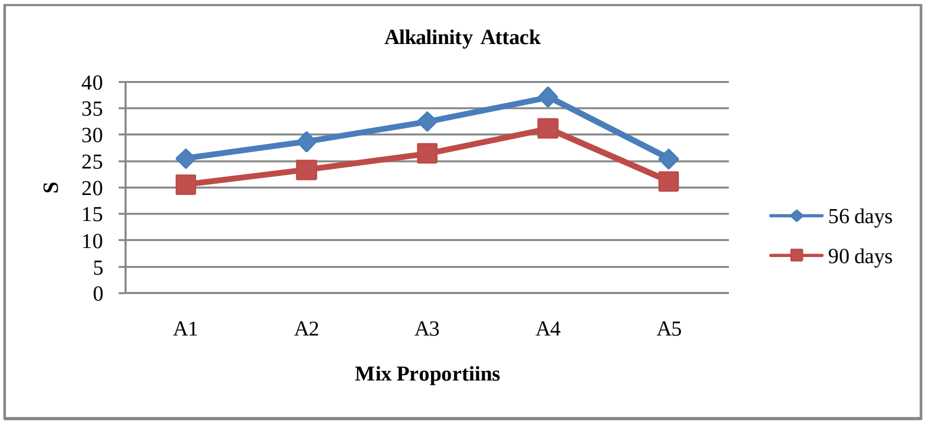

Fig no 12: Alkalinity Test Result

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In this Alkalinity Attack Test strength at 56 days strength 0.5%steel+5% silica fume and quartz powder is using 12.37%increase and 1%steel+10% silica fume and quartz using 27.44% increase and 1.5% steel+15% silica fume and quartz using 45.45% increase and 2% steel +20 silica and quartz using 10% increase when compare to conventional concrete the max strength at 1.5% steel+15%silicafume and quartz 45.45% increase compare to conventional concrete..the 90 days 51.13% increase when compare to the conventional concrete.

G. Rapid Chloride Permeability Test

The Rapid Chloride Permeability test was used for determining the chloride penetration resistance ion of the concrete is prescribed by ASTM C1202. The test results of chloride ion permeability were given below.

Table no 8: RCPT Results

Mix Proportions	RCPT for 28 days (coulombs)	RCPT for 60 days (coulombs)
A1	624.6	332.1
A2	1348.2	617.4
A3	1443.6	863.1
A4	1699.2	1073.7
A5	1753.2	1283.4

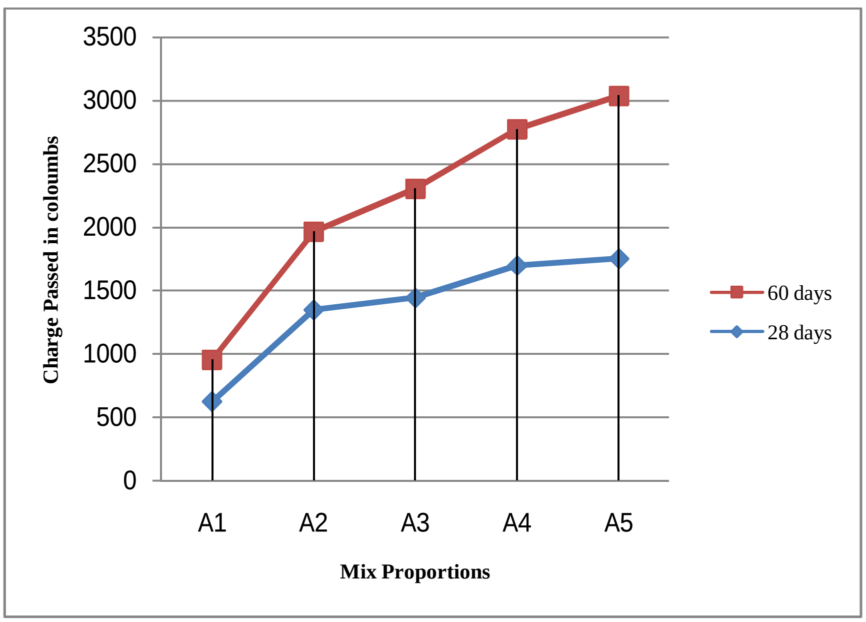

Fig no 13: RCPT Results

Replace cement in this 1699.2 coulombs are passed in this percentage get the more(1074.06 coulombs) permeability value compare to the normal concrete and remain percentage as well as in 60 days also get the more(740 coulombs) permeability value than normal concrete and remaining percentage.

