WEB OF SCIENTIST: INTERNATIONAL SCIENTIFIC RESEARCH JOURNAL
ISSN: 2776-0979, Volume 4, Issue 4, April., 2023

OF NANOMATERIALS PLACE IN MODERN CONCRETE PRODUCTION

Mamatkulov Asilbek Kiryigitovich
Assistant of Jizzakh Polytechnic Institute

Kholmominova Dilrabo Akhmatkulovna
Assistant of Jizzakh Polytechnic Institute

Abstract:
The use of nanoparticle cements to improve their physico-mechanical properties, brand and other properties in obtaining concrete and reinforced concrete products is the basis for their wide use in construction and other industries. Materials obtained on the basis of nanocements are promising building materials.

Keywords: binding materials, modifiers, active mineral additives, reinforcing fibers, nanostructure, nanotechnology, hydrated alite, aggregated nanoparticles, nanosilicates, microsilica, dispersant- hyperplasticizer, polycarboxylate superplasticizer.

Researchers' penetration into the nanoscale puts concrete on par with high-tech materials whose structures are "engineered" in advance: These criteria include levels of strength and durability and low environmental impact. This ensures that concrete will remain the main construction material in the near future.

In the last decade, significant progress has been made in concrete technology. In these years, new effective binding materials, modifiers for them and concrete, active mineral additives and fillers, reinforcing fibers, new technological and construction composites production methods were created. Concretes are composite materials with the structure of hydrated cement phase with particle sizes of 1...100 nm. The reduction of the number of constituent elements, the formation of unique thread continuous structures, the formation of three-dimensional contacts between nanoparticles of different phases led to a radical improvement in the field of their use [1, 2].

In transition from macro dimensions to nano dimensions, electrical conductivity, optical absorption chemical reactivity and mechanical properties, surface energy values and surface morphology of composites undergo drastic changes.

Introduction of methods of control of properties and reactions in nanostructures allows creation of new materials, technologies and devices.

The principles of using nanotechnologies in concrete were mainly aimed at studying the structuring of cement materials in cement and their decomposition mechanisms.

WEB OF SCIENTIST: INTERNATIONAL SCIENTIFIC RESEARCH JOURNAL
ISSN: 2776-0979, Volume 4, Issue 4, April., 2023

With the help of new devices, it is possible to observe the structure of cement composites at the atomic level and determine their strength, hardness and other main properties in micro and nanospaces. For example, the amorphous C-8-H gel can be studied under an atomic microscope and shows that the product has a highly ordered structure [6].

Examination of the smooth surface of hydrated alite by atomic microscopy shows the presence of aggregated nanoparticles of dispersed phase elements in C-Б-H pattern. The C-Б-H gel of the hydrated cement paste forms a network of nanoparticle plates with a size of 60x30 nm2 and a thickness of 5 nm according to the results of atomic microscopy.

Using nuclear magnetic resonance, it is possible to identify the various surface layers formed as a result of the hydration reaction. For example, a surface layer with a thickness of 20 nm acts as a semi-conducting membrane, and this leads to the absorption of water into the cement particles and the alkalization of calcium ions. But larger silicate ions are "trapped" in this membrane, if there are no Ca^{2+} ions under the surface layer, silicate tetrahedra in the form of a polymerized gel are formed, and this causes the cement particle to shrink. Such disruption allows the absorption of silicate ions and the formation of C-Б-H gel, which binds cement particles and contributes to the strength of concrete.

The transition to the nanometric level allows paramechanic analysis of cementitious systems. From the point of view of parmechanics, the C-Б-H globule contains 18% internal nanopores, which are filled with structured water and are considered the "elementary solid phase".

The flowability of concrete is explained by the dependence of C-Б-H nanoparticle regrouping density changes. Thus, when considering the relationship of cement stone with microsilica, it becomes clear why the addition of microsilica reduces the flowability of concrete, and this creates an opportunity to obtain high-order materials.

Knowledge of these mechanisms opens the possibility of controlling the properties and structures of newly formed cementitious composites in a certain direction.

The introduction of nano-sized particles into the concrete mixture has a significant effect on its properties. For example, the use of nanosilicates with a specific surface area of not less than 180 m^2/g is ten times greater than the specific surface area of microsilica, and the composites obtained on the basis of new dispersant-hyperplastics provide a new strength structure of cement stone. This makes it possible to increase the compressive strength of composite powders up to 800 MPa and their bending strength up to 100 MPa.

WEB OF SCIENTIST: INTERNATIONAL SCIENTIFIC RESEARCH JOURNAL
ISSN: 2776-0979, Volume 4, Issue 4, April., 2023

The use of concrete nanosilicates not only improves the location of their constituents. Perhaps increasing their strength allows to control the reaction of formation, to control the course of reactions to ensure the strength of cement stone.

The use of БЮ2 nanoparticles increases the activity of the released ash sufficiently, and this leads to an increase in the strength of concrete containing a large amount of this additive [7-9].

Electron microscope studies show that Fe_2O_3 and БЮ2 particles fill the pores and reduce the amount of $Ca(OH)_2$ during hydration. This improves the properties of nanoparticle cement liquids.

Soil nanoparticles affect mechanical properties. Resistance to the penetration of chlorides reduces the permeability and penetration of concrete, and therefore they are used in self-compacting concrete mixtures.

