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Retraction

Retracted: Application Value Analysis of Nanooptical Materials in Martial Art Single-Kick Protective Equipment

Journal of Nanomaterials

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

In addition, our investigation has also shown that one or more of the following human-subject reporting requirements has not been met in this article: ethical approval by an Institutional Review Board (IRB) committee or equivalent, patient/ participant consent to participate, and/or agreement to publish patient/ participant details (where relevant).

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] S. Yu, "Application Value Analysis of Nanooptical Materials in Martial Art Single-Kick Protective Equipment," *Journal of Nanomaterials*, vol. 2022, Article ID 2714874, 8 pages, 2022.

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Research Article

Application Value Analysis of Nanooptical Materials in Martial Art Single-Kick Protective Equipment

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If there is no protective equipment in martial art single practice, it is very easy to be injured, so protective equipment in martial arts has been paid more and more attention. The protective effect of Wushu Sanda protective gear is related to the safety of every Wushu Sanda practitioner. The purpose of this paper is to study crystalline nanooptical materials and Wushu Sanda protective gear and propose the idea of using more crystalline nanooptical materials in the manufacture and use of Wushu Sanda protective gear. This paper mainly introduces the related content of crystalline nanooptical materials, martial art single-leg kick, and martial art single-leg protective gear and conducts experiments on crystalline nanooptical materials and martial art single-leg protective gear based on crystalline nanooptical materials. The experimental results show that the protective effect of protective equipment based on crystalline nanooptical materials can play a greater role than traditional protective equipment. In the experiments in this paper, the martial art single-leg kicking protective gear based on crystalline nanooptical materials has at least a 10% improvement in protective effect.

1. Introduction

With the improvement of people's living standards, more and more people who are interested in study and work will take time to participate in some activities, such as Wushu Sanda when they are in Wushu singles. However, there are often some factors that affect their own safety. Therefore, Wushu single protective equipment plays a pivotal role in the safety of martial art singles. Therefore, Wushu single-kick protective equipment plays an important role in protecting the safety of Wushu single kick. Due to its special microstructure, nanocrystalline materials have a series of excellent mechanical properties such as higher yield strength, hardness, and good wear resistance that conventional coarse-grained materials do not have and have attracted extensive attention from sports people.

In recent years, the safety of martial art single kick has become the focus of society and schools. How to effectively prevent and properly handle the safety accident of single kicking in martial arts is an important problem that all sectors of society need to think about and solve. The development of a reasonable use of martial art equipment is one of the ways to reduce safety accidents in martial arts. When practicing martial art movements, wearing martial art equipment reasonably can reduce self-injury caused by uncontrolled movements during practice.

With the development of society, nanocrystalline materials have attracted more and more attention. In one study, Shaat and Abdelkefi investigated the modeling and performance of mechanical resonators for biological cell mass detection, nanocrystalline material characterization, and human immunoviral disease diagnosis [1]. In their research, Ovid'ko and Sheinerman described the effect of free surfaces on grain boundary dislocation-mediated rotational deformation in nanocrystalline materials [2]. Likewise, other researchers have conducted extensive experimental studies on nanomaterials. Fang et al. experiments show that stress-driven grain growth will strongly affect the motion and distribution of dislocations in nanocrystalline materials. At the same time, their research also shows that nanotwins often originate from the generation and slip of partial dislocations, which are also affected by grain growth [3]. Tserpes et al. use finite element models to test and simulate tungsten-copper alloys with coarse and nanocrystalline microstructures. The effect of the sharpness of the