Alkaline Attack test of M_{30} grade of concrete by replaces in ordinary Portland cement with Natural silica fume and quartz powder like 5%,10%,15%,20.andby Adding the percentages of Crimped steel fibers and polypropylene fibers like 0.5%,1%,1.5%,2% The results of compressive strength of A1, A2, A3,A4, and A5 concrete mixtures tested at28 days and 60 days the data are presented in the graphical presentation of Water Permeability.

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Table 9: Water Permeability Test Results

Mix Proportion	Depth of penetration (in cm)		Coefficient of permeability (K in m/sec)	
	28 days	60 days	28 days	60 days
A1	0.35	0.30	1.57 x 10^{-13}	1.35 x 10^{-13}
A2	5.84	4.56	2.63 x 10^{-10}	2.05 x 10-^{10}
A3	5.67	4.30	2.55 x10^{-10}	1.94 x 10^{-10}
A4	4.32	3.95	1.94 x10^{-10}	1.77 x 10^{-10}
A5	6.30	5.61	2.8 x 10^{-13}	2.4 x 10^{-10}

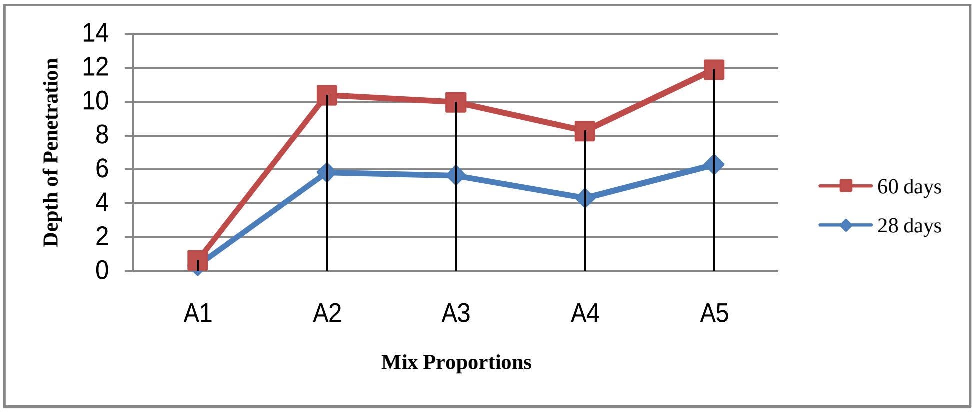

Fig no 14: Water Permeability Results

The water permeability of concrete is less for conventional normal curing when compared with other replacement The concrete with using 1.5% fibers is less when compared remains percentages in 28days and 60 days. The results of Water Penetration of self curing concrete mixtures tested at 60 days the data are presented in above table and graphical presentation of Water Penetration

VI. CONCLUSION

A. Crimped Steel Fibers are used low carbon cold drawn steel wire fibers designed to provide concrete with temperature and shrinkage crack control, improved shear strength crack resistance of the concrete.

B. Poly propylene fibers capability of durable structures to resist weathering action, chemical attack, abrasion and other degradation. The roll of fibers in crack prevention.

C. Quartz was most common of all minerals is composed of silica dioxide it is an essential of igneous and metamorphic rock.

D. Silica fume is made by combustion of silicon tetra chloride in a hydrogen oxygen flame. It is a very fine pozzolanic amorphous material.

E. In this investigation for M30 grade of concrete it can be calculated that the cement can be replaced up to 5%, 10%, 15% and 20% of silica fume and quartz powder and crimped and poly propylene fibers are using additional strength purpose up to 0.5%, 1%, 1.5% and 2%.

F. Compressive strength of concrete having more strength on 1.5% fibers+ 15% silica fume and quartz powder 27.25% increase in 56 days and 34.43% increase at 90 days when compared normal concrete .

G. Split tensile strength of concrete having more strength on 1.5% fibers+ 15% silica fume and quartz powder 24.6% increase at 56 days and 34.24% increase at 90 days when compared normal concrete.

H. Acid attack test is having more strength on 1.5% fibers+ 15% silica fume and quartz powder 34.49% increase at 56 days and 36.53% increase at 90 days when compared normal concrete. In this investigation 56 days compressive strength is more than the 90 days strength.

I. Alkalinity test is having more strength on 1.5% fibers+ 15% silica fume and quartz powder 45.45% increase at 56 days and 51.13% increase at 90 days when compared normal concrete. In this investigation 56 days compressive strength is more than the 90 days strength.

