Growing Application of Commercial Nanotechnology-based Products in Construction Industrial Sector

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China and Germany are the two leading countries in the production of nanotechnology-based products in the field of building industry, according to the statistics published by Statnano Database website.

Nanotechnology is the fourth wave of industrial revolution, which has been adopted by all scientific majors and is being developed and adopted by the industries as fast as possible.

This technology provides an appropriate opportunity to produce building materials with new properties and modified structure. Building with long life and higher strength can be built using nanotechnology. The simple and cost-effective methods to produce nanotechnology-based products are the reason for the companies active in the production of nanomaterials to produce nano-based products to be applied in building industry. This report reviews nanotechnology-based products in the field of building industry.

A number of 346 nanotechnology-based building industry products were presented to the international market by 106 enterprises by January 2015. China and Germany are the two leading countries in the production of nanotechnology-based products by possessing a share of 30% and 25% of all nanotechnology-based building products in the global market, respectively. The United States, Switzerland, Greece, Poland, Singapore, Denmark and Finland are among the other countries active in the production of these products (Figure 1).

Fig 1: Share of Countries Active in the Production of Nanotechnology-Based Building Products according to the Number of Products in Each Country

Figure 2 demonstrates the number of products presented by the most active enterprises in this field. Shanghai Huzehng Nanotechnology Co ranks first in this ranking by presenting 44 individual products to the market.

Fig 2: Most Active Enterprises in the Production of Nanotechnology-Based Building Products

Nanotechnology-based building products have wide range of applications among which mention can be made of modification of the properties of cement and concrete, self-cleaning nanocoatings, multi-purpose nanocoatings, nano waterproofing agents, nano glass, clay nanocomposites, etc. Building nanocoatings are used on the internal and external surfaces of the buildings, including glass surfaces, plastic, wood, steel, rock, bricks, tiles, ceramics, cement, concrete, marble and clay. Building nanocoatings have antibacterial properties and therefore, they are harmless to the body. The most important advantages in the application of these nanocoatings are the creation of an appropriate insulation, prevention of the diffusion of corrosive agents into the coatings, increasing the resistance to heat transfer, increasing the resistance to corrosion, abrasion and rotting as well as self-cleaning specifications.

Various nanomaterials are used in building products depending on their applications. Among the most important nanomaterials mention can be made of titanium dioxide, silver, silicon dioxide, calcium silicate, aluminum phosphate and carbon nanotubes.

Figure 3 demonstrates the share of various nanomaterials from building nanotechnology-based products. Titanium dioxide (TiO2) is found in 58% of all nanotechnology products in the field of building. Increasing mechanical properties of the samples in the main structures, waterproof application in internal and external surface of the buildings, prevention of dirt, UV-resistance, production of strengthened, self-repair and self-cleaning concrete, fireproof and self-cleaning glass and energy saving glass are the most important applications of these nanoparticles in building industry.

Nanosilica (SiO_2) possesses a high share of nanotechnology-based building products by having a share of 21%. The use of nanosilica decreases the viscosity of cement mortar which results in a decrease in water consumption. Based on studies, silicone chains are created in the nanometric structure of cement with various lengths. The length of the chains is very important in the stability of cement. Fireproof glass is another achievement of nanotechnology in the field of building industry. This product is produced by adding a transparent layer of silica nanoparticles between the two sheets of glass. When the glass becomes warm, the transparent layer turns into a hard, dark and fireproof coating.

Fig 3: Share of Various Nanomaterials Used in Nanotechnology-Based Building Products

Nanomaterials are the creative units in nanotechnology and the magic of this technology depends on the type and quality of nanomaterials. Therefore, enterprises such as Behr® PREMIUM PLUS, Applied Thin Films Inc., Bioni CS and Celanese Corporation are not only active in the field of the production of industrial products, but they are also active in carrying out researches, publication of scientific articles, studying the changes and publication of patents related to novel and efficient methods in the production of products.