



**The process of producing sustainable wooden
materials based on sustainable engineering in
China---Cork jewelry**

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<p>Abstract:</p> <p>The cork industry has developed rapidly in recent years, thanks to the environmental protection, unique material properties of cork materials and the high economic return of cork products. If the designer can use the material in a reasonable and reasonable amount, the use value of the material can be maximized. The development of cork jewelry is a powerful driving force for social and economic development on the one hand, and a green shield for the environment on the other. Therefore, it is very consistent with China's current sustainable engineering.</p> <p>This thesis uses the basic properties of cork as the entry point for writing and research. Cork appearance properties, basic physical properties, etc. are the basic research on cork in this thesis. On this basis, the paper launches targeted cork jewelry design research, and introduces in detail the sustainable production of cork. First, the cork jewelry design based on the appearance attributes of cork has the original shape, the color variety, and the natural and simple texture. The resulting cork jewelry has unique characteristics; then the cork jewelry design based on the basic physical properties of the cork is simple, easy to obtain, compressible and elastic, powerful and durable, there are many basic physical properties of cork, using its compressibility, elasticity, liquid impermeability, heat insulation, electrical insulation, abrasion resistance, and sound absorption and sound insulation. The appearance and function are integrated, showing the broad design space of cork material; then the cork jewelry design based on cork proposes: easy to press forming, integrated and natural, full of meaning, self-expression, and individual design concepts, which can be passed through machine processing can obtain modern cork ornaments, and hand-carved processing methods can be used to create cork ornaments with Chinese cultural characteristics.</p>	
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1. Introduction

1. 1 Introduction

The rapid development of social economy and the rapid development of science and technology has brought tremendous changes to people's lives. People's living standards have been continuously improved, and cultural shocks have affected people's daily lives from the side. At the same time, people's lives have been diversified from a subsistence type to a well-off society. A variety of accessories fill people's lives. The rich, diverse and fast-changing pace of social development has prompted people to increase their demand and requirements for accessories. While satisfying the appreciation, they also pay attention to the use of functions. The spiritual level of the requirements of advocating human nature, following the trend, expressing personality, has become an outlet for personal charm.

Speaking of the cork industry, I have to say that this is a new star that promotes social and economic development. From the initial small corks to various types of products, the types of industries are becoming more and more diverse. Cork materials have been cared for by designers due to their special material properties. Various cork accessories designed to add color to consumers' lives are loved by a wide range of consumers. The diversity of jewelry reflects the rich and complex practicality of materials, which is not only due to the talent of materials, but also the designer's keen perception of materials. The advantage of cork lies not only in its unique material properties, but also in its ability to contribute to the cause of green environmental protection. Cork has a strong renewable ability. After several years of trimming, a new round of cork material can be grown from trees. It is not difficult to see as far as the green sustainable development route, e. g the cork industry and the jewelry industry are concerned, cork is not only a simple usable material, but also a beneficial material that is beneficial to the sustainable development of society and economic growth.

However, although the trend of green design has received attention in recent years, more people are still needed to support it; the development of the cork industry is still in its infancy in China; the jewelry industry is developing fast and still needs to integrate more Elements to meet people's demands and stimulate the market to move forward.

Therefore, it is meaningful to understand cork, explore various properties of cork material, incorporate diversified elements into cork jewelry design, and achieve the unity of its form, function, and spirit. It is also the shining point in the sustainable wood material production project[1].

1. 2 Research background

(1)From the perspective of sustainable development, explain the necessity of studying cork.

Green design is now attracting attention, and many environmental problems have caused inconvenience and great changes in people's lives. As a renewable material, cork responds to the "green design" slogan, and the products derived from it are closely related to people's lives. The so-called design comes from life, design activities and social life are inseparable, so are materials and design. When people ask for raw materials from nature, they don't need to cut off the trees. Instead, they hire professional workers to peel off the bark to obtain cork material. The peeled tree will not die, and it will still take root and grow in the soil, that is to say, cork. It will not be exhausted or become scarce because of people's demands. After the big tree is peeled by professionals, the bark grows again after 6 to 9 years of trimming. At this point, its "green" characteristics are demonstrated, but a principle must be added before that-the right amount of time and amount. Therefore, if people use reasonable management and controlled solicitation, the supply and demand of materials can be balanced. Then, from the perspective of cork's green contribution to the environment, renewable and sustainable development, research on cork materials is needed [2].

(2) The use of cork has a long history, so this section mainly studies the historical necessity of cork. According to relevant records in the twelfth and thirteenth centuries, cork has been artificially used. The world cork industry emerged in the 1880s. With people's research and continuous attempts on cork materials, it has grown from an inconspicuous wine bottle into a wide range of industries, such as: construction engineering, transportation, culture and sports, clothing, interior decoration and many other fields. It is not difficult to find that it appears in people's lives in different identities: the floor, wallpaper, and ceiling in interior decoration have its presence;

when the decoration is completed, the choice of decorations, such as computer mouse pads, message boards, and note boards, carving and decorative arts and crafts have not been able to leave it; moreover, daily entertainment or daily necessities, such as badminton, fishing rod, baseball, softball, and umbrella also have its existence. The cork industry is a new type of industry in our country. In the early days of the founding of the People's Republic of my country, the cork industry took the lead in the development of coastal areas. As the economic benefits brought by the cork industry increased year by year, the benefits of driving urban development cannot be underestimated. Economic development has made the cork industry more and more important, from the initial few coastal cities to most industrial cities along the coast of China. With the development of the cork industry, the planting area of cork species in my country is increasing year by year. The annual output of cork raw materials is about 50, 000 tons. The main producing areas are mainly concentrated in the Qinba mountainous area of Shaanxi. In this view, it is necessary to study cork that surrounds all aspects of people's lives.

(3)There are three main types of cork processing enterprises in China: the first type of processing enterprises with supplied materials, this type of enterprise has low processing technology requirements and large supply. The main products processed and sold are the well-known cork stoppers and badminton heads. Among these products, cork stoppers alone account for 15% of the economy; the second type of raw material processing enterprises, which mainly produce semi-finished products of various specifications of cork particles, with relatively few product types; the third type of comprehensive cork Processing companies, such companies have a wide range of products, mainly purchasing raw materials or semi-finished particles, conducting deep processing, and producing various types of cork products, which are rich in types, mainly cork decorative flooring, cultural and sports products, household goods, etc. , the cork accessories referred to in this article Mostly from this type of enterprise. Various types of cork products have been well-known in recent years. The reason is that the properties of cork raw materials and the special cell structure make the material have the advantages of low density, elasticity, airtight, impermeable, and oil resistant, and are selected by many designers. The raw materials are convenient for designing

and processing to make various cork products. Among them, cork jewelry is developing rapidly, covering a wide range, and being close to people's lives. Therefore, it is important to conduct research on the design of cork jewelry that is selected and recognized by the public.

At present, the domestic research work on cork is weak, and great improvement is needed in the development of new cork products and enterprise technological innovation. The green benefits, economic benefits, and social benefits brought by cork cannot be ignored. Deepening research on it can make better use of materials. While creating new products, it is undoubtedly important to increase the utilization rate of materials as much as possible and reduce waste. This article picks up one of the rich cork products, cork ornaments, and conducts a multi-faceted understanding and understanding, combined with the analysis and utilization of the properties of cork materials, hoping to have a feasible guiding role in the design of cork ornaments.

1. 3 Research status and level at home and abroad

1. 3. 1 Research status and level of cork industry at home and abroad.

Cork has a long history of use in the world development process. According to relevant records, as early as the 13th century, the Portuguese promulgated relevant regulations to protect cork tree (one of the tree species that grow cork), which is even better than the origin naming system for any wine is early, and cork has become the main export product of Portugal. my country has recorded it as early as the Spring and Autumn Period and Warring States Period. Not only that but also the use of cork in many countries has been recorded for a long time. The ancient Greeks and Romans used cork to make shoe soles, honeycombs and buoys.

