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The Ethical Reflection on Nanotechnology Applications in the Field of Sports

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Abstract. With the development of nano science and technology, its application has been widely used in the sports scientific research, almost involve all fields. This article mainly discusses the characteristics of nanometer technology and its application in the field of sports equipment. On this basis, outlook the application prospect in the field of nanotechnology in sports equipment according to the present situation and the trend in the development of nanotechnology.

Nanometer and nano technology

Nanometer is a small scale unit. A nanometer is one billionth of a meter (10-9m), about four times the diameter of a single atom. Through the observation of new phenomena and the new processes at the nanoscale, human beings have developed many tools, materials, devices and systems of unique performance using nanotechnology. Nanotechnology is a high-tech which has come into being and developed in the late 1980 s. Its basic meaning refers to analyzing the composition of the material within the nanoscale, creating new materials by manipulating and arranging atomic and molecular. The emergence of nanotechnology marked that the human's cognitive areas have been expanded to the atomic and molecular level, leading to a new era of human science and technology— the era of nanotechnology.

Nanotechnology is a science based on many advanced science and technology. It is the combination of modern science (quantum mechanics, molecular biology) and modern technology （microelectronics technology, computer technology and the high resolution microscopy and thermal analysis technology ）. Nanotechnology continues to permeate various fields of modern science and technology and at the same time, forming emerging disciplines related to nanotechnology such as: nanophysics, nanochemistry, nanometer materials science, nanobiology, nanoelectronics, nano machining and nano mechanics. It is these emerging subjects that constitute the main content of nano science and technology.

The application in the field of nanotechnology in sports equipment

Currently, the object of nanotechnology application is not athletes themselves, but the special sports equipment used by athletes to improve performance. Through the principle of mechanics and chemistry, using the characteristics of nano materials, special sports equipment and apparatus are improved, making it lighter and more flexible, more stable, creating better movement feel (including comfort). Thereby the equipment serves to lowering the extent of the athletes' active force, reduce the drag in the movement and save energy. All the above factors lead to the improvement of the athletes' performance. With the development of technology, these devices and equipment have begun to highlight the special features and characteristics of the athletes "personality."

2.1 Applications based on drag reduction

2.1.1 Sharkskin swimsuit

In the 2000 Olympic Games "sharkskin swimsuit" (Fastskin) show great power, It is made of PTFE -based materials and it is the joint effort of fluid mechanics and material science and other multi-disciplinary experts. This kind of swimsuit aims to reduce the water resistance. That is using materials similar to shark skin at the site where resistance need to be reduced, enabling the athletes distribute the muscle load and the joint load properly. Thus it is more prone for the athletes to exercise power. However, the drag reduction effect disappears when you use the swimsuit one or two times and the swimsuit has individual requirements. Athletes with different shape and strength require different swimsuit. So only a few world-class athletes wearing tailored swimsuit achieved good results including Australian swimmer Thorpe. After that, the world's most famous swimsuit manufacturers are designing more effective drag reduction swimsuit whose effect could last a little longer. Again the second generation of sharkskin swimsuit again got the favor of world-class elite athletes.

2.1.2 Drag-reducing coating on sport boats

Boat coating is another contribution of nanomaterials. In the British rowing World Cup of 2005, nano coating material for drag reduction made great contribution to Shanghai women's winning in the eight-people boat race. It is also the first time in the history of China to win this game. The DRA uses a strong light-cured fluorinated hydrophobic wax as matrix material and processing the nano particle through the technique of decorating in order to dispersing it in the wax. Painting the bottom of the boat by hands forms Nano-scale ultra-thin film. Thus the surface of a motor boat has no weight, no pollution, polishing, anti-fouling, hydrophobic and waterproof. The drag reduction coating can significantly reduce the fluid resistance of motor boats. The angle between the water surface and the film is 160 °, greater than 106 °, which means a long time resistance water scouring of 10 m/s. In the real ship fluid resistance comparison test, we notice that after obliterating DRA, the boats' water friction can be reduced by 1% to 1.5%, within the speed of 3.5m/s～6.5m/s (speed range in the race). Moreover, this kind of nano-DPR doesn't affect the color, the weight of the boat or the quality of the water and it completely conforms to international competition rules of the game.

2.2.1 Nano-bike

As the equipment to achieve the highest speed, bicycle requires light weight, strong anti-collision capability. The 2005 Tour de France, athletes of Swiss Phonak team participate in the game riding bicycles with carbon nanotubes. The frame of the bike weighs less than one kilogram and has good rigidity and strength.