Berkovich indenter was also investigated. Experimental results show the superiority of nanocrystalline materials, with better convergence for the rounded tip of the indenter [4]. In terms of sports safety research, Hong et al. expand safe and healthy life sports activities in Korea by carrying out education, management, and best practices related to life sports safety in Germany and establish an accident prevention system in Korea [5]. At the same time, in order to examine the consistency of sports safety with school administration quality standards and teacher compliance practices, Jani et al. conducted an experiment using a questionnaire. The experimental results show that all schools have good quality standards for sports safety administration. There is a very close and important relationship between the quality standards of administration and the compliance of teachers' sports safety practices [6]. In the research of sports safety protective equipment, Park and Ko developed safety clothing, which is a must for young people to protect their bodies from accidental injuries and pursue activities and individuality [7]. These methods provide some references for our research, which have not been recognized by the public due to the short time and large scope of the relevant research. These researchers have outstanding performance in their respective research fields, but their research scope is often very large, which is not conducive to further in-depth experimental research.

The innovation of this paper lies in the research on crystalline nanooptical materials. Through the understanding of the properties of nanomaterials, especially the research on crystalline nanooptical materials, after fully understanding their unique mechanical properties, they are applied to the manufacture and use of martial art single-kick protective equipment. Through the use of crystalline nanooptical materials, not only can the role of nanomaterials be fully utilized but also the safety and reliability of martial art single-kick protective equipment can be improved. Nanomaterials and nanotechnology have provided new ideas and approaches for the research of modern equipment protection technology and laid the foundation for the breakthrough improvement of its performance.

2. Crystalline Nanooptical Materials and Motion

2.1. Crystalline Nanooptical Materials. Crystalline materials with a particle size of 1 to 250 nm are called nanocrystalline materials. Nanopowders can be used in thick-film technology to fabricate elongated conductive tunnels. The porous nanomaterial sintered body has strong activity and is suitable for catalysts and high-power capacitors. If the particle size of nanocrystalline material becomes smaller, its volume fraction will increase [8]. Generally speaking, the internal structure of nanocrystals consists of two different types of atoms. Atoms in a crystal are arranged in adjacent lattices, and there are different atomic spacings between grain boundary atoms. The proportion of atoms in the interface of nanocrystalline material is related to the tightness of the interface of nanocrystalline material. The following is a brief discussion on the related content of nanocrystalline materials [9].

2.1.1. Mechanical Properties of Nanocrystalline Materials

(1) Yield Strength. Yield strength is the stress that resists slight plastic deformation under external load, that is, the yield limit of metallic materials [10]. When the stress reaches a certain value and enters the yield stage, the deformation increases rapidly. At this stage, elastic deformation and local plastic deformation occur simultaneously. With increasing stress, the plastic strain changes greatly, but the stress and strain hardly change. This phenomenon is called yielding [11]. The maximum stress at this stage is called the upper yield point, and the minimum stress is called the lower yield point. Here, a relatively stable low yield point value is used as an indicator of material resistance, namely, yield strength or yield point [12]. The grain size has a great influence on the yield strength of the material. The most important factor affecting the yield strength is the size of the crystal force. Taking tensile strength as an example, under the same strain condition, for a sample with a small grain size, the smaller the uniformly distributed strain inside the grain, the smaller the dislocation density. Therefore, the yield strength is greater. The relationship between yield stress and grain size is based on the relationship between traditional coarse-grained materials, and its correlation formula conforms to the Hall-Petch relationship:

$$\partial_i = \partial_o + md^{1/2}. \quad (1)$$

(2) Scalability. Ductility refers to the property of a material stretching without breaking under an external load, and ductility refers to the property of a material rolling into a thin sheet without breaking under an external load. It is a mechanical property of a substance that expresses the ability of a material to deform plastically before fracture under force [13]. Under the action of shock and vibration loads, the material of the structure is required to be able to absorb a large amount of energy, and at the same time, it can produce a certain deformation without damage; that is, the structure or component is required to have good ductility. In conventional crystalline materials, the grain size decreases and the ductility of the material increases. The ductility of nanocrystalline materials is also affected by these deformation mechanisms. Zhang changed the grain size of the nanocrystalline material Zn by changing the processing times. The researchers found that the nanocrystalline material Zn can exhibit good strength and ductility at the same time after a period of treatment [14]. The processed material contains 30% larger grains. This optimal microstructure exhibits more strain hardening than other machined materials studied. It can be said that reasonable grain size distribution and strain hardening help to improve the ductility of the material [15].

