1. List three items (in addition to those shown in Figure 1.8 of Chapter 1 in the e-text I uploaded) made from metals or their alloys. For each item, note the specific metal or alloy used and at least one characteristic that makes it the material of choice.

(1)Titanium alloy aircraft parts - Titanium alloy has high strength and corrosion resistance and is one of the preferred materials for the aviation industry.

(2)Aluminum bicycle frame - Aluminum alloy is lightweight and has good strength, making it ideal for bicycle manufacturing.

(3)Brass instruments - Brass alloys have good resonant properties and sound, so they are often used to make Musical Instruments, such as trumpets and trombones.

1. Classify each of the following materials as to whether it is a metal, ceramic, or polymer. Justify each choice:
2. Alumina is a ceramic material. It is a compound composed of aluminum and oxygen elements, with good high temperature resistance, corrosion resistance and insulation properties. Alumina also has a high hardness and strength, making it suitable for a variety of industrial applications, such as ceramic tiles, ceramic tools, grinding materials, etc. Therefore, alumina is classified as a ceramic material.
3. Brass is an alloy material. It is composed of an alloy of copper and zinc, usually containing 70-90% copper and 10-30% zinc. Brass has good processability, electrical conductivity and corrosion resistance, so it is widely used in the manufacture of various industries and ornaments. Because of its alloying properties, brass is classified as an alloying material.
4. Cast iron is an alloy material. It is an alloy composed of iron and a certain amount of carbon, and usually contains other alloying elements. Cast iron usually has a high melting point and good fluidity, making it suitable for casting parts and components of various shapes and structures. Due to its carbon content, the properties and uses of cast iron are different from those of pure iron, so it is classified as an alloy material.
5. Plexiglas® is a polymer material, usually a composite material composed of epoxy resin and glass fiber. Because of its high strength, corrosion resistance and heat resistance, glass resins are often used in the manufacture of composite parts in the fields of aerospace, automotive, Marine and construction. Therefore, glass resins are classified as polymer composites.
6. Boron carbide is a ceramic material. It is a compound formed from the elements carbon and boron and has extremely high hardness, wear resistance and high temperature resistance. Boron carbide is commonly used in the manufacture of ceramic tools, ceramic coatings and wear parts. Therefore, boron carbide is classified as a ceramic material.
7. PolyChloroprene is a synthetic rubber, also known as neoprene. It is an elastomer material polymerized from chloroprene monomer. Polychloroprene has good wear resistance, oil resistance and weather resistance, so it is widely used in the manufacture of rubber products, such as seals, rubber tubes, rubber MATS and so on. Due to its synthetic rubber properties, polychloroprene is classified as an elastomer material.

3.report：

Manufacturing Process and Properties Analysis of Micro-fiber Leather for Basketball Casing

1.Microfiber leather features overview

Microfiber leather is a three-dimensional mesh high density non-woven fabric made of island fiber, which is similar to the structure and properties of natural leather. The island fiber non-woven fabric is the skeleton of microfiber leather, which mainly takes the sea island type superfiber as the core technology, and is highly similar to the ultra-fine collagen fiber of natural leather, which can promote the mechanical strength, chemical resistance, wear resistance and wrinkle resistance of microfiber leather are significantly better than that of natural leather. Compared with natural leather, the price advantage of microfiber leather is also very significant, which can be continuously produced according to specifications, diversified color types, and high production utilization rate. High-density non-woven fabric has laid a solid foundation for the simulation of natural leather for microfiber leather, and with the micro-porous structure of polyurethane resin and subsequent finishing, the microfiber leather has evolved into an ideal material that can replace natural leather. However, microfiber leather also has certain shortcomings, mainly due to the same internal and external density of the non-woven substrate, which cannot be compared with the density gradient distribution of natural leather cross sections. In addition, the surface of microfiber leather can not reach the unique natural texture of the natural leather surface, and the moisture permeability is also different from that of natural leather.