First of all, there are detailed and comprehensive records on the correlation research of cork cell structure. In 2008, Luo Shehong concluded in his paper "Exploring the Development Road of Cork Industry" that my country's cork industry started late and is a new industry in my country. At present, the cork industry has made preliminary

development with our country, but the research on cork is still at a blank stage, especially the chemical properties and microstructure of cork. But looking at foreign countries, they have been understanding and researching cork materials a long time ago. In 1664, Robert Hook was the first to use a microscope to observe sections of cork cells and define the gaps observed as plant cells. Under the microscope, he saw the parenchyma cells neatly arranged in cork cells. Not only that, he also concluded that these cells are closely arranged and have no gaps; in the 1970s, Holloway did relevant research on its cork layer in 1972, 1982, and 1983 respectively. In 1981, it was confirmed that cork resin constituted the main part of cork. In the same year, Gibson L. J proved in-depth that the cork cells are tightly integrated between the two adjacent sides. In 1987, Pereira et al. magnified the cork cells 1000 times and observed that the cork cells were granular and spherical. They were visually expressed using mathematical models, which was recognized by many researchers. With in-depth research on cork cells, Grace J and Pereira H concluded in 2004 that there are lenticular lenticules arranged radially in the cortical cells of the cortex ridge, and the stomatal passages on these lenticules are hollow round bodies. Next, Lewis et al. conducted an in-depth study on stomata and found that the number of stomata affects the quality of cork. The larger the area of the stomata, the worse the quality of the cork. At the same time, with the unremitting efforts of researchers, the research on cork properties has developed more and more extensively and in-depth, which has opened the door for people to deeply understand cork.

There are also many researches on the physical and chemical properties of cork materials. In 1990, physical properties such as viscoelasticity, thermal conductivity and water absorption were studied. In 1992, Kim and Rosa conducted research on the tensile and compressive properties of cork. In 1994, Chinese scholar Zeng Xinde summarized the characteristics of cork in 'Unique Cork Decoration Materials', and hereby explained the special cell structure and composition of cork, making it a unique and charming natural material. Cork is composed of many six-body cork cells arranged and stacked in a honeycomb shape, and its pores are 75-80%. The cavity of each cork cell is filled with air, and the cell wall and the intercellular layer between adjacent cells are "filled" with a chemically stable "resin" material (cork cell), so that each cork cell It

becomes a relatively independent sealed cell unit, impervious to water and air, so the cork has the ability to restore its natural state when it is pressed. Moreover, when the cork cells are compressed, only the air density in the cell cavity increases, which makes the cork have good compressibility, that is, when the cork is compressed, only the thickness is reduced without lateral expansion, indicating that the cork has good moldability. At the same time, cork is also an excellent thermal insulation material. In 1997, Riu pointed out in the paper that cork has strong adhesion and the degree of cork decay depends on the resistance of cork resin to fungi. So far, there is no detailed analysis of this performance in China. When Rocha and Goodfellow analyzed the chemical composition of the cork material, they determined that there are fatty acid polyesters and unsaturated fatty acid polyesters. In 2001, Kolattukudy recognized this conclusion in a paper, and because of this finding, the cork has corrosion resistance. It also has fire resistance and insect resistance, as well as the ability to not be destroyed by general chemicals. In 2002, Joao conducted research on the elastic modulus of cork materials. In 2007, Liu Yanzhen, Shi Xiaojuan and others summarized the research status of the macroscopic, microstructure and excellent physical properties of European cork by domestic and foreign scholars in the article "Research Progress on the Structure and Physical Properties of cork. In 2009, Zhang Licong in the paper "Research on the Natural Corrosion Resistance of Cork and Its Products" after research and determined that the corrosion resistance of cork is Grade A, which is a material with natural corrosion resistance. In 2011, Hao Qifeng conducted related experiments and researches on the weatherability of cork materials in the "Research on the Weatherability of Cork and Its Main Products", and summarized the anti-aging measures and applications of cork and related products for different reasons, which meant to improve the cork and its related products. The anti-aging performance of its products and delaying aging provide feasibility theoretical support. On the other hand, it improves the quality of my country's cork products and enhances the competitiveness of my country's cork products in the international market. In 2012, Jia Ting took his composite materials as the research object in his thesis "Research on the Sound Absorption of Cork Agglomerated Materials". Through a series of studies, he analyzed the thickness, density, substrate type, composite structure and the influence of factors such as the thickness of the left cavity on the sound absorption performance of the

material. Zheng Zhifang said in his book "Bark Chemistry and Utilization" that the structure and chemical components of cork materials are different from wood substrates.

To use the material perfectly, it is necessary to study the appearance properties of cork materials. The appearance characteristics of cork materials are introduced in "Back to Nature Cork Decoration Materials". When it comes to cork, the most attractive charm lies in its all-natural and disorderly patterned decorations. surface. The texture is clear and beautiful, and the lines are varied and colorful. With the soft gold and the honey color of the shade, the cork tone of the natural color gives a warm and beautiful visual effect. Some varieties are artificially dyed on the basis of natural board surface to make the pattern color more three-dimensional. The finishes of all products are full of vitality and change, showing a faithful and natural return mentality everywhere, without the feeling of artificial carving. Because of this, cork is deeply loved by people.

In the research on the environmental performance of cork materials, first of all, people's concept of environmental protection has not been revealed in recent years. Green topics have long become an international hot spot, and the concept of green environmental protection has been paid more and more attention by the public. The American design theorist Victor Barbarnack argued in his book "Designing for the Real World" that designers should shoulder heavy responsibility for the social and ecological environment, rather than design for profitable consumption. With the rapid development of society, people's social activities consume the earth's energy, and the metabolites produced at the same time increase. Gradually, the environment has changed, and various environmental problems have become the topic of much attention. At the same time, my country's industry has developed rapidly and has gradually become the world's largest processing power. In addition to economic development, there are also a series of environmental problems brought about by industrialization. This has also become a problem that we pay attention to. At the end of the 20th century, Green design is sweeping the world, and China is deeply influenced by it. Cai Jun, director of the Industrial Design Department of Tsinghua Academy of Fine Arts, once said that the requirements of social sustainable development indicate that "green design" will become one of the hot spots of industrial design in the 21st century.

Nevertheless, at the time when the topic of green is so concerned, and products such as cork jewelry are popular in the society today, Chinese researchers have not discussed much about the design of cork jewelry, and relevant information is relatively small, but the cork industry and jewelry design as far as the field of green design is concerned, there are many valuable points for reference. In 2011, Zhou Bin said in the "Enlightenment of Green Design Thoughts to Product Packaging Design" that ecological design is also called green design, which is a design concept that emphasizes the ecological balance between the environment and people. This design concept attaches importance to recyclability, disassembly, maintenance, reusability and so on, because the natural environment is closely related to human survival and cannot be seen separately. Therefore, design is also a human social activity that shoulders certain social responsibilities. We can easily draw from the activity itself: materials and design activities can be described as inseparable. When it comes to cork, we have to pay attention to its "green" attributes, as a renewable rare resource that conforms to the trend of society should be valued by people. In 2010, it was mentioned in the "Environmental Protection Material that Cork Should Be Valued" that at the Shanghai World Expo, the Portuguese Pavilion matched the theme of the World Expo "Better City, Better Life" and displayed buildings made of high-quality cork. Canada in 2015 There was a dispute with the United States on the cork trade issue. By 2015, the two sides had a cork trade cooperation relationship for 5 years and the transaction amount was large, indicating that cork is one of the important materials needed by both parties. All these have proved that Portugal and other countries attach great importance to cork. For unknown reasons, cork, such an environmentally friendly material, is not sought after in the Chinese market. Looking at the distribution of resources, my country is a big growth country for cork materials, mainly in the Qinba area. Cork companies have grown from more than 100 in the late 1980s to 493 with a scale in 2013, but we are still the utility of cork in China needs to be developed and explored, and the use of cork in the country should also be strengthened. Speaking of foreign countries, the Italian-Italian-Sardinian Cultural Exchange Association in the article "Italian Oak Contains Soft Business Opportunities" talked about the research and development of the professors and designers of the University of Sardinia in Italy over the years, and the development of energy saving and environmental protection. Thousands of cork products such as construction and decoration materials, exquisite home decoration