(3) Anti-Hall-Petch Relationship. The general law of the Petch relationship is that the grain size decreases and the yield stress of the material increases. Figure 1 shows the HP relationship of the nanocrystalline material Cu.

From Figure 1, we can clearly find that as the particle size decreases below 25 nm, the HP relationship of

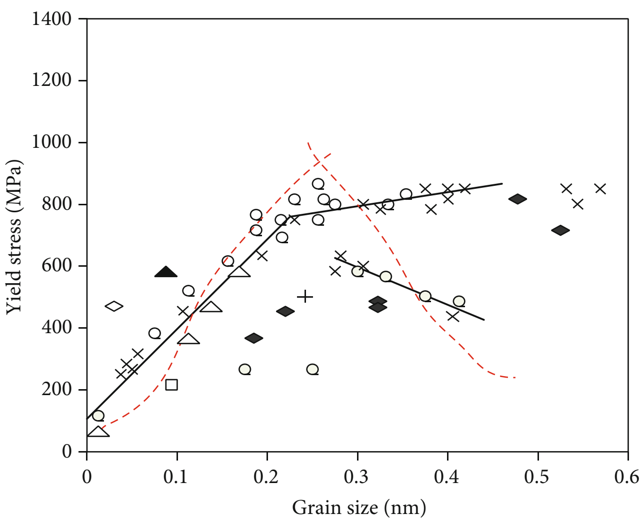

FIGURE 1: Variation of yield stress of Cu material with grain size from coarse to nanocrystalline.

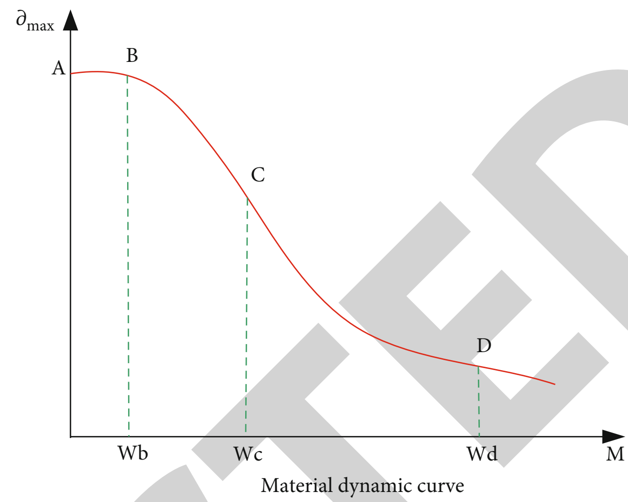

FIGURE 2: Fatigue curve of material.

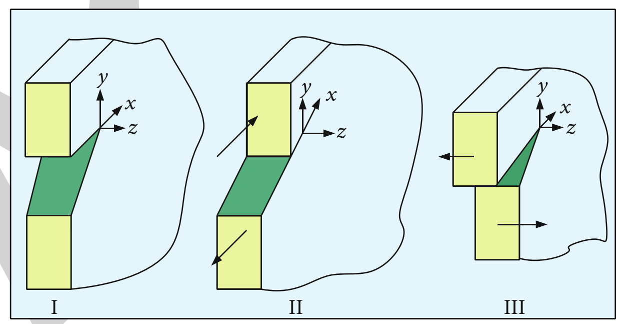

FIGURE 3: Three different forms of cracks.

nanocrystalline materials is not visible. The slope of the HP relationship for nanocrystalline materials decreases with decreasing grain size [16].

