Technical Application of Nanocomposite in Construction

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Abstract: The particle size of nano-ions is very small, and the specific surface area is large. It has the characteristics of significant and small size effect, so it is more commonly used in construction at present. This article starts with the progress of nanocomposite technology in new functional building, and explores its specific ideas in new building materials through in-depth analysis.

1. Introduction
Although nano-ion has high surface energy and surface activity is very large, but its performance is not stable. It is easy to adsorb other particles or substances, and the surface activity and energy of nanoparticle are also due to the properties of mutual attraction and aggregation between particles greatly reduced. If it needs to effectively solve the application problems of nanoparticles, it is necessary to find ways to avoid the agglomeration of nanoparticles.

2. Overview of nanocomposite technology
Nanocomposite technology is based on the design of micro-particles and the design of particle functions and surface characteristics by assembling their structures, so that the composite functional materials obtained on this basis can be applied to more fields. In the specific process of composite nano or micro particles, it not only fully involves the selection of the size of the surface modifier and the composite ion, but also the selection of the most suitable composite technology. According to the classification of the structure, the composite particles can be divided into film composite type, particle composite type and multi-layer composite type.

![Schematic illustration of the nanoparticle recombination process](image)

Figure 1. Schematic illustration of the nanoparticle recombination process

3. Specific application of nano-composite technology in new architectural coatings

3.1. Application of nano titanium dioxide in indoor coatings
Specifically, the interior and exterior walls of the building need to be painted. However, many practices...
have found that most of the traditional coatings used have related problems such as easy aging, difficult to clean, low suspension stability, and low finish. High-end architectural coatings need to have high stain resistance, weather resistance, and protection and more functions such as color, heat preservation and insulation. It is precisely because of the current rapid development of nanocomposite technology that new architectural coatings have a broader development prospect.

For example, the hiding power and whiteness of titanium dioxide are relatively high, so it is usually used as the main white pigment in architectural coatings. However, titanium dioxide is too wasteful, and the use of nanocomposite technology can give full play to its functions. First of all, titanium dioxide is made into corresponding nanoparticles, and then added to the coating, so as to improve the grade of the coating and increase the added value. Then, the titanium dioxide particles will approach each other when the paint pigment concentration increases, or they may contact each other and agglomerate, which will continuously reduce the light scattering performance of the titanium dioxide particles, resulting in light clustering. Next, it needs to first effectively treat the nano-titanium dioxide to stably improve the dispersibility, and then add fillers into the coating formulation. In this way, the titanium dioxide particles are separated so that it cannot produce a group effect. Finally, the extracted nano-titanium dioxide has excellent transparency and high ultraviolet shielding ability, and it can be used as an interior wall paint to be applied to the wallpaper or brick walls of indoor buildings. When there is indoor lighting or sunlight, the indoor oil stains and odors can be effectively decomposed by taking full advantage of the strong oxidation and decomposition ability of nano titanium dioxide. On this basis, the indoor air is fresher and bacteria and germs are greatly reduced.

3.2. Application of nano titanium dioxide in exterior wall coatings
Nano titanium dioxide has a strong inhibitory effect on colibacillus, and a large number of experiments have shown that if a certain area is seriously polluted, nano titanium dioxide can be applied to the outer walls of buildings or the acoustic insulation of highways, so as to remove harmful nitrogen oxides from the air. The application of nano-titanium dioxide in exterior wall coating is as follows.

For example, deodorization and sterilization. The technicians apply nano-titanium dioxide composite material on the lampshade, which can easily decompose the adsorbent. Even if the lamp is not turned on, the lampshade has a high absorption and deodorization. When it is exposed to sunlight or turned on, the effect of nano-titanium dioxide on the lamp is more significant. It can achieve sterilization and deodorization, effectively make it clean at a fast speed. Nest is self cleaning and decontamination. Since the contact angle between the surface of titanium dioxide and water is about 72 degrees, the contact angle remains below 5 degrees or even reaches 0 degrees after exposure to ultraviolet light. At this point the surface can be fully wet by water to maximize hydrophilicity. The building that contains coating of titanium dioxide can make full use of its super-hydrophilic and reach the special performance such as antifogging, antifouling, decontamination cleanness. The last is the other properties. Nano titanium dioxide composite materials used in building coatings can make the coating and building surface adhesion strength significantly improved, increase the building surface wear resistance and hardness. It also can greatly improve the coating layer's patience. In the meantime, it still can promote the service life of coating and achieve beautification adornment to decorate the goal.

4. The concrete application of nanocomposite technology in new cement

4.1. Nanostructured composite cement
The nano-structured composite cement materials is significantly changed by adding nanostructured or nanocomposite materials to the cement. Cement voids can be filled with nanocomposite, and the fluidity of concrete can be significantly improved.

For example, firstly, technicians can reduce the size of nanocomposite to the nanometer level, causing significant changes in their surface properties and a significant increase in the number of surface atoms to maintain high surface activity. Then, it is added to cement, which allows the nanocomposite to bond with hydration products in a large amount. Using nanoparticles as crystal nuclei, the network
structure with nanoparticles as the nucleus will appear on the surface of cement particles, thereby effectively reducing the creep of cement and greatly improving the strength and other structural properties of the cement hardened paste. Next, nano-scale silica can also be mixed into the cement paste. When the output of nano-scale silica reaches a certain proportion of the cement consumption, the water demand of the cement paste will double. At this time, the silica fume particles can fully fill the small spheres of nano-scale silica, thereby forming a better particle-graded structure with the silica fume. Finally, the cement added with nanocomposite is thoroughly mixed with other materials in a high-speed mixer in an appropriate ratio. Thus, a nano-composite cement structural material with good performance is prepared, and the durability and toughness of the cement are significantly improved.