crafts, creative and unique office supplies, and luxurious fashionable clothing hats have formed a low-carbon, environmentally friendly and sustainable cork production chain. In "The Magical Green Material of Cork", Wang Zhou mentioned that with the continuous expansion of the environmental protection concept of "sustainable development" and the popular support, coupled with the rapid development of the high-tech industry, the application of cork in my country has also expanded. Open up a brand-new field. Space shuttles and satellite launch rockets use high-quality cork-made outer shell insulation panels, and nuclear submarine ventilation ducts and air-conditioning facilities inner insulation devices also use magical cork-made materials. These new uses have doubled the value of cork, and cork is getting closer to our lives. People are also expecting that in the development process of the cork industry, the harmonious interdependence of man and cork, and man and nature will deduce a modern version of the magical story of cork. From another perspective, the cork industry has a good development prospect in my country.

From the above analysis, it can be found that foreign research on the properties of cork materials is relatively comprehensive, including the cells, layers, physical and chemical properties of cork, and the application of cork materials' environmental performance. On this basis, domestic scholars are also accelerating the pace of research on cork properties, which has played a huge role in promoting the development of the cork industry, and is also a solid foundation for the author's understanding of cork materials [3].

1. 3. 2 Research status of cork products at home and abroad

As early as thousands of years ago, cork stoppers were found in Egyptian tombs. The ancient Greeks and ancient Egyptians used cork to seal olive oil or wine bottles. This material is slowly being used in a wider range of fields. This is the embryonic form of the development of the cork industry. Until the last 25 years of the nineteenth century, the cork industry began to develop, and it can be said to be the pillar economy of the city. This is the follow-up development of the cork material, and it is still being written today. Among them, the demand for various cork products is increasing, and the types

of products are also increasing. Cork jewelry has entered people's lives and its presence is everywhere. The development prospects of cork jewelry design should not be underestimated [4].

According to relevant statistics at the end of the 1980s, there were 100 cork companies in my country, processing 40, 000 tons of cork annually, with an output value of 50 million yuan, and a profit of nearly 10 million yuan. The products are low-value cork bricks, cork stoppers, Mainly products such as cork paper. With the development of the past ten years, there are more than 100 various cork enterprises in my country, which process more than 60, 000 tons of cork annually, with an output value of more than 250 million yuan and a profit of about 60 million yuan. This shows that my country's cork production and market demand have grown rapidly, and the main products have shifted from low-value products to high-value products, such as cork flooring, cork handicrafts, and home accessories. In 2004, Zhao Ge, Duan Xinfang and others made a summary analysis based on the development status of the cork industry combined with the current status of the world's cork processing and utilization, and put forward suggestions and countermeasures for the development of my country's cork industry. In 2006, Zhong Guanghua wrote about the distribution of cork resources in the world in the article "Overview of the Cork Industry", summarized the excellent properties of cork, and gave a general overview of common cork products. Not only that, but also analyzed my country Cork Industry Institute. Existing problems. These have helped the author understand the cork and the development of the cork industry in the country. From January to December 2014, the national cork products and other wood products manufacturing industries completed a total of 62. 649 billion yuan in main business income, a year-on-year increase of 15. 07%. The data shows that the cork industry creates significant economic benefits and is a powerful social and economic driver.

It can be seen from the above materials that due to the special properties of cork materials, it has a wide range of applications and rich varieties of cork. Domestic cork ornaments still need innovative development in design, and the development of cork ornaments deserves the attention of the government. Improving the processing and production technology of cork is equivalent to stimulating the development of the cork industry. In the study of cork processing methods, Wu Biyang summarized the methods

of improving the utilization rate of cork and the experience of improving production technology in the article "Wuchang Cork Factory Cork Processing and Production Experience", and listed the improvement of cork brick, cork paper and cork bottle stopper productivity. The processing and production methods. Yang Mingzhu" Cork Product Factory New Process and Equipment Transformation" made a detailed description and summary of the advantages and disadvantages of cork processing. In 2008, Zhou Wei focused on cork materials in the "Cork Fiber Composite Materials Research" The shortcomings of the cork coalescing board, adding fiber as a reinforcement material, discussing the production process of cork composite materials, and comparing the performance of various cork products. Then in 2009, Lei Yafang, Zhou Wei etc. In the paper "Research on Cork and Asparagus Fiber Composite Materials", people said that most cork peeling cannot be directly processed into natural cork products. Generally, they are crushed into cork particles of different thicknesses with a grinder. Then it is winnowed to obtain relatively pure cork particles, and then glued with various adhesives to produce a variety of cork products. In 2011, Lu Quanji discussed cork decoration in the article "Research on the Main Processing Technology of Cork Facing Materials" The three main production processes of the surface material production process, including hot pressing, cutting and surface coating, are studied. In 2013, Zhang Xin introduced the cork material technology in the "Cork Furniture Design Research", combining modern technology and cork material characteristics and Applied in home design. Daniel Michalik's design team explored the manufacturing process and craftsmanship of cork jewelry in Brooklyn's studio. Qiu Zengchu and others summarized China's cork resources in "Cork Product Research, Industrial Development and Standardization System" The shortcomings: limited resources and the material has been used as raw materials for export or primary applications such as cork cardboard for a long time. "The status and development trend of cork puffing treatment" said that the traditional foreign cork puffing treatment method is also boiled in water, and the cork is used in the steamer. The pure water is boiled for about 1 hour, and then sorted. In addition, the relevant treatment methods abroad are introduced[5].

In the research of cork products, in 1994, Du Ziwei concluded that because cork has good properties, it is widely used in industry and construction because of its unique excellent properties. In 1997, Wang Xinjian took my country's cork rubber products as

the subject of investigation in "Cork Rubber Products" and introduced the characteristics, tests and applications of cork rubber products made by organically combining rubber and cork particles. In 1998, Shao Xuedong wrote in his paper "A Brief Talk on the Production and Quality Control of Wine Cork Stoppers" that cork is not only used in wine corks, but also widely used in low-temperature laboratories, chemical equipment, high-end building insulation, highway, bridge, culvert, and airport runway shrinkage joint filler. In addition to these, in 2000, Huang Guodan wrote in his paper "Treasures of Insoles—Cork Warm Fitness Insoles" that cork materials were also processed into power mechanical seals, shockproof, brakes, and friction plates. In the same year, Zhu Shineng continued to expand the use of cork materials in the paper "Magic Cork Environmental Shoe Material and Finished Products Landed in Hangzhou". The sound-absorbing materials in broadcasting rooms, theaters, and dance halls were also made of cork materials. More than that, there are cork materials in cold storage, cars, ships, and oil depots. Cork materials are not only widely used in industry. In 1989, Du Ziwei concluded in his thesis "Cork Products and Applications" that cork is mainly used for cork floor, wallpaper, ceiling and other decorative materials in civil use. In 1998, Hu Yimin and others discovered that cork is still a good material for making table tennis rackets. From 1990 to 1991, Li Dalian, Fan Yuming, Yang Jun and others summarized in detail the products of cork in civilian products, including computer mouse pads, coasters, bath mats, note boards, message boards, bulletin boards, decorative paintings, etc. Decorative crafts, as well as baseball cores, fishing rod handles, badminton heads, softball cores, shoe materials. In 2000, Huang Guodan added that cork is also used to make elastic materials for pillows and other appliances. In addition, a study by Karade and Irle in 2001 showed that cork can not only form a composite material with Asparagus, Salix and straw fibers in a certain proportion, but also has compatibility with cement. In 2005, Zhan Zhongxian] elaborated in detail the preparation process and the influencing factors in the reaction process of the one-component polyurethane glue for cork products in "Development of Polyurethane Adhesive for Cork Products". In 2008, Liu Hongling, Ma Xueliang, and Lei Yafang discussed cork furniture, cork bags, cork mats; cork flooring, cork wall panels, ceilings, and cork floors in "Application of Cork in Furniture and Interior Design" The application of mats, cork paintings and cork crafts in interior design. Let the author realize that with the development of social economy, people pay more and more