2.The performance advantage of microfiber leather for basketball

2.1 Close to natural leather feel

The linear density of microfiber leather material is lower than 0.55dtex, and the basketball ball leather made of microfiber leather material is soft and comfortable, and has strong durability, which can provide athletes with the texture and feel close to natural leather. At the same time, microfiber leather materials can also avoid a series of problems such as poor body parts and uneven thickness of general cofskin basketball surface, so microfiber leather basketball can approach or surpass natural cofskin basketball in terms of feel and texture perspective.

2.2 Excellent air permeability

The key reason why the basketball is mainly made of leather material is that the leather material can give the basketball superior air permeability and sweat absorption. Sweat absorption is the main index to characterize the properties of basketball fiber materials, but most synthetic leather fiber materials lack hydrophilic group, resulting in the synthetic leather basketball sweat absorption is not sufficient. Although microfiber leather is not as good as natural leather, it is obviously better than other synthetic leather, so the preparation of basketball by microfiber leather can achieve more ideal gas induction and sweat absorption, so as to ensure the comfort of basketball use.

2.3 Good elastic modulus

As far as polyamide microfiber leather is concerned, polyamide fiber is closely related to polyamide material. Compared with natural leather, polyamide microfiber fiber braid density is smaller, the base fabric as a whole shows a loose state, polyamide microfiber fabric with branching interlace three-dimensional network structure compared with natural leather fiber to check the curve fiber three-dimensional structure has better elastic modulus, providing ideal anti-torsion and protection ability for basketball.

3.Microfiber leather basketball ball leather material production tech

General microfiber leather basketball ball material production is to improve the permeability, softness, wear resistance as the essence, at this stage Spalding, Li Ning, Weirsheng and other enterprises research and development of microfiber leather basketball ball material in the comprehensive performance side is still slightly different, according to the derivative of various basketball manufacturers of microfiber leather basketball ball material production process.

3.1 Spalding microfiber leather basketball ball leather material production process

Spalding TF series basketball 750 basketball sweat absorption and anti-slip is very prominent, in the production of its ball skin material, the research and development personnel use the warm soaking process, washing with the Marine island-oriented microfiber nonwoven cloth such as NA, the generated microfiber leather basketball skin material is very good in moisture permeability and air permeability, can provide superior sweat absorption and anti-slip function. The handle of model 1000 basketball is very unusual, which is highly close to the leather basketball. When the ball skin material is made, the research and development personnel use acid hydrolysis and enzymatic hydrolysis technology to chemically modify the microfiber, which promotes the opening of the amine-phobic bond and effectively increases the surface active group of the microfiber. Then, through a series of processes such as doubting, filling and fatting, the macromolecular components of doubting agent are evenly filled in the ultra-fine fiber material, and the microfiber base cloth of basketball skin obtained by this process is highly similar to the natural leather germ in the feel.

3.2 Li Ning microfiber leather basketball ball leather material production process

Li Ning microfiber leather basketball types are various, of which the most representative are LBQ series, ABQ series. LBQ series basketball is mainly aimed at professional league, the purchase of sufficient funds, so the development of this series of basketball will not be too emphasis on the wear resistance of basketball skin material, but more emphasis on the viscosity of ball skin material. In this case, the researchers mainly use butene homopolymer as the adhesive material for surface treatment of microfiber leather material, and through the chemical reaction of butene homopolymer at a fixed temperature, the surface of microfiber leather is generated into a viscous substance, which can effectively improve the surface friction of microfiber leather, as long as the basketball is in the outside temperature control within 60°C. Then the viscosity of this viscous substance can be stored and effective for a long time. ABQ series basketball is mainly aimed at amateur league, the organization scale and purchase funds are relatively limited, so the development of this series of basketball pays more attention to the wear resistance of the ball material. In order to effectively improve the wear resistance of the microfiber leather basketball ball material, the researchers modified the surface of the basketball microfiber leather with the convex rod 10, and moderately added micron grade polytetroxide micro-powder and fumed silica micro-powder, which effectively strengthened the wear resistance of the microfiber leather basketball ball material. ABQ series basketballs can be used not only on indoor wooden floor courts, but also on outdoor plastic and cement courts.