Thus, based on the obtained data, the positive effect of nanoparticles on the microstructure and properties of cement can be explained by the following factors:

- finely dispersed nanoparticles increase the viscosity of the liquid phase and increase the stability of the mixture. Improves the comfortable positioning of the system;
-nanoparticles fill the space between cement granules and this causes connection with free water;
- finely dispersed nanoparticles are formed as centers of crystallization in cement hydrates, thus accelerating the hydration process;
- nanoparticles have a positive effect on the formation of small aluminum ferrite crystals and increase the homogeneity of С-Б-Н hydrosilicates;
- БЮ2 nanoparticles improve the structure of the contact zone of the filler, reduce the formation of cracks, increase the strength, resistance to sliding, and slightly increase the bending strength of cement base materials.

Carbon nanoparticles, nanotubes, and nanofibers are used by many companies on an industrial scale to increase the strength of relatively strong long-term structural materials.

When introducing nanotubes with a geometry close to the thickness of the С-Б-Н layer into the cement matrix, significant changes in its properties are observed. This increases the compressive and tensile strength. In recent years, polycarboxylate superplasticizers, which have higher efficiency, are used more and more in concrete preparation in construction practice. With the help of such superplasticizers, it is possible to reduce the water-cement ratio up to 40% [8-10].

The decrease in water demand of the concrete mixture is explained by the rate of adsorption of electric charges and polymers to cement particles. Such plasticizers are used more in the preparation of self-compacting concrete mixtures and reactive powder concrete.

High-strength, highly elastic and shock-resistant coatings are somewhat resistant to chemical effects and protect reinforced concrete structures from corrosion.

Ultraviolet rays TiO_2 is used as a photocatalyst, and atomic oxygen is released from water vapor.

The released active oxygen plays an important role in breaking down organic pollutants, disinfecting buildings and killing bacteria.

In recent years, rapidly developing nanotechnologies are expected to produce the following nanoproducts related to concrete technology:

-catalysts to accelerate the hydration and synthesis of ordinary cements;
- creation of additives for mechanochemical activation of cements and grinding to super powder;
-creation of new generations of superplasticizers that reduce water consumption, nanoparticle, nanorod, nanotube binders;
- creation of environmental binders modified with nanoparticles;
- creation of nanobiomaterials;
-Cement-based very long-lasting composites, materials with self-healing properties, and new nanocements with low thermal expansion and so on.

Summary

1. Nanotechnologies have changed and will continue to change our capabilities and views in the field of controlling the material world. Such changes will also find their place in the construction and building materials industry.
2. Modern progress based on nanotechnology will successfully solve many problems that are currently considered fantastic in the next decade.
3. Nanotechnologies are currently moving from basic science to industrial applications. Currently, its use in practice, especially in the construction materials industry, is very limited. But the fact that nanotechnologies have a high potential is very promising in terms of improving the properties of simple materials and processes.
4. Portland cement is one of the most widely consumed materials by mankind, and its study has not yet been completed. The fact that the nano-level structure of cement-holding materials is very complex makes it possible to create a new generation of highly technological, efficient and ecological concrete.

LIST OF REFERENCES

1. Баженов Ю.М. Технология бетона. М. : Изд-во АСВ, 2011. 528 с.
2.БаженовЮ.М., ДемьяноваВ.С., КалашниковВ.И. Модифицированные высококачественные бетоны. М. : Изд-во АСВ, 2006. 368 с.
3.Баженов Ю.М. Нанотехнологии в строительстве и производстве строительных материалов // Наносистемы в строительстве и производстве строительных материалов : сб. докл. участников круглого стола. М. : МГСУ, 2007. С. 12—16.
4.Баженов Ю.М., Королев Е.В. Нанотехнология и наномодифицирование в строительном материаловедении. Зарубежный и отечественный опыт // Вестник БГТУ им. В.Г. Шухова. 2007. № 2. С. 16—19.
5. Баженов Ю.М. Использование наносистем в строительном материаловедении // Вопросы применения нанотехнологий в строительстве : сб. докл. участников круглого стола. М. : МГСУ,2009. С. 4—8.
6.Фаликман В.Р. Анализ и разработка концепции развития работ в области применения на-номатериалов и нанотехнологий в строительстве // Наносистемы в строительстве и производстве строительных материалов : сб. докл. участников круглого стола. М. : МГСУ, 2007. С. 104—114.
7.Фаликман В.Р. Об использовании нанотехнологий и наноматериалов в строительстве // Нанотехнологии в строительстве : научный Интернет-журнал. 2009. № 1, 2. Режим доступа: http//www.nanobuild.ru. Дата обращения: 15.08.12.
8. Фаликман В.Р., Соболев К.Г. «Простор за пределом», или как нанотехнологии могут изменить мир бетона. Часть 1 // Нанотехнологии в строительстве : научный Интернет-журнал. 2010. № 6. С. 17—31. Режим доступа: http // www.nanobuild.ru. Дата обращения: 10.02.11.
9. Фаликман В.Р., Соболев К.Г. «Простор за пределом», или как нанотехнологии могут изменить мир бетона. Часть 2 // Нанотехнологии в строительстве : научный Интернет-журнал.
2011. № 2. С. 21—31. Режим доступа: http // www.nanobuild.ru. Дата обращения: 03.03.11.
10. Фаликман В.Р. Новое поколение суперпластификаторов в современной технологии бетона-поликарбоксилаты // Вопросы применения нанотехнологий в строительстве : сб. докл. участников круглого стола. М. : МГСУ, 2009. С. 111—119.
11. Фаликман В.Р., Вайнер А.Я. Фотокаталитически активные строительные материалы с наночастицами диоксида титана — новая концепция улучшения экологии мегаполисов// Вопросы применения нанотехнологий в строительстве : сб. докл. участников круглого стола. М. : МГСУ, 2009. С. 35—49.