Polymer Composite Materials Used in Sports Equipment and Its Influence on Competitive Sports

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Abstract. To explore the impact of polymer composite materials on the performance of competitive sports and sports equipment, the effects of polymer composite materials in cycling, swimming, and table tennis were studied. The results showed that the composite-based sports equipment significantly helped improving the performance of athletes, whether for cycling, swimming or some other related sports. The results of polymer composite materials for cycling and swimmers were improved by about 3%, and the scores of table tennis players in the starting, receiving, and holding stages were increased by about 6%. To sum up, polymer composite materials are more prominent for sports equipment and athletes in the competitive level, which can be promoted in other sports fields and promote the improvement of high-tech technology for sports.

1. Introduction

Polymer composite materials are the product of high-tech technology, which combine the excellent characteristics of a variety of materials and are widely used in many fields [1]. Using polymer composite materials to promote the development and progress of various industries has been widely recognized [2]. As people's living standards and the progress of society improve, people's interests and hobbies are more and more extensive, among which sports receive a lot of attention. Sports can not only exercise, but also improve people's interests and hobbies [3,4]. Swimming is a very popular sport, especially with the excellent results of Chinese swimming team in the world, there are more and more participants in swimming [5]. For competitive sports, the performance is a very important measurement standard, and swimming is no exception. To achieve more outstanding results, each team member constantly improves their comprehensive ability, and needs to use some high-tech technology to improve their performance [6]. At present, the main difficulty in improving the sports level of China is that the low level of technology hinders the athletes' performance [7]. The effect of the equipment has been unsatisfactory, and the impact on the competition is very obvious [8]. This situation has seriously hindered the development of the level of Chinese athletes [9].

Thus, it is proposed to study the effects of cycling, swimming, and table tennis based on polymer composite materials. The contribution of this paper mainly lies in the in-depth and comprehensive analysis of the competitive level of players and the use of equipment in many sports. In this way, the effect of polymer composite materials is determined more efficiently and accurately, and then the obstacles brought by technology to the improvement of sports are effectively solved. It is of great significance for the analysis and research of athletes in the technical level, both for the social and sports level.

2. Method

2.1 Polymer Composite Materials

In a narrow sense, polymer composite materials refer to many materials formed by polymer and other different components, shapes, and properties through composite reaction. It is generally divided into two types: structural composite and functional composite. In general, polymer composite materials refer to the common mixed system of polymer, also known as polymer alloy. When the dispersed phase is metal or inorganic, the blend system of which the dispersed phase is

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metal or inorganic is called organic polymer composite or inorganic polymer composite, and the blend system of which the dispersed phase is heterogeneous polymer material is called polymer blend. Trees, beehives, and bird's nests in nature belong to polymer composite materials.

Polymer composite materials are made by composite bonding with other materials with different composition, shape, and properties, so they generally have interfacial properties. The performance of polymer composite materials is usually based on the advantages of various components, such as high strength, light weight, high-temperature resistance, corrosion resistance, heat insulation, insulation, and other advantages. In daily life, polymer materials and other special materials are generally processed with required properties and manufactured as the composite materials needed.

2.2 Sports Equipment Made of Polymer Composite Materials

At present, the best sports equipment in the world is closely related to science. The development of science and technology can bring the rapid development of high-tech sports equipment. The technology added to the equipment has greatly improved its performance, avoidance, and comfort. These include materials science, medical science, mechanical engineering technology, mechanics, and biology. The physics of life can be simply defined as how the human body responds to the discipline of internal and external forces.

Because sports equipment has effects on joints, ligaments, and muscle tissues of human body through mechanical principles and mechanisms, the strength, toughness, density, corrosion resistance and other properties of the materials used in the design of sports equipment should be considered. In production, polymer composite materials are usually used to design and manufacture various sports equipment to meet people's needs through continuous reform and innovation.

2.3 Analysis of the Influence of Polymer Composite Materials on Competitive Sports

Cycling: this kind of transportation equipment is very efficient. The development of bicycle is mainly reflected in the wheel and frame. It can be regarded as a modified space frame; whose skeleton is diamond structure. For the selection of skeleton material, its strength design should be focused on. Carbon filler is the most ideal material without considering the cost. Of course, titanium, magnesium, and aluminum can also be used. Under the condition of considering cost, it is suitable to use steel. In addition to strengthening the framework of carbon fiber mixture, currently it also manufactures mixed framework, such as joint application of titanium and carbon fiber mixture. Based on the stability requirements of mountain bike, the disc wheel of reinforced glass fiber nylon has been manufactured. For the disc wheel, the carbon fiber composite or aluminum alloy is gradually replacing the previous wheel spokes. To provide excellent side aerodynamic performance and stability, five spoke wheels or three spoke wheels are also manufactured. For example, the average speed of cyclists in the “Tour De France” over the years proves that the application of carbon fiber in bicycles can greatly improve the performance of cyclists.