2.1.2. Fatigue Damage of Nanocrystalline Materials. Crack growth can be divided into two forms: unstable growth and subcritical crack growth. Unstable growth is a rapid crack growth process. An important condition for its occurrence is that the stress expansion coefficient of the crack tip inside the material reaches or exceeds the fracture toughness of the material [17]. Subcritical crack growth is a slow-growing process where microcracks develop inside the material before reaching critically fast and unstable growth conditions. For traditional fatigue testing, we get a very classic *SN* curve, the fracture curve between the cycles of the metal being fractured and the cyclic stress or alternating stress, where *S* and *N* represent the magnitude of the cyclic stress and fracture, respectively; pressure, respectively; and hours of the week [18]. The *SN* curve of the material can be divided into three parts: static strength stage, low cycle fatigue stage, and high cycle fatigue stage. Figure 2 shows the fatigue curve of the material.

The place where fatigue cracks are most likely to initiate is the place where it is most likely to slip, and the place that is most likely to slip is also the place where the local plastic deformation is the largest. Fatigue crack initiation, propagation, and fatigue strength are all affected by slip [19]. Grain refinement increases the barrier of grain boundaries, thereby slowing the initiation and propagation of fatigue cracks. The crack growth rate is a method for predicting crack growth rate and crack growth life of a mechanical structure, which belongs to the calculation method of the fatigue crack growth rate and crack growth length of mechanical structure. The main expression for the crack growth rate is

$$\frac{Da}{DW} = c(\Delta n)^t. \quad (2)$$

With regard to cracks, cracks are mainly classified into Type I cracks, Type II cracks, and Type III cracks. As shown in Figure 3, there are three different forms of cracks.

(1) Mechanical Model. For the establishment of the mechanical model, the first consideration is the critical condition of crack initiation at the twin boundary. Numerous studies have found that cracks in nanotwinned materials usually originate from three places: grain boundaries, twin boundaries, and slip zones. In the fatigue cracking study of nanotwinned materials, it is found that under high-cycle fatigue loads, cracks generally originate from twin boundaries, and the initiation mechanism is due to the stress concentration generated by elastic anisotropy on both sides, dual interface [20]. Under low-cycle fatigue loads, the location of fatigue cracks becomes very complex.

(i) *Schmid Factor.* Zhang expresses the relationship between the shear stress α at the twin boundary and the resulting dislocation density β:

$$\alpha = \alpha_0 + MNc\sqrt{\beta}, \quad (3)$$

where M is a constant, N is the shear modulus, and c is the Burgers vector. Since the orientation of the twin boundary has an influence on the critical condition of the twin boundary fracture, it can be known from Schmid's law that

$$\alpha = \varepsilon\lambda, \tag{4}$$

where ε represents the flow stress and λ represents the orientation factor. And due to the cumulative value of dislocations per unit length,

$$j = \sqrt{\beta}. \tag{5}$$

Derive from the above formula:

$$j = \sqrt{\beta} = \frac{m(\varepsilon - \varepsilon_0)}{MNc}. \tag{6}$$

If the average thickness of the twin boundary is set as E, the dislocation accumulation amount caused by different orientations is expressed as

$$j_m = \sqrt{\beta} = \frac{m(\varepsilon - \varepsilon_0)}{MNc}E. \tag{7}$$

(ii) *The Influence of Stacking Fault Energy*. The critical condition for considering the fracture of twin boundaries is only affected by the stacking fault energy. In face-centered cubic metals, in order to reduce the energy, a complete dislocation is decomposed into two incomplete dislocations, and the two incomplete dislocations are connected by a stacking fault band, that is, an extended dislocation [21]. When the extended dislocations are in equilibrium, the gravitational force θ per unit length produced by stacking faults and the repulsive force T produced by partial dislocations are balanced:

$$U = \frac{T}{\theta}, \tag{8}$$

where U represents the width of the stacking fault and is a constant. But when the dislocation moves and approaches the twin boundary, it will be repulsed by the twin boundary P. The equilibrium equation at this time is

$$P + \theta = \frac{T}{U}. \tag{9}$$

It can be seen from Wei Yujie's research that the expression of critical shear stress α during twinning deformation is

$$\alpha = \alpha_1 + \varepsilon\frac{8}{\pi}\frac{2-w}{1-w}\frac{E}{c}\delta k^i - \frac{2\theta_{th}}{Ek^i}. \tag{10}$$

As the shear rate α increases, the appearance of the extrudate shows unstable flow phenomena such as surface roughness, undulation, helical twist, and even melt fracture. Therefore, the shear stress during molding must be lower than α.