attention to the use of natural materials in homes, and cork, as a natural material, enters people's lives and is accepted and loved by the public. At present, natural cork stoppers on the market mostly use cork with low density and good elasticity, while domestic cork cork has a higher density. In 2013, Zhang Xin defined cork furniture in the paper "Research on Cork Furniture Design" and analyzed its production process and material technology. And on the basis of research, combined with our country's actual cork raw material life cycle theory, it summarizes several laws of material-driven ecological furniture design and two important ways of cork furniture design. The reporter Li Jian reported in the article "The new favorite of low-carbon and environmentally friendly life-cork products" that the reason why cork products have become the new darling of today's decorative materials industry is mainly due to the many natural advantages of its own characteristics. The most important thing is that it is processed Advantages such as less pollution in the process.

Regarding the relevant research on cork crafts, in 1998, Wu Ming wrote in the article "Research Progress in Cork Buildings" and outlined that cork and wood can be used to make crafts through carving, such as cork photo frames, cork candle holders, cork wallets, cork backpacks, Puzzle blocks, message boards, cork paintings, etc. Among them, Chinese cork painting is a characteristic handicraft of our country, which has always been well-known in the world. The paper also introduced that Chinese cork painting has the characteristics of combining "painting" and "carving". It is a decorative handicraft made of natural cork with soft texture and delicate texture through the design and processing of the artist. In 2007, Yu Siwei gave a detailed introduction and interpretation of the unique art form of cork painting in "Interpretation of Fuzhou Cork Painting". Cork painting is one of the three treasures of Fuzhou, with Chinese characteristics and more local characteristics. It is another Chinese sculpture category. Door unique craftsmanship. In 2008 and 2009, Wei Feng, Lin Gengsheng, and Lin Xinfang gave detailed explanations on the rise and fall and current situation of cork. Cork painting is a work of art with historical heritage, but because its economic value has not been recognized, plus The production of a piece of work takes a long time, and it is difficult for the artists in this industry to guarantee their lives. It is a pity that the cork painting has gradually declined due to this. In 2009, the author of "Looking at the

Inheritance of Arts and Crafts from the Rise and Fall of Cork Painting" gave a detailed description of the development of cork painting, and proposed to combine cork painting with the local tourism industry to promote the development of the cork painting market. In 2013, Chen Jieyin introduced the aesthetic value and artistic accomplishments of cork painting in "Fuzhou Cork Painting Art Language and Aesthetic Value Research". Cork painting is a unique art form in China and should be highly valued and should be passed on from generation to generation. In the same year, He Ping discussed the relationship between the protection of intangible cultural heritage and the sustainable development of regional cultural tourism for cork paintings. He believed that intangible cultural heritage is an important resource for tourist areas and an important force in promoting social development. Then in 2014, Ye Ye gave a related explanation on the protection and development of Fuzhou folk crafts and cork paintings. The inheritance and development of cork paintings are inseparable from the support and attention of the government. In 2015, Liu Yansong and Shu Peng introduced Wu Chuanfu, the inheritor of my country's cork painting intangible cultural heritage in their article "Awesome workmanship, showing the beauty of nature. " Innovation-driven development is a good choice, which requires the support of contemporary young people [6].

Related research on cork for ornaments, cork ornaments are ornaments made from cork as the main raw material. Its main feature is to retain the natural characteristics and color of the material, and it can play a role in space or occasion or use. Certain functional or decorative items. There are many types of cork jewelry. Many people who travel to Portugal can find that packages made of cork are everywhere. This is because the cork industry in Portugal is very developed and is one of their three major industries. Cork products are the most cork. However, there are very few related documents on cork jewelry, but there are many documents on jewelry design, which also provide assistance in writing this article. Among them, "Research on the Application of Materials in Jewelry Design" mentions the understanding of materials and how to select materials. The combination of the characteristics of the jewelry and the design of the jewelry provides innovative ideas for design and development inspiration. "The Status Quo of Coral Jewelry in Taiwan and Its Innovative Design" discusses the innovative design of coral jewelry, analyzes and draws on outstanding designs, and learns from

outstanding works is a good way. "Ceramic Jewelry Research and Design Practice" introduces the design techniques and design elements of ceramic jewelry, integrates multidisciplinary knowledge of color psychology, ergonomics, and consumer psychology, and conducts analysis and research on ceramic jewelry design. "Research on the Design of Interior Accessories Based on Aesthetic Principles" elaborates on the principles of matching accessories in the interior. "The Application of Shaanxi Folk Paper-cutting in the Design of Home Accessories" introduces the design method of folk art paper-cutting in the design of interior accessories. "A Discussion on the Formal Beauty of Contemporary Ornament Form Design" designs ornaments from the design techniques of ornament form, which is helpful to the author in the ornament form design. In "Research on Knowledge Management Technology Supporting Innovative Design of Jewelry", the author helped the author on the innovative research of jewelry and the summary of knowledge. In the "Research on the Principles of Visual Design in Composition Design", the author explained that cultivating designers to understand the rules of product form beauty in design, improving the beauty of shapes, and enhancing the ability of creative thinking play an important role in product design. The author of "Application of Modular Design Principles in Product Modeling Structure" concluded that modular design is very suitable for product design, shortening the production time period, free assembly, and economical prices, and should be taken seriously in design. "Research on Household Goods Design Based on Nostalgic Psychological Phenomenon" found that emotional design can meet the needs of different users through a series of investigations and studies, which shows that the introduction of emotional design into the market can enrich the market. "Analysis of the Aesthetics and Application of Soft Decoration in Modern Living Room Space" mentioned that the soft decoration design is the perfection and deepening of the interior space, can enhance the atmosphere, and can also play a "finishing finishing touch" role.

The above literature and knowledge have been researched and analyzed for jewelry design from different angles, and integrated with multi-disciplinary knowledge to enrich jewelry design methods and theories, and provide some theoretical foundations for the cork jewelry design methods of this topic.

1. 4 The purpose and significance of the research

1. 4. 1 Research purpose

Wood has always been a necessity of human life. It can be used in daily life and decoration. However, the exploitation of forests by humans for a long time has made the current wood resources gradually scarce. Therefore, we design and develop cork accessories according to the special attributes of cork. Diversified jewelry to increase the added value of jewelry. Through the development and design of cork ornaments, the competitiveness of the ornaments industry is improved, so as to promote the sound development of the cork ornaments industry, thus reflecting China's sustainable wood material production project.

1. 4. 2 Research significance

While the rapid development of society brings economic benefits, it also brings environmental pollution. As the main body of society, from the perspective of long-term development, human beings have an irreconcilable responsibility to actively protect a large environment in harmony with nature. Moreover, with the popularization and in-depth understanding of the green trend of thought, the influence of design activities on people's lives will surely affect people's perceptions. The awareness of low-carbon and environmental protection is deeply rooted in people's hearts and becomes a spontaneous behavior, thereby making it possible to make a comprehensive life green. Then, the design that pays attention to green materials is unstoppable, and design as a practical activity also shoulders this important task. From this, it can be seen that using green materials as raw materials for jewelry design is the correct decision to achieve green design.