Table tennis: in a series of sports, new technology can be seen everywhere. It not only protects the safety and health of athletes, but also directly determines the effect of sports. For example, in table tennis, the performance of players is often seriously affected by the materials of racket. After using polymer composite ball, the scoring rate of direct serve, forehand attack, side attack, and post serve control has been improved. The percentage of points lost in backhand attack, onstage attack, and serve direct fault decreased. Through video analysis, it is found that the quality of forehand and side position attack is high and the threat is great after using the new material racket, which shows that the polymer composite racket has a significant impact on the performance of the players.

Swimming: swimsuit is also called zero-resistance swimsuit. Based on the continuous progress of science and technology, to ensure the flow of water along the body surface, a series of new materials are constantly emerging. People make swimsuits with new materials, and the new swimsuits are designed to improve the concave convex of the body, and to prevent the water from entering the swimsuits. In other words, although the water can enter the swimsuits, but it can also drain water quickly. Combined with this theory, shark-skin swimsuits can bring power to the swimmers when they are rowing backward and simulating human tendons at the seams. Meantime,

according to the data information of the athletes' body detected by laser, the swimsuit was designed by Teflon fiber to realize the three-dimensional design, thus wrapping the ankles and wrists of the athletes. Moreover, such swimsuits also imitate human skin and use elastic fabrics. It has been proved that when an athlete swims, he can reduce the water resistance by 3%, so that he can win the competition in one thousandth of a second.

3. Results and Discussion

Figure 1 shows the comparison of scoring rate of common ball and polymer table tennis in different stages. It suggests that the polymer composite ball used is more prominent than the common ball in the starting, receiving, and holding stages of table tennis, which significantly improves the scores of athletes. Thus, it can be determined that the prediction results of scoring rate based on the polymer composite ball for table tennis players in different stages of the field, namely, the starting stage, the receiving stage and the holding stage, are satisfactory.

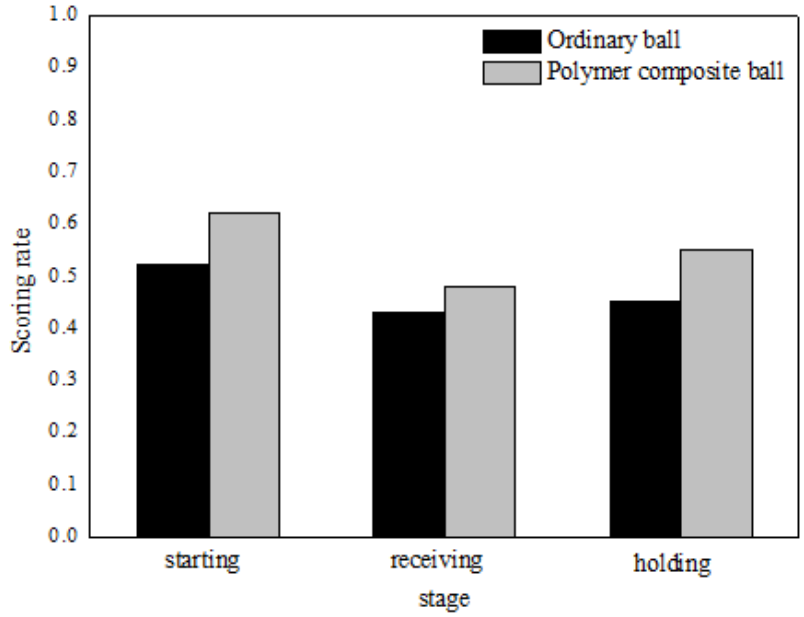

Figure 1. Comparison of scoring rate between common ball and polymer composite ball in different stages