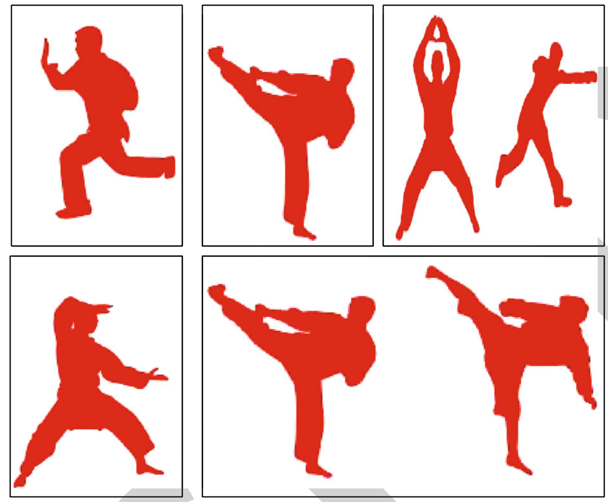

FIGURE 4: Martial art single kick.

2.2. Martial Art Singles and Their Protective Equipment. In a broad sense, martial art singles are also called sports. It refers to the basic means of consciously organizing social activities, improving people's physical strength, promoting all-round development, enriching social and cultural life, and promoting spiritual civilization [22]. Figure 4 shows martial art singles.

2.2.1. The Role of Single Kick in Martial Arts. Exercise promotes the growth of human bones and muscles, improves cardiopulmonary function, and improves the functional status of the blood circulatory system, respiratory system, and digestive system. In particular, it has a very important impact on the quality of people's mental health [23].

Mental health qualifications are formed by a combination of genetics and environment. They are intrinsic, basic, and relatively stable psychological qualities and characteristics. These psychological attributes and physiological characteristics determine whether to affect the individual's psychological, physiological, and social functions and then affect the individual's mental health [24]. Therefore, the quality of mental health is an important aspect of mental health that affects a person's level of mental health. Mental health quality and mental health are important signs of individual psychological phenomena. In a word, the quality of mental health is a stable psychological characteristic, and mental health is a state of psychological safety and happiness. The level of mental health quality is directly related to the level of mental health. Quality indicators of mental health often include many indicators of mental health.

(1) Evaluation Standard of Mental Health Quality. Scholars at home and abroad have a good understanding of the benchmark of mental health from different perspectives and social backgrounds. According to the college education and training goals and social development requirements of college students, the mental health standards of college students are determined by the following aspects: (1) normal cognitive ability [25], including sharp thinking, good memory, rich imagination, perception, and learning ability; (2)

Figure 5: Common sports protective gear.

healthy and stable interpersonal relationships: emotions, emotional stability, quick response, satisfaction, happiness and other positive emotions, as well as optimistic thoughts dominate, and can reasonably vent, adjust, and control negative emotions; (3) perfect personality, coordinated actions, excellent self-awareness, able to maintain the integrity and coordination of personality, and effectively control their own psychology and actions and keep the internal reflection of the action consistent with the external performance; and (4) harmonious interpersonal relationships: in study, life, and work, being good at communication and being able to objectively evaluate others, handle emergencies reasonably, accept the shortcomings of others, adapt to the environment, and establish harmonious interpersonal relationships.