The cork industry is constantly developing and has become an inseparable part of people's lives. The use of cork materials not only realizes the use value of commodities, but also the raw material itself has the attributes of green and environmental protection. Use it as a raw material for jewelry design to the environment brings huge benefits and brings double added value of "green" and "multiple gold" to commodities, which is of extraordinary significance.

Through a series of investigations, it is known that my country's jewelry design is still in a passive state, mainly due to lack of originality. Jewelry closely fits people's lives. It not only needs to satisfy a certain function, but it also needs to be ornamental to a certain extent. The so-called functionality means that the accessories must first be used by people to meet the needs of people's lives. This is the most basic value of the product; the so-called ornamental means that this kind of home furnishings must conform to the aesthetics of the public and reflect a Kind of beauty. Ornaments are the unity of practical value and ornamental value, and it is worth exploring.

1. 5 Research content and methods

1. 5. 1 Research content

This paper will take cork as the main research object, starting from the various properties of cork materials, combining relevant theories and knowledge, analyzing the current design principles and laws of cork materials, and discussing new directions for cork jewelry design. The specific research content is as follows:

The first part: literature review part, to understand domestic cork resources, the in-depth study of cork materials related properties mainly includes three aspects:

- the appearance attributes and characteristics of cork
- basic physical properties of cork
- general view of cork

The second part: Cork's unique attributes and the study of the correlation between jewelry design, including:

- Overview of cork related concepts
- Cork material appearance attributes and jewelry design correlation
- The basic physical properties of cork materials and jewelry design
- The relevance of cork material and jewelry design

The third part: Cork jewelry design practice, through design practice to prove the feasibility of the conclusion of this paper, and on this basis, perfect the theoretical system of cork jewelry innovation design.

1. 5. 2 Research method

(1) Literature research method: by reading a large number of professional literature materials, consult domestic and foreign websites, such as: "Extreme Utilization of Cork Resources", "Cork Furniture Design Research", "Cork Resources and Utilization", "The Current Status of Cork Processing and Utilization in the World" And my country's Cork Industry Development Countermeasures", "Research on the Design of Interior Accessories Based on Aesthetic Principles", "Research on the Design of Wooden Ornaments", etc. to establish and improve the theoretical system of cork jewelry design. Understand research trends at home and abroad, obtain relevant theoretical results and methods, and lay the foundation for in-depth research on the subject;

(2) Comparative analysis method: by comparing domestic and foreign production's status, theory and practice, entity and imagination. A comparative analysis is carried out to find out a plan that can improve the design of cork jewelry;

(3) Research method: Through the investigation and analysis of various cork ornaments on the decorative surface, the relevant materials are further collected to prepare for research.

2. OVERVIEW OF THE BASIC PROPERTIES OF CORK

2. 1 Cork

Cork refers to the bark peeled off from cork storage or cork ridges. It is not a kind of wood in the strict sense. It is generally called cork because of its soft texture, and it has been called until today. In this article, because the shape changes after machining, they are also called cork particles, but they are actually the same substance. Cork is selected as the design object because the special properties of cork material meet the design needs in many aspects, and it can perfectly fit the form requirements and functional requirements required by the product. In the production process of cork jewelry, traditional wood processing techniques, such as sawing and planing are generally not used, and the natural appearance and physical properties are mainly used as much as possible. This makes the jewelry basically do not need iron nails, and the jewelry is easy to press and form. The structure is simple and independent, and there are basically no connectors required, which is the unique point of cork jewelry. Most of the cork jewelry designs mentioned in this article show the natural color and texture of the cork material. This is due to the rustic color of the cork material and the simple surface texture effect. Generally speaking, the final jewelry gives a fresh and natural closeness. Sense of. In addition, a small part of cork is processed by bleaching, dyeing, engraving and other processing methods to enrich the intuitive diversity of jewelry and improve the design sense and economic and artistic value of jewelry.

There are four main types of cork trees: *Quercu surber*, *Quercu occidentalis*, *Quercu pseudosuber*, and *Quercu surber* in Europe and Africa, and *Quercu pseudosuber* in my country and Japan. According to relevant data, cork tree is one of the most widely distributed tree species in my country, and its planting area accounts for 44. 1% of the country's planted area. It is mainly distributed in more than 300 counties in Shaanxi, Gansu, Sichuan, and Yunnan. Among them, my country The Qinba mountainous area has the richest resources and is the main exporter of my country's softwood material output.

Cork tree is also one of the important economic tree species in my country. The diameter of the tree species to be stripped for the first time needs to be more than 60 cm. It usually takes 20 years of growth. It is also called primary skin. The one that peels off again is called regenerated skin or secondary skin. Each round stripping takes about nine years. A cork tree can generally be stripped about 10 times. The time interval for stripping is long, which is the shortcoming of cork. But the function of cork tree is not only to produce cork material. In addition, its various parts have many uses. The branch right of the tree is a good place for cultivating fungus. The fruit of the tree can be used for wine and feed. The leaves can be used to raise silkworms, and the tree itself is also a good hard broad-leaved material. It can be seen that planting cork trees is not only a cornucopia for obtaining cork materials, but its comprehensive utilization value is very high.

2. 2 Appearance attributes of cork

2. 2. 1 Morphology

Cork is the bark of cork ridges. Normally, it is a thick shell attached to the trunk and branches. The cork material is obtained by hand-picking and peeling by professionals. The peeled cork is lumpy or flake, with a curved shape, similar to a roll of paper. What this form presents is a natural form without any artificial and mechanical processing, which can be expressed in a non-representational way. Figure 2. 1 is a cork that has been manually peeled and placed to dry. It is obviously curled.

Before using the cork material, the obtained material is usually subjected to high temperature disinfection treatment, and then the machine is used to break it into granules or powder after drying. This is to facilitate the long-distance transportation of the material and the use of molding machines to make jewelry in the future. It is the granular form of cork raw material. Figure 2. 2 shows the cork raw material that has been crushed into pellets for easy transportation.

When cork is used to make cork products, granular or powdered cork raw materials are used, and the cork products are made according to the designer's ideas through the combination of professional mechanical equipment and corresponding processing materials. Most cork accessories are also made in the same way. At this time, the cork has different shapes, satisfying the designer's drawings or the shape that the public loves. This is because the special cell structure of the cork material allows the cork to be produced in thousands of different shapes. Figure 2. 3 is one of the cork ornaments that are processed and formed, which has the function of heat insulation and can also play a certain role in decorating the interior space of the cork coaster.



Figure 2. 1 Stripped cork[11]



Figure 2. 2 Cork pellets[12]



Figure 2. 3 Cork coaster[13]

2. 2. 2 Color

Cork ridge grows in the Mediterranean climate area, loves sunlight, and is particularly adaptable to climate and soil. The color of cork, no matter how dark or light it is, always feels new and natural.

There are many colors of cork products in daily life. This is because the cork grown on different trees shows different colors, and even the cork grown on the same tree trunk can cause the cork color to be different due to different stripping methods or different techniques. First, the color of the peeled cork will also change with time. Before peeling off, the cork attached to the trunk has a thick shell, which is darker and brown. The cork we usually use and see is a granular raw material that is crushed. The color of the raw material is generally brown, with changes but subtle. As shown in Figure 2. 4, the color of the cork shell is dark, and the cortex under the hard shell is lighter [7].



Figure 2. 4 Cross section of cork[14]

2. 2. 3 Texture

Cork grows on cork ridges and is part of the bark obtained through the harvesting process, which is different from ordinary bark. First, the texture of cork is flexible, thick, and the cork layer is very developed; secondly, the cork ornaments we have seen are products that have undergone primary processing or finishing, but in fact, the cork is backed by a hard back leather, the shell is hard, the color is dark, and the surface Very rough, with deep vertical cracks in the texture, similar to the bark of trees we see every day; when it comes to the cork material with the hard back bark cut off, its shape is similar to a thick wooden board with pores floating on the surface. Regular and slightly rough. The left side of Figure 2. 5 is the cork with the outer skin. The roughness and deep texture cracks can be seen. The right side is the cork material cut into flakes. The surface is smooth and there are pore-like textures of different sizes.



