Titanium Dioxide Products Available in Market

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Titanium dioxide or Titania (TiO2) is an n-type semiconductor with wide band gap, which allows visible light to pass through it. Titania nanostructures have been attractive since the beginning of the formation of nanotechnology due to their other characteristics such as photocatalytic properties, waterproofing, self-cleaning, biocompatibility, antibacterial properties, and resistance against ultraviolet radiation of the sun. In addition to the above mentioned properties, the simple and cost effective production method is another reason for the organizations active in the field of nanomaterials production to produce crystalline structures and various morphologies of nanotitania.

According to Statnano, a number of 180 products based on titanium dioxide nanostructures had been presented to the global market by 32 productive organizations by the beginning of September 2014. China and the United States are the leading countries by providing 53% and 25% of all TiO2 products in the market, respectively. Among other active countries in this field, mention can be made of Canada, France, Germany, India, Australia, Mexico, Spain, and Japan (Figure 1).

Figure 1: Share of top Countries of total number of TiO2 Nanoproducts.

Table 1 lists the number of products presented to the market by the most active productive

organizations in production of TiO2 nanostructures. US Research Nanomaterials Organization is the leading organization in this table by producing 20 individual products.

Table 1: Most Active Organizations in the Production of Individual Titanium Dioxide Products

Organization	Headquarters Office	Number of TiO2 Products
US Research Nanomaterials	USA	20
American Elements	USA	19
Ishihara Corporation	USA	17
M K Impex Corp.	Canada	17
Xuancheng Jingrui New Material Co. Ltd.	China	15
ACS Material	USA	9
Shanghai Huzheng Nanotechnology Co. Ltd	China	9
Sigma-Aldrich Co. LLC.	USA	9
NanoAmor	USA	7
Avanzare	Spain	6
Nanoshel LLC	USA	6
SkySpring Nanomaterials, Inc.	USA	5

Among titanium dioxide nanoproducts presented to the market, mention can be made of anatase nanoparticles powder, rutile nanoparticles, brookite nanoparticles, etc. Table 2 presents the share of different types of titanium dioxide products. The products have applications in various industries such as energy, building construction, packaging, cosmetics, and health and hygiene depending on their unique properties.

Table 2: Share and applications of Various Types of Titanium Dioxide Nanoproducts

TiO2 Product	Production Share (%)	Cosmetics	Paint	Energy	Packaging	Catalysts	Antibacterial
Rutile Nanoparticles	33/9	*	*	*			*
Anatase Nanoparticles	31/5	*	*	*	*	*	*
Combination of Anatase and Rutile Nanoparticles	16/9		*	*		*	*
Nanowires	9/1			*		*	*
Nanotubes	3/2			*		*	*

Colloid Solution	1/8	*	*	*	*	*	*
Brookite Nanoparticles	0.6			*			*
Tungsten-Doped Nanoparticles	0.6		*	*		*	
Manganese-Doped Nanoparticles	0.6		*	*		*	
Aluminum-Coated Rutile Nanoparticles	0.6		*	*		*	
Zirconium-Coated Rutile Nanoparticles	0.6		*	*		*	
Silane-Coated Nanoparticles	0.6		*	*		*	

Nanoparticles of titania possess the largest share of the market. These nanoparticles are synthesized at various diameters differing from 5 to 250 nanometers and purity of 75 - 99.97%. Rutile and anatase nanoparticles are usually used as initial materials in traffic paints, sunburn lotions, solar cells, and self-cleaning and waterproof coatings. Therefore, these two types of particles possess the highest amount of production in the global market by having a share of 33.9% and 31.5%. An average diameter of 20 nm and a purity of 99.5% have the most popularity among the producers and buyers. For example, P25 is the trademark of one of the most applicable products of titanium dioxide nanoparticles that is produced by Evonik Industries Company. This product is a combination of anatase and rutile crystalline structures with an average diameter of 21 nm and purity of 99.5%.

Among titanium dioxide nanostructures, nanosheets and nanospheres have not been commercially produced yet although they are being produced in large quantity at laboratorial scale. The production of these products requires more complicated technology yet they have limited applications in comparison with other morphologies and crystalline structures of titania. That is why companies are not willing to produce these types of products.

Nanomaterials are constructive units of nanotechnology, and the miracle of nanotechnology depends on the type and quality of nanomaterials. As a results, some companies such as Sigma-Aldrich, US Research Nanomaterials, NanoAmor, Xuancheng Jingrui New Material, and Evonik Industries are active not only in the production of titanium dioxide nanomaterials, but also in carrying out researches and in the publication of scientific articles and patenting related to the new and effective methods for the synthesis of these materials.