(2) Mental Health Quality Measurement Tools. Mental health measurement tools are developed according to the development needs of various research fields, combined with definitions and evaluation criteria. At present, the commonly used mental health assessment tools mainly include the symptom self-rating scale and the Japanese revised personality question questionnaire. In addition, there are emotional state scales, depression self-assessment scales, mental health diagnostic tests, motor perception scales, existential personality scales, life events scales, and state characteristic anxiety scales. At the same time, the use of physiological indicators is mainly EMG, reaction time, heart rate and blood pressure, brain waves, and other evaluation methods.

2.2.2. Martial Art Single-Kick Protector. When people engage in martial art single kick, martial art single-kick protective equipment is essential. On the one hand, the protective equipment for martial art single-leg kicks needs to ensure that the personnel being used can be protected. On the other hand, the material of the protective equipment itself should not be harmful to the human body but provide high-quality protection for human activities. Due to the particularity of the composition and structure of nanocrystalline materials, its performance has been significantly improved compared with traditional materials, especially the particularity of super hardness, super modulus effect, etc., so it has become an important material for martial art single-kick protective equipment.

Table 1: Parameter comparison table.

Scope	Symbol	Value
Burgers vector size	*C*	0.266 nm
Taylor constant	Alpha	0.6
Lattice constant	Large	0.4 nm
Poisson's ratio	Phosphorus	0.49
Shear modulus	Meter	51 GPa

Table 2: Students' mental health scores.

	Know	Mood	Character	Adapt	Overall result
Actively participate in sports	68	79	64	78	289
Participate in sports occasionally	60	71	58	62	251

Table 3: Comparison of mental health quality in different age groups.

	Know	Mood	Character	Adapt
F value	10	5	3	4
Phosphorus	0.000	0.008	0.012	0.006

Table 4: Statistical table of protective effects of various types of protective gear.

	Ordinary protective gear	Nanomaterial protective equipment
Helmet	70%	91%
Goggles	69%	82%
Bracers	75%	93%
Waist protection	62%	80%
Knee pads	72%	86%

Safety protective equipment is a necessary preventive device to protect the safety and health of athletes during sports. Use specific shields, pendants, or floats to protect athletes through barriers, absorption, dispersion, and containment and protect part or the entire body of an athlete from external attack. The use of personal protective equipment is an important means to prevent or mitigate sports safety accidents. There are many classification methods for safety protection equipment, which can be classified according to the use, the protection part, and the nature of the raw materials used. According to different uses, it can be divided into cold-proof products, shock-proof products, antidrop products, mechanical trauma products, antifouling products, waterproof products, and life-saving products. According to the protective gear, there are 8 kinds of protective gears for the head, face, eyes, airway, ears, hands, feet, and body. The protective effect of various protective tools is limited. In order to prevent accidents, it is necessary to use protective tools correctly and choose protective equipment reasonably