Figure 2. 5 Texture of cork[15]

When designing with cork material, it is different from ordinary wood, and its original form is rarely used, but it is broken into granules or powder, using professional machinery and equipment, and the combination of adhesives is finally required. Cork ornaments. In terms of tactile effects, the surface of the jewelry is much smoother than the raw materials, and the arranged particles are of different sizes and shapes, giving

people a primitive and simple feeling. In terms of visual effects, the granular surface formed by natural random arrangement and scattered presents a natural feeling. On the jewelry processed with cork particles, you can intuitively see the granular texture on the surface of the jewelry, and feel the slightly undulating uneven texture on the surface. The surface texture is unpredictable, which is different from the refined surface that is polished by a machine. Smooth modern industrial products bring people more natural and simple accessories that are close to nature and relax. When designing jewelry using materials, we should pay attention to the advantages of cork texture and give full play to the rustic texture of cork materials.

As shown in Figure 2. 6, the original rough surface of the flower is processed and made with a unique flavor, which brings the viewer a rough and unrestrained aesthetic feeling. It is in sharp contrast with the cork vase ornament shown in Figure 2. 7. The glass material of the vase body, the cork material is made by industrial machine molding processing. The cork material plays a role in enriching the jewelry shape. You can see that the vase has a delicate and round appearance, and the texture effect is softened. In general, it has an industrialized regularity and neatness.



Figure 2. 7 Cork flower vase[16]



Figure 2. 8 Cork vase[17]

2. 3 Basic physical properties of cork

2. 3. 1 Density

The density of cork is extremely low, and the variation range is large, from 0, 12-0, 24g/cm³. Chinese scholars have summarized the density of cork. The density of cork is

affected by the growth stage, not only that the density of primary cork, regenerated cork and cork processed by different methods is different. However, the density of cork cell walls did not change much. According to the experiments and studies of relevant personnel, the density of cork material cell walls was 1, 15g/cm³, and the average density of cork was 0, 17g/cm³. The density of cork is affected by the size of the cells, the wrinkles of the cells, and the volume occupied by the stomata, in a certain proportional relationship. In general, as shown in Table 2. 1, the density of cork is generally low. This is also due to the low density of cork material, which makes the accessories made of cork material light and easy to move or carry [8].

Table 2. 1 Density of cork

Item	Cork from Gansu	Cork from Shaanxi	Import cork
Density (g/cm ³)	0, 269	0, 262	0, 15-0, 30

2. 3. 2 Compressibility

Compressibility is the most distinctive physical property of cork. It means that when cork is compressed by a vertical external force, it will only reduce its thickness without lateral expansion. This characteristic of cork benefits from its special Cell organization structure. Observation through the microscope shows that cork has a layer of cork cell structure, which is generally parenchyma. There are few inclusions in the tissue, but it is full of air and has compression space, which makes the cork compressible. As shown in Table 2. 2, the difference in compressibility between domestic cork and imported cork shows that the compressibility of domestic cork under a pressure of 0, 69 MPa is less than 6, and imported cork is between 4 and 6; at 0, 5 trillion the compressibility of domestic cork under the pressure of Pa is between 2 and 3, 5, while that of imported cork is between 1. 1 and 1. 65. Because the cork material has good compressibility, the use of materials to make jewelry can largely satisfy the designer's idea of jewelry shape, which makes the shape of cork jewelry full of possibilities.

Table 2. 2 Compressibility of cork

Item	Domestic cork	Imported cork
Compressibility under 0. 69MPa (%)	<6	4-6
Compress 50% force (MPa)	2-3, 5	1, 1-1, 165

2. 3. 3 Elasticity

The cork can be restored to its original shape very well when it is compressed with a small amount of force. When the external force is removed, the cork can rebound quickly, basically returning to the original thickness of the material. This characteristic is called resilience. Considered the elasticity of cork. When cork cells are compressed, they will constantly try to return to their original size, and can keep the material texture tight without wrinkles. During compression, the volume of the cork gradually decreases, and the resilience of the volume is divided into two steps: when the pressure stops, the elasticity of the cork reaches 85% of the original size, and after 24 hours, its elastic recovery reaches 94% of the original size. Cork with good elasticity can maintain the integrity of its texture and texture while changing certain temperature and pressure conditions. The data in Table 2. 3 show that both domestic cork and imported cork have high resilience, which means that the cork material is not easy to break and has good stability. Because the excellent elasticity of the cork material makes the cork ornaments have good stability after forming, this feature is often used by designers to make a kind of ornaments that need to withstand gravity, such as bookstands and shelves.

Table 2. 3 Elasticity of cork

Item	Domestic cork	Imported cork
Rebound rate (%)	91, 5-95, 5	≥95
Impact resistance (%)	/	22-26

2. 3. 4 Liquid impermeability

The liquid impermeability of cork refers to the ability of the material to be insoluble in water and inert solvents. The material is impermeable to gas and liquid in its natural state, making the material almost able to achieve waterproof and gas-proof functions. The data in Table 2. 4 shows that both domestic cork and imported cork have low moisture absorption and water absorption, indicating that the water absorption capacity of cork is not strong, and it has good liquid impermeability. The liquid impermeability of cork materials is often valued by designers. Combined with the good shaping properties of cork materials, it can be made to contain liquid-containing jewelry.

Table 2. 4 Moisture and water absorption properties of cork[21]

Item	Domestic cork	Imported cork
Moisture absorption rate (%)	<4	<4
Water absorption (%)	<15	<15

2. 3. 5 Thermal insulation

Cork is a thermal insulator with good thermal insulation performance and is a very good thermal insulation material. Cork is an inert material. When it is put into liquid nitrogen close to absolute zero, the cork can still maintain good elasticity and cohesion. This good thermal insulation is also determined by the special structure of the cork cells. First of all, the conduction of heat is conducted through the solid matter of the object, a large volume of gas and radiation. Looking at the cork cells, the cells are filled with gas

but not large in volume, and only the cell walls in the cells affect conduction heat. The rest of the cell structure does not conduct heat, and radiation has less effect in the cells. In combination, the thermal conductivity of cork is very low. The data in Table 2. 5 shows that the thermal conductivity of cork is very low, which indicates that its thermal conductivity is extremely poor, so that the material has good thermal insulation. Speaking of the thermal insulation of cork, this is one of the cork properties we are most familiar with. Because cork material has this characteristic, the material is generally used to make various shapes of coasters, heat insulation pads and other accessories.

Table 2. 5 Thermal conductivity of cork

Item	Domestic cork	Imported cork
Thermal conductivity (W/M.k)	0, 05	0, 046

2. 3. 6 Electrical insulation

Most materials with excellent electrical insulation properties generally do not have free electrons and ions. Cork has outstanding electrical insulation properties due to its special cell structure. The electrical insulation of cork material has laid a good industrial foundation for cork products, and it also adds new options to the function of cork jewelry in terms of jewelry design.

2. 3. 7 Wear resistance

The wear resistance of cork is very good, and the wear resistance coefficient is high, far exceeding that of rubber and leather. This is because the exposed cells of the cortex play a great role in enhancing friction. Table 2. 6 shows the coefficient of friction of cork. The coefficient of friction refers to the ratio of the frictional force between the surfaces of two objects to the vertical force acting on the surface of one of the objects. It is

related to the roughness of the surface of the object. According to the nature of motion, it is divided into dynamic friction coefficient and static friction coefficient. According to many studies, almost no substance has a coefficient of friction higher than 1, while the static coefficient of friction of cork is 1, which can indicate that cork has excellent wear resistance. The wear resistance of cork materials is very outstanding, so in the eyes of many designers, cork materials can withstand high-strength human use. When designing cork accessories, considering the wear resistance characteristics of materials, the use of cork accessories is expanded [9].

