Research Article

Tang Sancai Cultural and Creative Product Design Based on Bi4Ti3O12 Ferroelectric Nanomaterials

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Nano has its small size and specific characteristics that are different from other materials, bringing a climax to the world’s on-site nano research and material development. In the ceramic industry, the nanometer is an important research object in the ceramic industry. This article aims to study nanomaterials and their application in Tang Sancai. The experiment in this paper shows from the Table that the sales volume of nanotechnology used in 2016-2020 is getting higher and higher, from 35.35 million yuan in 2016 to 10.43 million yuan in 2020, while the sales volume of ceramics that do not use nanotechnology has increased from 3567 in 2016 to 26.32 million yuan in 2020. It can be seen that ceramics using nanotechnology are more popular.

1. Introduction

Nanoscience is an emerging science that integrates basic science and applied science, including nanoelectronics, nanomaterials, and nanobiology. In the process of economic globalization, life is now filled with more and more colorful Western culture. Many scholars and designers have noticed this problem and are working hard to explore and protect traditional Chinese culture. Chinese elements with different styles are gradually being paid attention to by domestic and foreign designers, and the redesign and wide application of traditional patterns have also become a trend. Bi4Ti3O12 ferroelectric nanomaterials are new materials developed in recent years. Because of their excellent optical properties and photoelectrochemical activity, they have broad application prospects in the establishment of fluorescence and photoelectrochemical sensors. Therefore, quantum dots have attracted more and more attention and become the current research hotspot. Tang Sancai occupies an important historical position in Chinese culture and has left a deep trace in the history of Chinese ceramics. Tang Sancai was born in the Tang Dynasty and represents the origin of culture. First of all, mature ceramic technology is the material basis for the birth of Tang Sancai; second, the great funeral wind of the Tang Dynasty is the direct guide to its birth; third, the history and culture of the Tang Dynasty in various fields are the best of its birth art nutrition. The birth of Tang Sancai is a process of combining the decoration of glaze and the decoration of hairy meat, and it is also the birth of a three-color glaze decoration technology. In the excellent Tang Sancai, its gorgeous artistic effect is fully displayed, and the brightly carved ornaments are vividly expressed. (Table 1)