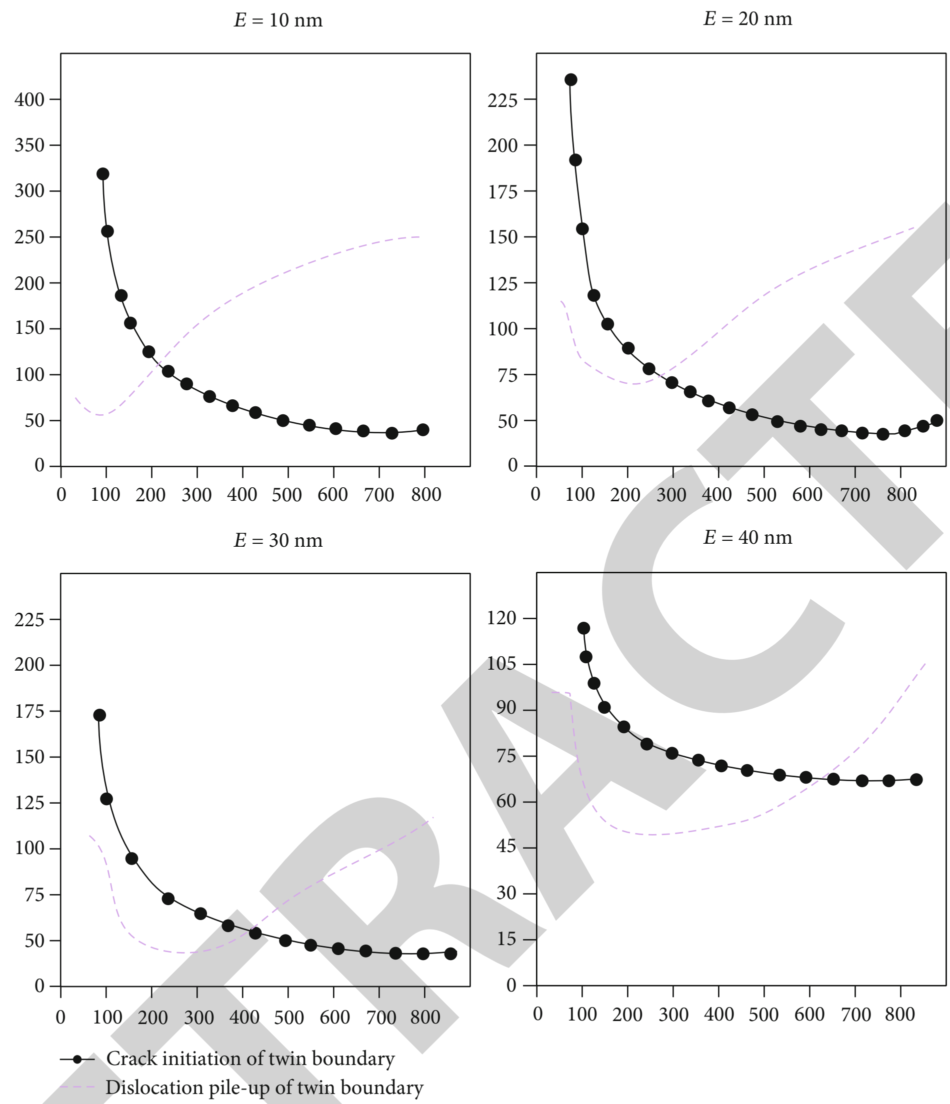

FIGURE 6: Relationship between crystal nanometer thickness and crack.

according to the type of exercise. Figure 5 is a common sports protective gear.

3. Experiments on Crystalline Nanooptical Materials and Martial Art Single-Kick Protective Equipment

3.1. Mechanical Experiments of Crystalline Nanooptical Materials. This experiment is based on the theoretical model of mechanics, taking crystalline nanooptical materials as the research object, to study the mechanical properties of crystalline nanooptical materials. In this experiment, pure copper samples with nanobimorph layers of different thicknesses were prepared, and tensile-tensile fatigue experiments under constant stress amplitude were carried out on these products. Pure copper has good electrical conductivity and is widely used in the manufacture of wires, cables, brushes, etc.; it has good thermal conductivity and is often used to manufacture magnetic instruments and meters that must be protected from magnetic interference; it has excellent plasticity and is easy to be processed by hot pressing and cold pressing. Table 1 is a reference table of the parameters required in the calculation process of the mechanical model.

3.2. Wushu Single-Kick Research Experiment. This experiment investigates the form of physical exercise and the quality of mental health of students in a university. Good psychological quality is the foundation of a healthy life for college students, and having a healthy body and mind is an important guarantee for their adulthood, talent, and success. Tables 2 and 3 show the mental health quality scores of regular and infrequent physical exercisers, the mental health status of different age groups, respectively, and quality comparison.

As can be seen from Tables 2 and 3, students who actively participated in sports had higher mental health scores in every aspect than students who participated in sports occasionally, indicating that students actively participated in sports.

