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Strengthening of AR Glass Fibre Concrete by Using Dunite Powder

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Abstract: ***In the contemporary era. Concrete, the most significant and frequently used material, frequently needs to have a very high strength and acceptable workability. Research on glass fibre reinforced concrete led to the development of alkali resistant fibres with a high capacity for dispersion, increasing long-term durability. When dunite is utilised as a cement alternative rather of regular cement, concrete is discovered to become up to 40% stronger. Studies based on periodic cement rate data show that, on average, dunite powder is less expensive than cement. Future cement usage will be dominated by the replacement of dunite powder. In the current experimental investigation, alkali resistant glass fibres have been employed to investigate the effect on compressive and split tensile strength on M30 grade of concrete can be determined for 28,56 and 90 days.***
Keywords: Alkaline glass fiber, durability, Dunite powder, compressive strength, split tensile.

I. INTRODUCTION

Concrete is the material utilised the most after water, and more than six billion tonnes of cement are produced annually. Numerous applications, such as new inventions, corrections, recoveries, and retrofitting, specifically require concrete. Examples of solid structure components that exist in a range of sizes and shapes are divider boards, doorsills, bar, columns and that's just the tip of the iceberg. The use of post-tensioned chunks is advised for the building of mechanical, commercial, and residential floor pieces.

Because each type of cement use has different needs and characteristics, it is desirable to group cement uses according to where, how, and where it is produced. The need for concrete has grown to be second only to the need for water due to technological advancements and an expanded range of applications for cement and mortars. As a result, several characteristics of typical cement had to be altered to make it more flexible, shrewd, and environmentally friendly. As a result, cementation materials are used.

Concrete that has been reinforced with A.R. glass fibre and other chemical admixtures is known as glass fibre reinforced concrete (GFRC), a new composite material that improves the performance of concrete. Discrete fibres act as crack aresters and strengthen the concrete's ability to withstand cracking.

Dunite is an igneous rock belonging to the peridotite group with an ultramafic composition and a coarse-grained or phaneritic texture. 90% of the dunite is olivine, and the other 10% mostly consists of minute amounts of pyrope, magnetite, chromite, and pyroxene.

II. OBJECTIVES

This study's goals are to:

1) Evaluate the use of dunite powder in concrete; and
2) To enhance the concrete compressive and split tensile strengths.

III. MATERIALS

A. Cement

Cement, a chemical used as a binding agent in construction, holds the other building materials together. Coarse aggregate is the primary ingredient of concrete, whereas fine aggregate is used to fill in any gaps that the coarse aggregates leave behind. Concrete is made of just cement mixed with coarse aggregate, whereas mortar is made of just plain cement mixed with fine aggregate and water.

B. Aggregates

Since aggregates make up roughly 80% of the volume of concrete, their properties greatly affect how the substance functions.

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C. Alkali Resistant Glass Fiber

Alkali resistant (AR) glass fibre is glass that has been coated with zirconium oxide to help it survive attack from alkalinity. This is a vital element of these fibres given the alkaline environment of concrete. Regular fibreglass (E-glass) deteriorates in concrete's alkaline aggregate environment. In the concrete industry, AR fibre has been widely used since the 1970s.

D. Dunite Powder

A plutonic rock called dunite (Magnesium Iron Silicate) is composed of a variety of fundamental minerals that routinely go through more or less intricate geological processes to transform them into secondary minerals. The main mineral in dunite, which is classified chemically as a basic rock, is olivine.

IV. EXPERIMENTAL INVESTIGATIONS

A. Compressive Strength Results

The compressive strength conducted in compression testing machine for the cast and cured specimens and the results are furnished in table 1 to 3.

Table 1: Compressive strength of concrete with dunite powder as partial replacement of cement

S.No.	% Dunite powder	Compressive strength of concrete, N/mm^2		
		28 days	56 days	90 Days
1	0	39.11	42.56	45.71
2	10	39.81	43.39	46.57
3	20	40.19	43.75	47.32
4	30	41.66	45.32	48.74
5	40	42.09	45.87	49.25
6	50	40.44	44.05	47.27

Table 2: Compressive strength of concrete with AR glass fibers

S.No.	Percentage of AR glass fibers	Compressive strength of concrete, N/mm^2		
		28 days	56 Days	90 Days
1	0%	39.11	42.59	45.72
2	0.03%	46.19	50.35	53.98

Table 3: Compressive strength of concrete with dunite powder and AR glass fibers

S.No.	Percentage of AR glass fibers	Compressive strength of concrete, N/mm^2		
		28 days	56 Days	90 Days
1	0%	39.11	42.59	45.92
2	40%DP+0.03%ARGF	47.68	51.96	55.78

B. Split Tensile Strength Results

The split tensile strength conducted in compression testing machine for the cast and cured specimens and the results are furnished in table 4 to 6.

Table 4: Split tensile strength of concrete with dunite powder as partial replacement of cement

S.No.	% Dunite powder	Split tensile strength of concrete, N/mm^2		
		28 days	56 Days	90 Days
1	0	3.81	4.17	4.42
2	10	3.86	4.25	4.59
3	20	3.97	4.31	4.62
4	30	4.12	4.49	4.81
5	40	4.23	4.62	4.95
6	50	3.98	4.33	4.65

Table 5: Split tensile strength of concrete with AR glass fibers

S.No.	Percentage of AR glass fibers	Split tensile strength of concrete, N/mm^2		
		28 days	56 Days	90 Days
1	0%	3.81	4.14	4.46
2	0.03%	4.55	4.98	5.34

Table 6: Split tensile strength of concrete with dunite powder and AR glass fibers

S.No.	Percentage of AR glass fibers	Split tensile strength of concrete, N/mm^2		
		28 days	56 Days	90 Days
1	0%	3.81	4.16	4.47
2	40%DP+0.03%ARGF	4.75	5.17	5.59

V. CONCLUSION

1) At 40% DP, the compressive strength of concrete is 42.09 N/mm^2 ,45.87 N/mm^2 and 49.25 N/mm^2 for 28 days, 56 days and 90 days.