Yu C proposed that Aurivillius phase Bi4Ti3-xWxO12 (+x)+0.2 wt. % Cr2O3 (BTWx-C, x = 0–0.1) ceramics are prepared by traditional ceramic technology, where plate-like grains with random orientation are formed. After ceramic doping with W, the aspect ratio of the crystal grains increases, while the volume density of the ceramic decreases. The change in Poisson’s ratio may be related to the change in buld density, and the change in bonding strength may be the cause of the change in Young’s modulus. Large-grain samples tend to have lower frequency constants, but they have higher elastic compliance and lower hardness. In particular, due to the mechanism of crack deflection, the larger grain size provides higher fracture toughness for the sample at x = 0.05. The stress-strain curve of BTWx-C ceramics under uniaxial compression is characterized by three stages, namely, linear elastic deformation, iron elastic...
Curie temperature (675°C) and large spontaneous polarization due to its high stable conditions [3]. Long C proposed that bismuth titanate is one of the media platforms while minimizing burdens and unstable conditions. The main question behind our research is what visual means does the knowledge graph use to represent its cultural framework? The main object of the team’s research is a set of images that visualize knowledge, mainly from the Chinese encyclopedia Sancai Tuhui (Sanjie Atlas). The core of the research study is the conceptual and creative development of visual translation. When making our visual translation, we integrated missing information or only mentioned information, such as the four main directions. By redesigning the existing knowledge graphics, the research team can perceive the cultural meaning of Chinese graphics. Practice-based research mainly allows us to better understand the original images through the process of tracing. This practice reveals their special characteristics to us [2]. Samuel studied the use of Internet-based media platforms for marketing communication among fashion designers as a manifestation of globalization and neoliberal free trade. It highlights some of the characteristics of neoliberalism, the subthemes of the concept of culture and creative industries, and some influences of the use of digital media technology and believes that there is a connection between these three concepts. It pointed out that neoliberal globalization promoted free markets and the removal of barriers that previously excluded many people from free trade. The survey results show that the use of digital marketing platforms has inherent economic benefits and unstable conditions. These conditions, some of which subvert the rewards that individuals obtain through the use of their talents, are consistent with the rise of unstable work under neoliberal capitalism. It suggests that cultural producers should seek to maximize the benefits of these media platforms while minimizing burdens and unstable conditions [3]. Long C proposed that bismuth titanate Bi4Ti3O12 (BiT) is one of the most promising lead-free high-temperature piezoelectric materials due to its high Curie temperature (675°C) and large spontaneous polarization (50 μC/cm²). However, extensive research has shown that high leakage conductivity can interfere with the polarization process and hinder its practical application. In this paper, low-level Nb donor substitution is used to suppress high-level holes associated with high oxygen vacancy concentrations, and electrical insulation properties are achieved. The resistivity of the Bi4Ti2.97Nb0.03O12 ceramic is significantly increased by more than three orders of magnitude, and the active energy value is >1.2 eV, which is of great significance for the piezoelectric application of BiT-based materials. However, pure and excessive A2O3 (A = Bi, La, and Nd; 3 at %) BiT ceramics are mixed holes and oxygen ion conductors. Due to the existence of semiconductor bulk, Schottky barriers are formed at the grain boundary region and the sample-electrode interface [4]. Dc A first characterizes the chemical composition of the corpse samples from Huangpi, Huangbao, Liqianfang, Xingtai, and Qionglai Tang Sancai kiln sites. Huangye, Huangbao, and Liqianfang are located near the provincial capital cities of Chang’an and Luoyang. Selecting local kiln sites in Qionglai, Sichuan and Xing, and Hebei for comparative research, we found that the corpse samples at these sites may be made of local clay. Kiln sites such as Huangye, Huangbao, and Xing use kaolin to produce green bodies, but the contents of K2O and TiO2 are different. At Liqianfang and Qionglai kiln sites, iron-rich “red soil” and calcium-rich “loess” were used instead. This article also aims to characterize the glaze samples from the Huangye and Huangbao kiln sites. We found that the Si/Al ratio of these samples was significantly higher than that of the corresponding main samples, which means that siliceous raw materials were intentionally added to the glaze [5]. The purpose of Azar G is to study the relationship between cultural distance (perceived and objective), innovation, and corporate export performance. The hypothesis here is tested through structural equation modeling, using data from Swedish companies entering 23 international markets and 186 export companies. The survey results show that when expanding to markets with distant cultures, managers’ perceptions of substantive and objective cultural differences (measured using Hofstede’s (1980, 2001) scores) and subsequent environmental uncertainty trigger interaction and communication strategy. It is combined with the market environment, which includes innovation and adoption of processes and products, as well as organizational strategies, structures, and administrative procedures to deal with the new environment and overcome uncertainties [6]. Felix pointed out that information and communication technology innovation is one of the main forces of social and economic development, and it is also a key factor in promoting a country’s economic growth. A number of studies have shown that culture is a key determinant of innovation. Felix examined the impact of social and cultural factors on ICT innovation, with particular attention to mobile banking services. A study of 220 respondents from a sample population of South Africa was conducted. The questionnaire used in this study was developed based on the previously proven research. The research results show that culture is an appropriate concept to describe how information and communication technology innovation is affected by human behavior [7]. Through the research and analysis of scholars, it can be seen that the application of nanomaterials in Tang
Sancai is becoming more and more widely used, and it is becoming more and more important. How to better design Tang Sancai’s creative products is the top priority.

The innovations of this article are (1) research on nanomaterials and their application in Tang Sancai. How to design Tang Sancai creative cultural products based on Bi4Ti3O12 ferroelectric nanomaterials. (2) Proposing the dielectric constant method based on Bi4Ti3O12 nanomaterials and the actual investigation method to the importance of nanotechnology in product design in Tang Sancai design.