3.3. Experimental Design of the Effect of Sports Protective Equipment Based on Crystalline Nanooptical Materials. For experiments on sports protective gear of nanooptical materials, first, an initial solution is provided; secondly, a metal compound is added to the initial solution and mixed under alkaline conditions to obtain an intermediate solution; finally, a quantum dot precursor is added to the intermediate solution to obtain nanomaterials, and then, the nanomaterials are added to the sports protective gear. During the experiment, a control experiment was also conducted on ordinary sports protective gear. In this experiment, data on the protective effects of different protective gears were collected. Table 4 is a statistical table of the protective effects of various protective gears in this experiment.

It can be seen from Table 4 that the performance of the protective gear with nanomaterial protective equipment is much higher than that of ordinary protective gear. It shows that nanomaterial protective equipment is better than ordinary protective equipment.

4. Experimental Analysis of Crystal-Based Nanooptical Materials and Sports Protective Equipment

4.1. Mechanical Experimental Results of Crystalline Nanooptical Materials. In this experiment, the mechanical properties of crystalline nanooptical materials were fully studied. During the experiment, the effect of the thickness of the crystalline nanomaterial bimorph on the crack suppression of the material was investigated. Combined with the experiments in this paper, a schematic diagram of the effect of the thickness of the crystalline nanooptical material wafer on the inhibition of crystal cracks is obtained, as shown in Figure 6:

It can be seen from Figure 6 that under the condition of constant applied load, when the thickness of the double crystal layer is $E = 10$ nm, the condition for the initiation of double grain boundary cracks is that the grain size $dG > 190$ nm; when the thickness of the double crystal layer $E = 30$ nm, the condition for the initiation of grain boundary cracks is that the grain size $dG > 420$ nm. From the data summarized in Figure 6, it can be seen that when the grain size cannot be refined, increasing the thickness of the twin layer can inhibit the initiation of twin boundary cracks, thereby improving the strength and hardness of the material.

4.2. Experimental Results of the Effect of Sports Protective Equipment Based on Crystalline Nanooptical Materials. According to Table 4, a comparison chart of the effects of sports protective equipment of different materials is obtained, as shown in Figure 7.

According to Figure 7, it can be concluded that it is a great improvement compared to conventional protection. It can be clearly seen from Figure 7 that the protective effect of sports protective equipment based on crystalline nanooptical materials has increased by an average of 12%.

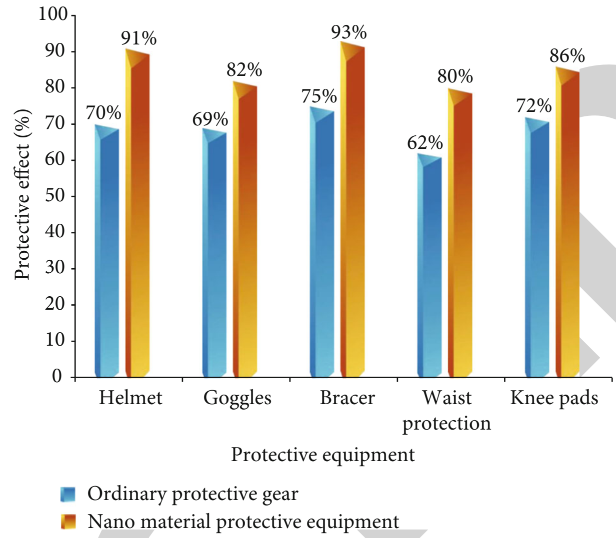

Figure 7: Comparison of different materials for sports protective equipment.

5. Conclusions

Nanooptical materials have high yield strength, hardness, and good wear resistance, making sports protective equipment based on crystalline nanooptical materials safe and reliable. Sex life is greatly improved. From the experiments in this paper, it can be concluded that the protective effect of sports protective gear based on crystalline nanooptical materials has been qualitatively improved, with a maximum increase of 21%.

Data Availability

No data were used to support this study.

Conflicts of Interest

The author declares that there are no conflicts of interest regarding the publication of this article.

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