2.2.2 Nano racket

Among all the racket, tennis, badminton, table tennis racket have firstly used nanotechnology. They reduce the weight of the racket in the premise, and then increase its flexibility, durability and hand feelings. Wilson ncode rackets fill nano-sized sio2 to the hole of carbon fiber composites so as to improve the uniform material structure, intensity and strength, the Williams sisters and Roger Federer used this kind of rackets in the French open tennis tournament. Japan SRI sports company's tennis rackets "love o f yoshino lu" series are about three times the weight of air quality, but 4000 times stronger than its own weight. YONEX also successfully fill the 0.7nm diameter nanomaterials "Vladimir Lun" particles into the carbon atoms gap. The racket witnesses 30% increase in resistance in strength, 10% increase in durability, 5% in rebound performance, 2 times in stability and the improve of hand feelings.

2.2.3 Running shoes

The crystal shoes worn by 100-meter air Jones is the representative of "personality". Experts design the shoes according to the characteristics of her running without heel strike. To reduce the weight of the shoes, experts only make the first half of the shoes with expensive transparent plastic, thus the shoes weigh only 99 grams. Similarly, a pair of shoes Nike made for Michael Johnson use five nails instead of the many and the shoes were experimented in wind tunnel weighing only 138 grams. In 1991, Japanese company Mizuno designed shoes for a famous American sprinter Lewis weighing 115 grams (20 g lighter than regular ones), the sole uses special glue and the shoe nail is ceramic, thanks to the shoes, Lewis breaks the world record in the Seoul Olympic Games in 9.86 seconds , winning gold medals. These "personalized" clothing will, no doubt, add the athletes' winning chips.

2.3 Applications in order to enhance the flexibility or increased fastness

2.3.1 Poles

The key equipment in pole vault is the pole. Throughout the history of the pole, it evolve from a wooden pole, bamboo, metal rod, glass fiber to the carbon fiber rod, the evolution of the pole reflects the innovation. At Beijing Olympic Games, gold medalist of women's pole vault Isinbayeva uses carbon fiber rod, the head and tail employs a large amount of carbon fiber materials, making the rod very light. The pole can bend 90 ° to store energy, rebound rapidly. This rod help Isinbayeva achieve 5.05 m new heights. Along with the perfection of modern technology in making the product, "personalized" pole has become possible. Besides, the application of nanometer materials will make the pole vault "further progress".

2.3.2 Nano ball

The performance and fastness of the ball determines its life, the increasing demand for the ball in the world-class event encourage the appearance of the nano ball. Recently, the nano tennis are available. The Double-Core Tennis uses butyl nanocomposite coating on the surface of the tennis. The spraying of nanomaterials on its surface produces gas barrier layer, which can slow down the air infiltration when it comes through the core-shell rubber, the pressure within the ball becomes extremely slow, greatly extending the life of tennis. Wilson nano tennis ball has been appointed as the official ball for Davis Tournament; NDMX golf designed by Nano Dynamics is allowed by United States Golf Association. These nano-products have been recognized by foreign top events organizers and athletes.

Prospects of nanotechnology in the field of sports equipment

Nanotechnology will change our lives in many aspects. Over the past few years, nanotechnology has developed market worth multi-billion dollars. Fundamental new phenomena and new process gave birth to the new, high value-added technology. The investments of nanoscience research and infrastructure will certainly pay off.

The developing competitive sports get close to the limit of the project. To increase ornamental values and challenge of the sports, international organization is bound to change the rules of the competition, which requires updates of sports equipment. The research of special sports equipment will be the focus of nanotech. We need to Invent nano materials that conform to the restraint of the rules to help the athletes gain advantage in Objective and psychological advantage. Nanotechnology is the new technology of the 21st century, which was affecting sports science from all aspects. Finding out the best balance between nanotech and sports equipment will make both of them inosculate.

References

[1] Lv Aijun-Approach the nano [J]. Journal of physics and engineering, 2001, 11

[2] Ren Xiaofei, Li Jing-Nanotechnology and new building materials [J]. Journal of Taiyuan University, 2002, 3

[3] Howard Brody-The physics and Technology of Tennis [M].2004, 4

[4] Wang Xiaping-The prospect of research in the applications of nanotechnology in sports biological science [J]. Journal of Xi ' an sports institute, 2002, 4

[5] Chen Weilin-Nano technology to promote the improvement of competitive sports research [J]. Journal of Shan Dong sports science and technology, 2003, 3

[6] Han Jing-The application of nanotechnology in the field of textile [J] QianJian, China, 2006.