Table 2. 6 Friction coefficient of cork

Item	Domestic cork	Imported cork
Coefficient of friction	Static=1	Dynamic 0, 42-0, 69

2. 3. 8 Sound absorption and sound insulation

Because the special cell structure of cork is a closed microporous structure, cork is a very good sound-absorbing material, and at the same time it can prevent echo. It is also an excellent sound insulation material that is often used as sound-absorbing panels and cushions. Cork has low density and porous cell structure, which makes it have excellent sound absorption and shock absorption effects. When the sound wave passes through the cork, part of the sound wave can be absorbed, but it is rarely reflected. The best sound absorption effect is puffed cork board or black cork coalescing board. Table 2. 7 compares the sound absorption performance of cork with other common materials. It can be seen that the sound absorption performance of cork is excellent among these materials. Because of the sound absorption and sound insulation of the cork material, it is often used in commercial spaces such as KTV to reduce the spread of sound. This feature is also used by designers to make cork accessories, such as headphones, audio and other functions and decorations. A suit of accessories.

Table 2. 7 Comparison of sound absorption performance of cork, metal, and some common substances[22]

Material name	Sound velocity (M/s)	Speaker impedance (g/cm ² x 10 ⁻⁴)
Cork	530	1, 30
Water	1450	14, 5
Rubber	30-70	0, 28
Stone	3800	99
Soft copper	5050	394
Wood	4400	35

Chapter summary

This chapter mainly summarizes the basic properties of cork, mainly from the natural appearance properties of cork materials, basic physical properties, etc. to carry out related research and analysis, and provide related diagrams. The content of this chapter firstly explains the concept of cork and the main growth place and source of cork. Then it explains the natural appearance attributes of cork. The advantages of the color and texture of cork are explained in detail. Published a small paper on jewelry design research on appearance attributes. This chapter also summarizes the physical properties of cork — compressibility, elasticity, liquid impermeability, heat insulation, electrical insulation, abrasion resistance, sound absorption and sound insulation.

3. JEWELRY DESIGN BASED ON THE BASIC PHYSICAL PROPERTIES OF CORK

The physical properties of cork materials affect the use of cork materials, and the unique physical properties give cork jewelry unique charm. There are many physical properties of cork. The basic physical properties described here are mainly the following: compressibility, elasticity, heat insulation, electrical insulation, abrasion resistance, sound absorption and sound insulation. These physical properties lay the industrial foundation of cork, and also make cork have a wide range of applications in jewelry design, and the material design space is large. Based on the basic physical properties of the material, it can create simple and easy to obtain, compressible and elastic, powerful, and durable. Cork ornaments and cork ornaments designed based on physical properties are almost all molded cork particles.

3. 1 Simple and easy to obtain cork jewelry design

Based on the compressibility of cork, various cork accessories can be made. Compressibility is the most representative physical property of cork. Due to the special cell structure of its material, it has good compressibility. The advantage of compressibility is that it can make cork have diversified changes and shapes in jewelry shape, and cork has good stability. If the designer does not pay attention to the compressibility of cork and takes advantage of the material, it is definitely a waste of material [10].

3. 1. 1 Simple shape

Compressibility is the dominant property of cork material, and it is also the most representative physical property of the material. Under the observation of the microscope, it can be clearly seen that the cork cells are arranged in a honeycomb structure. The special cell structure and structure make the thickness of the cork change when subjected to vertical force, but does not expand laterally. This special compressibility property It can provide the feasibility of various shapes for our design, and at the same time, the compressed jewelry shape has good stability and long storage

time. If the designer exerts a reasonable imagination, the utilization rate of materials can be increased. In the long history of development, people used this feature to choose cork to make wine bottle stoppers. This type of jewelry generally uses cork that is machined into pellets. The shape of cork jewelry made based on compressibility is simple. The most common method is to mold cork particles into a standard geometry, and the shape of the jewelry is easy to be formed. The cork chandelier shown in Figure 3. 1, first of all, the lamp is indispensable in the interior space. In addition to being a lighting tool, it also plays a role in decorating the space and setting off the atmosphere of the space. The author thinks it is a kind of interior space decoration. Secondly, this group of chandeliers embodies the important role of compressibility in jewelry design. It can be seen that the shape is simple and is hemispherical. It has a modern minimalist style and is suitable for use in modern interior spaces.



Figure 3. 1 Cork Chandelier[18]

3. 1. 2 Simple structure

Due to the compressibility of the cork material, the cork ornaments are easy to be pressed into shape, and the ornaments with simple structure can be obtained through processing. For example, Figure 3. 2 is a shelf with a simple structure. It can be seen from the appearance that the structure design of the shelf is simple and there are no connecting parts. Although simple enough, the design of the jewelry structure fully considers the needs of contemporary people's daily life. Tablets, mobile phones, keys

and other items can be placed to free up the desktop space, thereby regularizing the desktop and decorating the interior space. It is a simple structure Accessories that make life easier. In addition to the structure of the jewelry, the use of cork materials can save materials more than traditional wood. If this jewelry is made of traditional wood, waste will be generated, material loss is large, and the production cost is high, which will inevitably cause unnecessary waste, but the cork particles are molded and processed so that the raw materials will not be lost, and mass production can be carried out to reduce the time cost and increase the value of the jewelry invisibly. The compressibility of cork has a simple structure, which is not only reflected in the production of small items, but also in many large decorations. For example, Figure 3. 3 is a seat made of cork particles by molding. The seat is It provides people with resting furniture and is also used to decorate and decorate the interior space, as a large-scale ornament. This piece of jewelry is large in size, but the structure is still single. This is the common point of small jewelry and large jewelry. It does not use traditional nails or other materials for stability, and does not require metal connectors. It can be used to make it based on the compressibility of cork. Simple structure ornaments.



Figure 3. 2 Cork set decoration[19]



Figure 3. 3 Cork stool[19]

3. 2 Compressible and elastic cork jewelry design

3. 2. 1 Interesting and flavorful cork jewelry

The cells of cork contain a lot of air, which makes the material lightweight, and the material is both compressible and elastic. This is the interesting nature of the material itself. Using the compressibility and elasticity of the material, the fun of cork ornaments can be realized. First of all, using the excellent styling ability of materials, when creating the appearance of jewelry, you can choose interesting cartoon images to add interest to the appearance of objects and attract consumers of lower ages. Second, the elasticity of cork material can increase the use of jewelry. . As shown in Figure 3. 6, it is a piece of office accessories, sticky notes, and targets. This work uses anthropomorphic techniques in its shape design. The standing villain is naive, giving people an intuitive feeling that is very interesting and can be added during boring and busy working hours. A touch of relaxation and pleasure. Because the cork has good elasticity, this sticky note target can withstand the repeated sting of a pin and use it many times without leaving a needle. This shows that designers can add interest by exaggerating and anthropomorphizing the shape of the ornaments, which is also an extended application of cork modeling capabilities; they can also add interest to the functions of ornaments based on the elasticity of materials. From this we can draw a conclusion: Cork jewelry is designed based on its compressible and elastic physical properties, which can add interest to the shape of the jewelry and enrich the functional talents, so as to obtain a cork jewelry with diversified visual perception and functional experience. As shown in Figure 3. 7, a set of cartoon-like bookends. The function of bookends is to organize and place books. Secondly, being able to decorate the desktop space also means decorating the interior space, which is a piece of jewelry. This group of jewelry makes use of the compressibility of cork material to easily obtain a childlike shape, and knows its elastic properties to make the jewelry have the advantage of not being easy to break. The two physical properties of cork material are perfectly combined and used, and the final piece is designed. A cartoon book stands with cute and playful appearance.