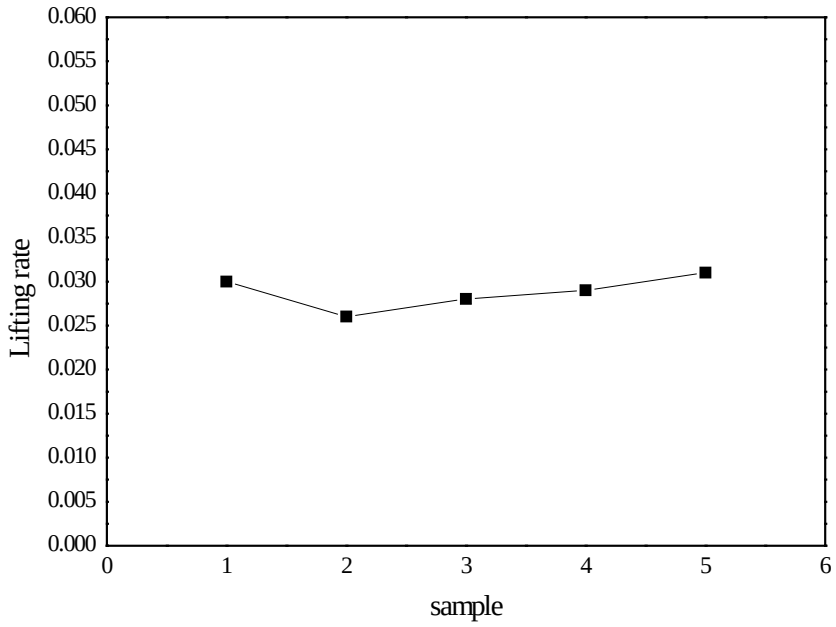

Figure 2. Analysis of polymer composite swimwear for swimming competition

Figure 2 shows the analysis of polymer composite swimwear on the level of swimming competition. Through the analysis of the data and trend, it can be seen clearly that in the five groups of simulation experiments, the performance of the athletes is increased by about 3% compared with that of the ordinary swimsuit, which will greatly help the athletes in the international high-level competition. Therefore, it can be determined that the swimwear based on polymer composite material has a significant impact on the improvement of swimmers' performance.

Figure 3 shows the analysis of the competitive level of polymer composite cycling. The analysis of the data and trend clearly shows that in the five groups of simulation experiments, the performance of athletes is improved compared with that of ordinary materials bicycles, which contributes a lot to the competition.

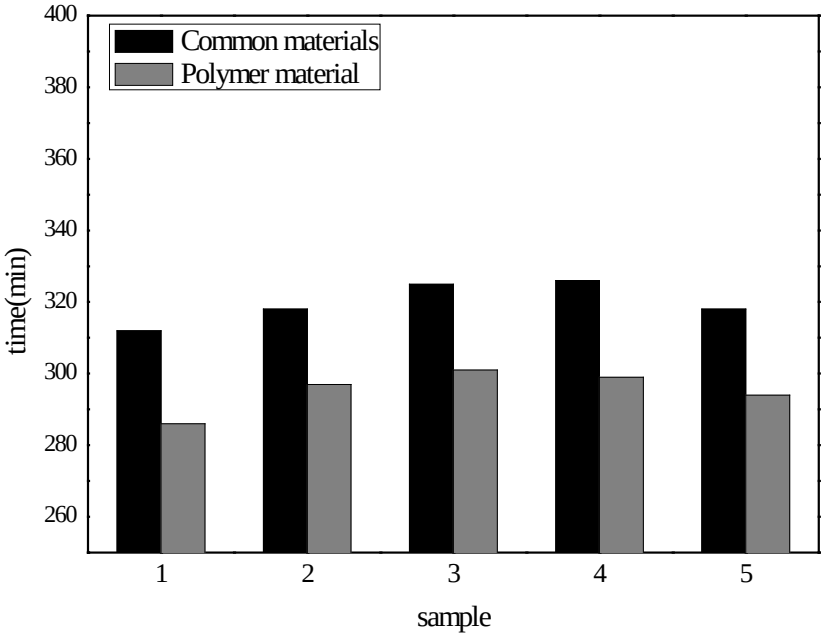

Figure 3. Analysis of the competitive level of polymer composite bicycle

4. Conclusion

The effects of polymer composite materials in cycling, swimming, and table tennis are studied. The results show that the polymer composite-based sports equipment greatly helps improving the performance of athletes, whether for cycling, swimming, or other sports. The results of high polymer composite materials for cyclists and swimmers are improved by about 3%, and the scores of table tennis players are increased by about 6%. The innovation lies in the in-depth and comprehensive analysis of the competitive level of players and the use of equipment in many sports, thereby determining the effect of polymer composite materials efficiently, and then effectively solving the obstacles brought by technology to the improvement of sports. However, there are also some deficiencies in the research process. For instance, the analysis and research of athletes' competitive level under the polymer composite materials is still in simulation and has not been tested by the actual situation. Due to the limitations of the actual situation and objective factors, it is impossible to obtain relevant data, so there will be many interference factors. In this paper, a lot of external factors are ignored and the results are a little less convincing, but the research provides a valuable reference for the follow-up research on the impact of polymer composites on athletes from a qualitative point of view.

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