2) For 0.03% AR glass fibers the compressive strength is 46.19 N/mm^2 ,50.35 N/mm^2 and 53.98 N/mm^2 28 days,56 days and 90 days.

3) With 0.03% AR glass fiber + 40% DP the maximum compressive strength is 47.68 N/mm^2 ,51.96 N/mm^2 and 55.78 N/mm^2 for 28 days, 56 days and 90 days.

4) At 40% DP, the split tensile strength of concrete is 4.23N/mm^2 , 4.62 N/mm^2 and 4.95 N/mm^2 for 28 days,56 days and 90 days.

5) For 0.03% AR glass fibers the split tensile strength is 4.55 N/mm^2 ,4.98 N/mm^2 and 5.34 N/mm^2 for 28 days,56 days and 90 days.

6) With 0.03% AR glass fiber + 40% DP the maximum split tensile strength is 4.75 N/mm^2 ,5.17 N/mm^2 and 5.59 N/mm^2 for 28 days,56 days and 90 days.

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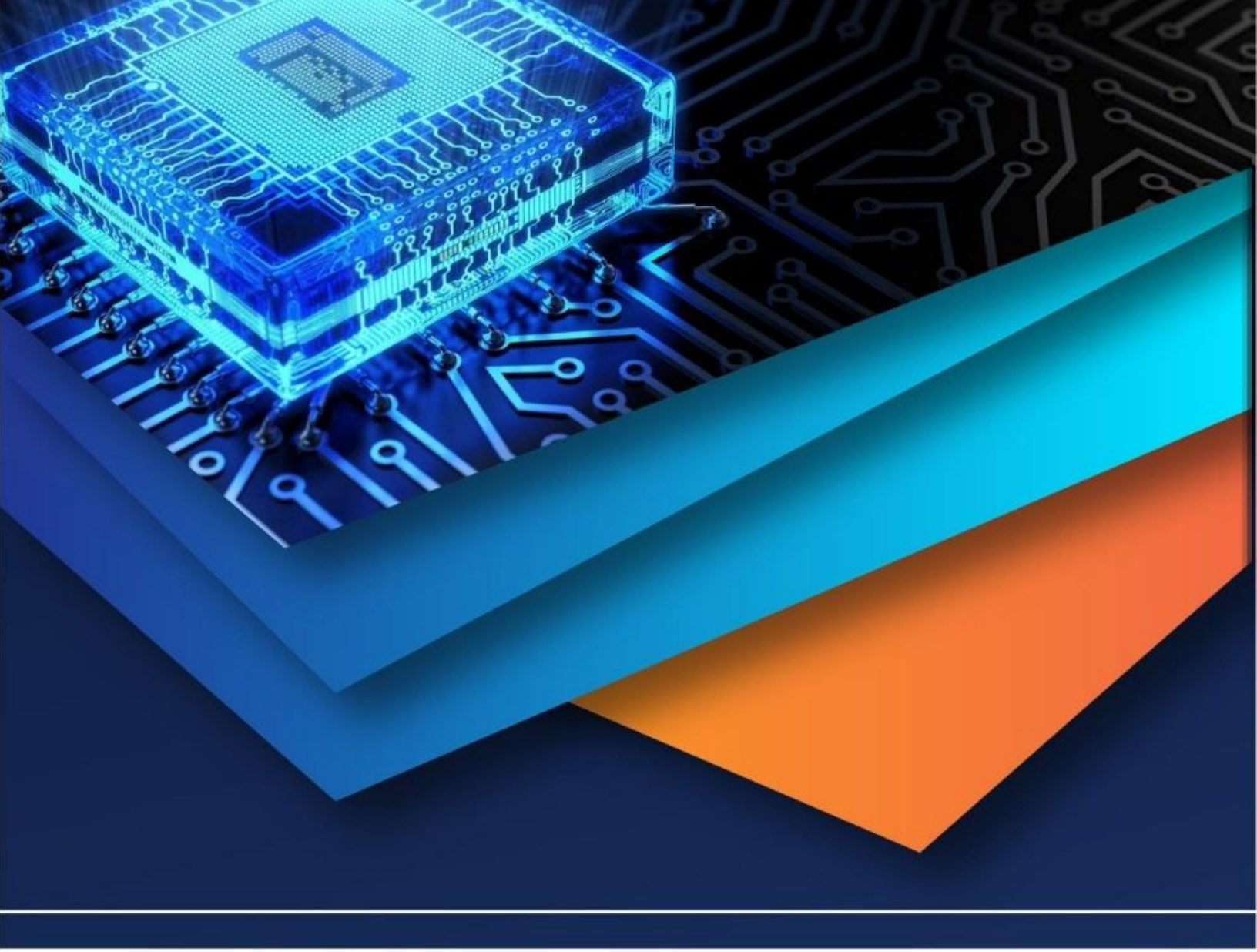
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