3.3 Weisheng microfiber leather basketball ball leather material production process

The moisture absorption and perspiration of the EVO series of microfiber leather basketball are strong, similar to the Spalding TF series 750 model basketball. In this research and development researchers in the preparation of EVO series of microfiber leather basketball ball materials, the use of polypolycoolamide 6 as a microfiber nonwoven fabric base cloth, the preparation of the ball material is a three-layer composite structure, the moisture permeability of up to 80 mg/cmd, highly close to the natural cowhide material. However, the foam rate of this microfiber leather basketball ball material is also very high, and it is easy to reduce the viscosity of the surface of the material, so the researchers can only add lines to the exposed rubber material of the ball to strengthen the surface viscosity of the ball material.

4.Microfiber leather basketball product performance analysis

4.1 Uniform surface and no parts difference

Compared with natural leather, microfiber leather has no thickness difference in different parts, mainly because microfiber leather is processed with microfiber and polyurethane and other materials, and its own thickness is relatively uniform. The thickness of the basketball skin processed with microfiber leather as the main material is easy to control, and the elasticity and feel of the basketball generated are more balanced, and the ball skin can be processed and prepared without strict material selection.

4.2 Good air permeability and close to natural leather

When basketball is used, it is necessary to contact the hands or other limbs of the players for a long time. If a large amount of sweat cannot be absorbed quickly and effectively, a smooth water layer will be generated on the surface of the basketball, which will affect the feel of the hand when completing technical actions such as dribbling and shooting. In the commonly used materials of basketball ball leather, microfiber leather ball material has the best air permeability, second only to natural leather, far beyond polyethylene and rubber ball material, and even compared with the general polyurethane cool ball material is still slightly better. Therefore, the microfiber leather basketball skin can meet the athletes' needs for idealized air permeability and moisture permeability to a greater extent.

4.3 Wear-resistant and tear resistant eyes can adapt to a variety of sites

Although the use of natural leather ball material of the basketball feel and gas induction is slightly better than microfiber leather ball material, but its wear resistance is not ideal, common natural leather basketball can only be used in indoor wooden floor places, but microfiber leather basketball can adapt to a variety of places to overcome these shortcomings. The three-dimensional network structure composed of microfiber and polyaminosol resin in microfiber leather ball material can make the tear resistance and wear resistance of the material better. This tear resistance and wear resistance ensure that the microfiber leather ball material can be used in a variety of harsh places, ensuring that the microfiber leather basketball can produce excellent performance in rubber floor places and cement floor places.

4.4 Green and environmentally friendly

Under the trend of increasing consumer awareness of environmental protection, the use of natural leather ball materials is gradually considered to be a very environmentally unfriendly behavior. The application of microfiber leather ball materials in basketball production is gradually deepened, which can effectively improve the green environmental protection of basketball, thereby reducing the frequency of use of natural leather materials, so from the perspective of green environmental protection, the application of microfiber leather ball materials in basketball will become more and more common in the future. In addition, the production of microfiber leather is different from that of general synthetic leather, which requires a large number of solvents to assist the production of synthetic leather, and consumes a lot of energy and human resources during recycling, which is easy to cause secondary pollution. However, the production of microfiber leather is mainly assisted by water-based solvents, which can significantly reduce the production rate of three wastes, and the green environmental protection of the produced basketball ball skin is more prominent.

4.5 Excellent comprehensive performance and can replace natural leather

At this stage, the comprehensive performance of the microfiber leather ball material basketball has been highly close to the natural leather material basketball, some manufacturers produced microfiber leather basketball in wear-resistant parts and surface viscosity and other specific properties even exceeded the natural leather basketball, but if the comprehensive performance perspective, the microfiber leather ball material basketball gas and softness and other properties are still different from the natural leather basketball. In the future, when developing microfiber leather basketball, manufacturers should focus on a variety of strategies to develop microfiber leather ball material with better comprehensive performance, integrating a series of performance advantages such as air permeability, wear resistance, and surface viscosity to further replace natural leather material basketball.

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