Figure 3. 6 Cork sticky note target[20]



Figure 3. 7 Cork book stand[20]

3. 2. 2 Flexible cork jewelry

The elasticity of cork material is undoubtedly a superior property of the material, and a physical property opposite to its compressibility. Elasticity is expressed in cork products. Cork products are not easy to break and have good flexibility. Ornaments designed based on elasticity can restore their original shape well when they are squeezed and pressed by external forces and maintain the appearance of the ornament. Figure 3. 8 is a decorative pendant made of cork material, which can be used to organize books, magazines, scarves or empty bottles to be used when fixed on the wall. There are many trivial items in daily life, and the messy placement will cause waste of living space and inconvenience of life. This pendant is decorated with blank walls, and more importantly, it fits people's daily needs. Based on the elasticity of the cork material, it is possible to design ornaments with different thicknesses, flexibility and not easy to break, which brings people a sense of modern beauty visually, meets people's daily life in function, and fully reflects the people-oriented design concept.



Figure 3. 8 Cork decorative pendant[20]

4. CONCLUSION

(1) Summary

Cork material has attracted the attention of the design community because of its unique material characteristics. This thesis takes cork materials as the research object, and conducts in-depth research on the appearance and basic physical properties of cork materials. On this basis, it explores the correlation between cork materials and jewelry design. The paper analyzes the color, texture characteristics, structure and processing technology of cork jewelry, forming the main thinking method and main design entry point of cork jewelry design.

In the research on the basic properties of cork, a variety of properties of cork materials are summarized. They have the appearance properties of cork, basic physical properties and. In terms of appearance color, the expansion of cork color options has been achieved through bleaching and dyeing. In addition, cork also has a unique material texture effect and a variety of basic physical properties. These properties make the design and creation of cork accessories large. At the same time, the good processing performance of the cork material enables the cork material to be processed into cork accessories with distinctive design features and outstanding style. In short, cork materials are very suitable for the design, creation and processing of cork ornaments in terms of appearance properties, physical properties, and so on.

In the research of jewelry design based on the basic properties of cork materials: The author made relevant explanations on the color and texture characteristics of cork materials in the analysis of the appearance properties of cork materials. Among them, in the analysis of the color characteristics of cork materials, when analyzing the color characteristics of cork materials, the color characteristics of cork decorations can be expanded by three methods: bleaching, dyeing and graffiti to meet the needs of different use environments.

For example: Analyze the texture characteristics of cork materials. There is a difference between original ecological texture and texture reconstruction. According to the basic physical characteristics of cork material, this article analyzes the decoration design in detail.

First of all, compressibility is the most typical characteristic of cork materials. It makes cork decorations simple in shape, structure and easy to disassemble.

At the same time, using the basic physical properties of cork materials, the properties of jewelry made are analyzed and summarized one by one. In the analysis of cork materials, the industrial processing methods and hand-carved processing methods of cork materials are discussed in detail, and the characteristics of cork ornaments obtained by machine graffiti and hand-painted graffiti are analyzed and summarized in detail. Finally, the author made cork jewelry design practice on the basic physical properties of cork materials, such as compressibility, elasticity, heat insulation, electrical insulation, and abrasion resistance.

Through the analysis and utilization of the various properties of cork materials, this paper demonstrates that designers can design cork accessories that integrate functions and decorations through scientific processing methods and modern design concepts, combined with various properties of cork materials.

5. References

- [1] Robert Hooke. *Micrographia*. The Royal Society. London. 1664: 112
- [2] Holloway, P.J. The suberin composition of the cork layers of some *Ribes* species. *PHYtochem*. 1972. 9: 171-179.
- [3] Holloway, P.J. Suberins of *Molus pimila* stem and root corks. *PHYtochem*, 1982, 21: 2117-2525
- [4] Holloway, P.J. Some variations in the composition of suberin from the cork layers of plants. *PHYtochem*, 1983, 22 (2j): 495-502

- [5] Liese W. , Gunzerodt H. 1981. Charaterisation of wet cork in Qucercus suber L. Holzforschung, 35(4): 195-199
- [6] Gibson L J, Easter ling K E}Ashby M F. 1981. The structure and mechanics of cork. Land: Pro. R. Soc, 377: 99-117.
- [7] Pereira H, Rosa ME, Fortes MA. 1987. The cellular structure of cork from Quercus suber L. IAWA Buletius, 8(3): 213217.
- [8] Graca J, Periera H. 2004. The per idem development in Querus suber L. IAWA, 25(3): 325335.
- [9] Irle M A. 2001. A preliminary investigation cement. Forest Products Research Ceutre, into the compatibility of granulated cork with ordinary Portland(5-7): 9396.
- [10] Kim, B. R. ; Mishiro, A. ; Sugiyama, J. ; Okano, T. The pPhysical properties of virgin and reproduction corks of Quercus variabilis Blume. Bulletin of the Tokyo University Forests, 1990, 82: 199-217
- [11]“Cork Bark Pile Stock Photos & Cork Bark Pile Stock Images: Image, Cork, Stock Images. ” Pinterest, br. [pinterest. com/pin/464222674071655876/](https://www.pinterest.com/pin/464222674071655876/).
- [12]“Cork (Material). ” Wikipedia, Wikimedia Foundation, 19 Nov. 2020, en. [wikipedia. org/wiki/Cork_\(material\)](https://www.wikipedia.org/wiki/Cork_(material)).
- [13]“Cork Coaster - 4. ” Instafreshener, [www. instafreshener. com/products/cork-coaster-4in-circle](https://www.instafreshener.com/products/cork-coaster-4in-circle).
- [14]FAVPNG. com. “Quercus Suber Peloritani Cork Bark Quercus Ilex - PNG - Download Free. ” FAVPNG. COM [favpng. com/png_view/in-the-long-section-of-cotton-quercus-suber-peloritani-cork-bark-quercus-ilex-png/GcSZQ7Y5](https://favpng.com/png_view/in-the-long-section-of-cotton-quercus-suber-peloritani-cork-bark-quercus-ilex-png/GcSZQ7Y5).
- [15]Zhihu, zhuanlan. [zhihu. com/p/87475268](https://www.zhihu.com/p/87475268).
- [16]“Wine Cork Flower Vase: Wine Cork Crafts, Cork Crafts, Wine Cork. ” *Pinterest*, [www. pinterest. com/pin/172614598190673255/](https://www.pinterest.com/pin/172614598190673255/).
- [17]“Cork Vases. ” Melanie Abrantes, [www. melanieabrant.es. com/cork-vases](https://www.melanieabrant.es.com/cork-vases).

- [18]“Portuguese Cork and It's Take on Contemporary Lighting Fixtures. ”Comtemporary Lighting, 20 Sept. 2017, [www. contemporarylighting. eu/2017/09/20/portuguese-cork-its-contemporary-lighting-fixtures/](http://www.contemporarylighting.eu/2017/09/20/portuguese-cork-its-contemporary-lighting-fixtures/).
- [19]“Pushpin Cork Chair/Table by Kenyon Yeh for COOIMA. ”Design Milk, 14 Aug. 2012, [design-milk. com/pushpin-cork-chair-table-by-kenyon-yeh-for-cooima/](http://design-milk.com/pushpin-cork-chair-table-by-kenyon-yeh-for-cooima/).
- [20]Pinterest, [www. pinterest. com/search/pins/? q=cork](http://www.pinterest.com/search/pins/?q=cork).
- [21]Wenku, [wenku. baidu. com/view/82c7b008f342336c1eb91a37f111f18582d00c3a. html](http://wenku.baidu.com/view/82c7b008f342336c1eb91a37f111f18582d00c3a.html).
- [22]Wenku, [wenku. baidu. com/view/9b4ea37802d8ce2f0066f5335a8102d277a26110. html](http://wenku.baidu.com/view/9b4ea37802d8ce2f0066f5335a8102d277a26110.html).