![Figure 2. High-strength cemented waterproof cement with nanocomposite additives](image)

4.2. Nano waterproof composite cement
Nanocomposite have many excellent properties, so if nanocomposite are fully added to other systems, they can promote the added system to show many other functional characteristics.

For example, XPM is a sprayed concrete additive nano material. After being added to the cement, it can fully reduce the rebound amount of the cement and speed up the shotcrete speed. The hydration reaction of the cement induction and acceleration period is significantly accelerated, and the three forms of gas, liquid and solid are connected. The three-dimensional structure of cement solidification is fully improved while the amount of concrete is saved, so that economic benefits are significantly improved. Nano waterproof composite can also effectively improve the bulk density of cement concrete, effectively reduce cement surface water and void water, and cause polymerization in micelles. At the same time, the application of XPM nano-admixture in shotcrete can significantly enhance the adhesion of cement and increase the use of sand and stone, so that the amount of cement per cubic meter of concrete can be greatly reduced and the dust concentration can be effectively reduced. If XPM grouting material is used in the field of grouting, a certain proportion can effectively improve the ion exchange rate and enhance the adhesion of cement.

4.3. Nanosensitive composite cement
Many metal oxide nanocomposite are very sensitive to changes in the surrounding environment, and the valence states of ions on the surface and interface of cement will change rapidly under changes in the environment. Therefore, technicians can improve the gas and humidity sensitivity of cement products.

For example, nanocomposite cement with gas-sensing function can be fully used in the construction of chemical plant buildings or road paving where poisonous gas leaks. First of all, technicians can add gas-sensitive nanocomposite to the composite cement. If there is a toxic gas leakage, the ground and the cement walls next to it will be detected and warned the first time. After being warned, people will check the accident in time and give solutions to minimize the casualties to related personnel. Then, it can add
carbon monoxide and other gases to the nanocomposite, and make full use of this composite cement. In the process of use, if the gas leaks it will be the timely reminder. It can also be fully used in the laying of gas pipelines. The nano gas-sensitive composite cement will give warning in the case of gas pipeline leakage, so as to effectively avoid possible accidents. Next, nanocomposite that sensitive to mechanical properties are added to cement, and then they are fully applied in the laying of highway surfaces and bridge construction. If vehicles are overweight, a certain warning will be issued, which can effectively avoid serious damage to the road surface or bridge collapse accidents caused by heavy loads.

4.4. Nano environmental friendly composite
Cement products can use the photo-catalytic function of nanocomposite to achieve the purpose of surface self-cleaning or air purification. It can be known that nanometer photo-catalytic materials such as anatase nano-titanium dioxide have very strong photo-catalytic activity and can produce strong oxidation under light irradiation. Free radicals and bacteria can be killed under the action of these oxidative decomposition.

For example, it is the titanium dioxide doping method. In the process of making water-permeable cement, the relevant technical personnel can first mix the nano-photo-catalytic composite micro-powder on the surface of the concrete, control the height of about one centimeter with the concrete surface and control the mixing amount to less than half, and then mix the already cement used in road construction such as concrete. The next is photo-catalytic carrier method. The technician needs to wrap a layer of composite film containing titanium dioxide in a part of the aggregate of the concrete, and then use it as an important carrier of the photo-catalyst to be fully placed on the surface of the concrete block. After exposing the aggregate part of the titanium dioxide composite film on a large scale, cement concrete with strong photo-catalytic function will be successfully obtained, and then this concrete can be applied to the building to effectively eliminate harmful gases such as nitrogen oxides.

4.5. Nano stealth composite cement
Nano composite such as nano metal powder can play a significant role in absorbing electromagnetic waves. After composite processing of different nano composite, it can give full play to its stealth functions and materials such as radar waves and infrared rays.

For example, relevant technicians can add some nanocomposite that have a relatively large absorption function to electromagnetic waves to the surface of cement in an appropriate proportion. In this way, cement products have significant stealth power against electromagnetic waves. This nano-stealth composite cement is fully used in the production of military bunkers such as trenches and bunkers to effectively avoid infrared or radar searches, greatly reducing the probability of being discovered by the other party. Nanocomposite technology can also be fully applied in the field of chemical catalysis. By tightly combining the catalyst particles and the reactant particles, the contact area between the reactant and the catalyst can be increased to achieve a better catalytic effect and greatly increase the chemical reaction speed. Application in high-performance explosives can effectively promote the combustion performance of nanocomposite catalysts. This technology can also be used to produce ultra-fine explosives. Therefore, nano-composite can play a vital role in many fields.

5. Conclusion
It can be seen from the above that nano-composite play a very significant role in building technology, which can not only fully apply nanocomposite technology in new building coatings, but also play an important role in new cement. It can also produce some value in the field of chemical biology, so it is necessary to make full use of nanocomposite technology in the whole new building materials.

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