

EXPERIMENTAL INVESTIGATION ON NANO CONCRETE WITH NANO SILICA AND M-SAND

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Abstract - The influence of Nano-Silica on various properties of concrete is obtained by replacing the cement with various percentages of Nano-Silica. Nano-Silica is used as a partial replacement for cement in the range of 3%, 3.5%, and 10% for M20 mix. Specimens are casted using Nano-Silica concrete. Laboratory tests conducted to determine the compressive strength, split tensile and flexural strength of Nano-Silica concrete at the age of 7, 14 and 28 days. Results indicate that the concrete, by using Nano-Silica powder, was able to increase its compressive strength. However, the density is reduce compared to standard mix of concrete. The replacement of cement with 3% Nano-Silica results in higher strength and reduction in the permeability than the controlled concrete. The replacement of cement with Nano-Silica more than 3% results in the reduction of various properties of Nano-Silica concrete.

Key Words: Nano-Silica Powder, Strength, Self-Weight Reduce, Concrete, Plasticizers.

1. INTRODUCTION

Concrete is the most widely used construction material in the world with the advancement of Nano technology. Nanotechnology has been applying to concrete production and has the capacity of improving the performance of concrete. In recent years, researchers have focused on the modified of concrete quality. It has been show to increase the mechanical and durability properties of concrete leading to development of novel and sustainable materials. However, the application of nanotechnology in concrete technology should go along with the availability of local materials. One interesting material to study is Nano silica produced from silica sand. Previous research on concrete using Nano silica has point out that improved workability and strength of concrete or mortar are to be expected.

Nano materials have been developed that can be applied to concrete mix designs to study the physical and mechanical properties of concrete. Nanotechnology is one of the most active research areas, which have wide applications in almost all the fields.

The fundamental processes that govern the properties of concrete are affect by the performance of the material on a Nano scale. As concrete is most usable material in construction industry it has been required to improve its quality. Recently Nano Technology has been introducing in Civil Engineering applications. One of the most used Nano

material is Nano Silica (NS). The advancement made by the study of concrete at Nano scale has proved the Nano silica is much better than silica fume used in conventional concrete. Now, the researchers are capitalizing on nanotechnology to innovate a new generation of concrete materials that overcome the above drawbacks and trying to achieve the sustainable concrete structures. Evolution of materials is need of the day for improved or better performance for special engineering applications and modifying the bulk state of materials in terms of composition or microstructure or nanostructure has been the established route for synthesizing new materials. The newer materials can also be obtaining by intelligent and intermixing of existing materials at element level.

Without advancement of Nano technology, Nano materials have been developed that can be apply to concrete mix designs to study the physical, chemical and enhanced mechanical properties of concrete. Among the various developed or manufactured Nano materials such as Nano silica, Nano alumina, Nano titania, Nano zirconia, Nano Fe₂O₃ etc., carbon Nano tubes [CNT] or wires etc., the addition of Nano silica (NS) enhances the possibility for the reaction with calcium hydroxide (CH) to develop more strength carrying structure of cement: calcium silica hydrate (C-S-H) and also pore filling effect of Nano silica in the concrete. Hence, in this paper, a critical review on the influencing factors of Nano silica in concrete in detail and the research initiative towards the above task in the future have been provided. With characterization tools, the ability to gain a better understanding of the materials under study for their size, shape and morphology of crystalline or amorphous nature of those materials have been discuss.

1.1 NANOTECHNOLOGY

Nano Technology applied to concrete includes the use of nanomaterial's like Nano silica, Nano fibers etc. By adding the Nanomaterial's, concrete composites with superior properties can be produce. Addition of Nano silica (NS) in concretes and mortars results in more efficient hydration of cement. Due to the pozzolanic activity, additional calcium silicate hydrates are form to generate more strength and to reduce free calcium hydroxide. This also helps in reducing the cement requirement; NS improves the microstructure and reduces the water permeability of concrete thus making it more durable. Concretes with strengths as high as 100 MPa with high workability, anti-bleeding properties and short de-