J. Sulphate attack test is having more strength on 1.5% fibers+ 15% silica fume and quartz powder 33.5% increase at 56 days and 33.09% increase at 90 days when compared normal concrete . In this investigation 56 days compressive strength is more than the 90 days strength.

K. Modulus of elasticity of concrete according to stress-strain curve 28 days of strength increase 1.5% fibers+ 15% silica fume and quartz powder 43.34% increase at 28 days and 37.37% increase at 60 days when compared normal concrete .

L. Durability of concrete as Rapid Chloride Permeability Test at 28 days chloride penetration is more than 56 days.

M. The water permeability of concrete with 1.5% fibers +15% silica fume and quartz powder 28 days is more than 56 days.

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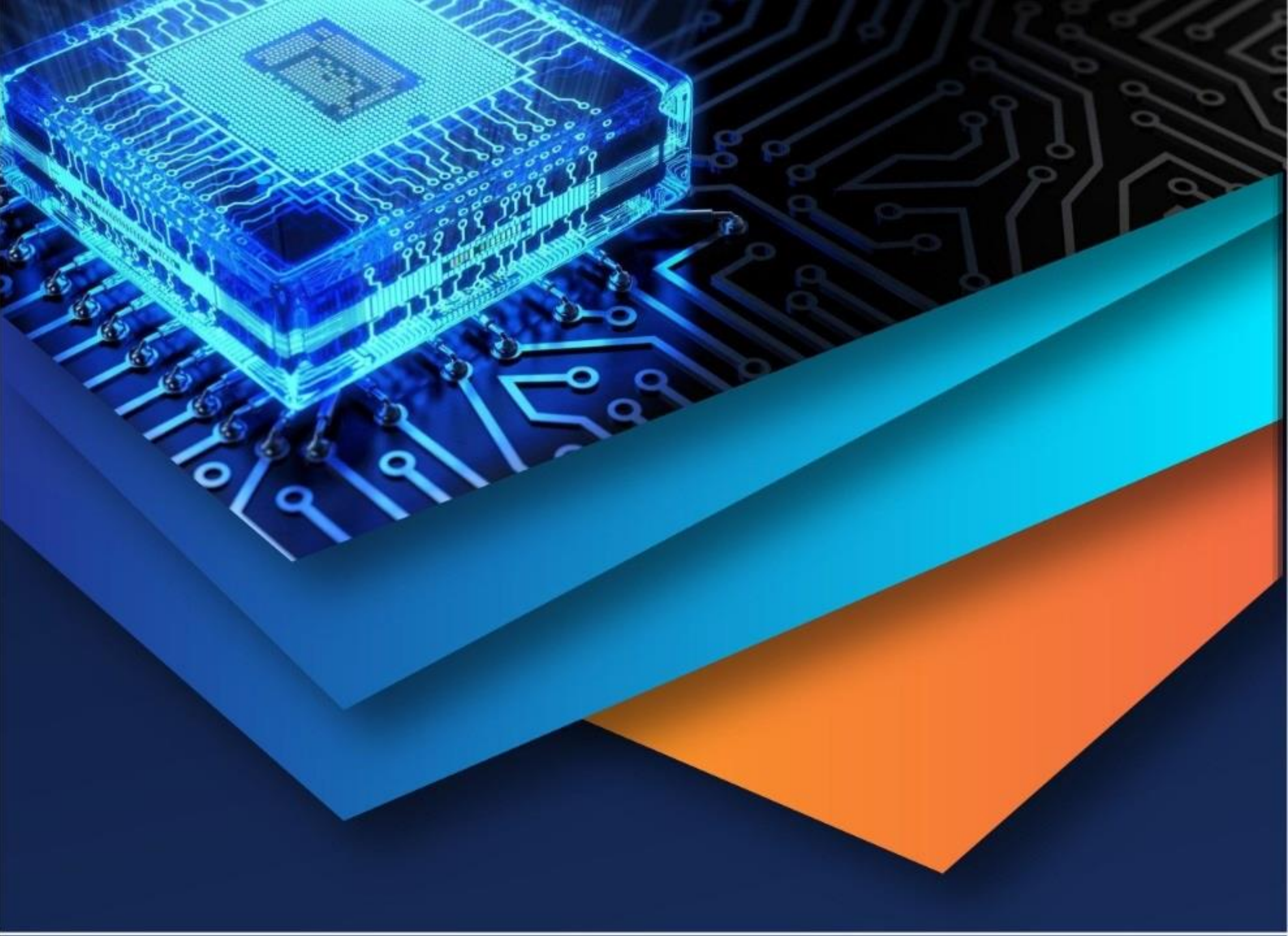

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