2. Dielectric Constant Method Based on Bi4Ti3O12 Nanomaterials

2.1. Nanotechnology. Nanotechnology is the science, engineering, and technology carried out on the nanometer scale of approximately 1 to 100 nanometers. Nanoscience and nanotechnology are the study and application of extremely small things that can be used in all other fields of science. Nanotechnology is a science and technology produced after the invention of the scanning tunneling microscope in 1981. It has the characteristics and applications of studying materials with a structure size of 10-10 to 10-7 m [8]. This field has attracted widespread attention worldwide, and the high enthusiasm caused by this has spread to many fields, including chemistry, physics, materials science, engineering, and technology, as shown in Figure 1.

As shown in Figure 1, the birth of nanoscience and technology has opened up a new level and new field of human understanding of the world. It is considered to be a high-tech that emerged at the turn of the century, bringing mankind into a new era—the era of nanotechnology [9]. Nanotechnology is an applied science whose purpose is to study the design methods, compositions, properties, and applications of substances and devices at the nanoscale.

Ferroelectric nanomaterials have excellent physical and chemical properties and are widely used in high-density memory, nanogenerators, nanosensors, dielectric tunnel junctions, detection arrays, and other fields [10]. The spontaneously polarized electric field generated by polar ferroelectric semiconductors can significantly improve the bulk charge separation efficiency of photocatalytic materials. The unique characteristics and uses of dielectric nanomaterials are closely related to the shape and size of the material. Its structure is shown in Figure 2.

As shown in Figure 2, exploring the controllable preparation conditions and mechanisms of ferroelectric nanomaterials is very important in studying the relationship between the morphology and performance of dielectric nanomaterials. It provides the possibility and foundation for expanding the application field of dielectric nanomaterials [11]. Polymer dielectric materials also have their own troubles, that is, the operating temperature is relatively low, and thus they cannot work in extreme environments.

2.2. Dielectric Constant. The permittivity is the product of the relative permittivity and the absolute permittivity in a vacuum. The dielectric constant represents the polarization behavior of the dielectric, which reflects the comprehensive characteristics of the medium under the action of an electric field, and it is a macroscopic physical quantity that represents the response ability of the dielectric to an external electric field. According to the research results of static electricity, the isolated charge \( q \) of the dielectric body generates an electric field \( E \) around it, and if the other test charge \( q0 \) enters the electric field, it will be affected by the electric field force. The electric field intensity generated by the charge \( q \) is as shown in the following formula:

\[
E = \frac{q}{4\pi \varepsilon r^2},
\]

where \( \varepsilon \) is the dielectric constant of the substance, and \( r \) is the radial distance from the point charge \( q \). Generally speaking, the electric field strength is a vector. In practical applications, in many cases, the standard, that is, the vacuum dielectric constant \( \varepsilon \) is selected as 0 [12]. As the specific permittivity of the dimensionless constant, the permittivity \( \varepsilon \) of the dielectric body is less than zero in the vacuum permittivity \( \varepsilon \), as shown in the following formula:
The dielectric constant $\varepsilon$ represents the limiting factor of the electric field intensity generated by the charge $q$ of the medium (except for the distance, which is also the only limiting factor). Under the continuous action of the applied electric field, the dielectric constant reflects the change in the direction of the applied electric field and the strength of the ability of the rearranged dipole group, electron, or dipole [13].

2.3. Ultralow Dielectric Realization Method. When all the bonds in the molecule are nonpolar bonds, the molecule is nonpolar (except for ozone). When all bonds in a molecule are identical, they are all polar bonds. In actual research and application, in order to obtain ultralow dielectric constant materials, nonpolar molecular materials are a very important choice [14]. For nonpolar molecules, Clusius Mosotti has a dielectric constant $\varepsilon$ associated with a polarizability $\alpha$, which is given in the following formula:

$$
\varepsilon - 1 = \frac{N\alpha}{3\varepsilon_0} + \frac{2}{\varepsilon + 2}.
$$

(3)

The first term is the orientation paramagnetic susceptibility, which is similar to Langevin’s classical conclusion and is related to temperature. The second term is the contribution of excited states to paramagnetism, which is essentially independent of temperature. The Debye formula provides a method to reduce the dielectric constant ($K$) of polymer-based nanocomposites by reducing molecular density ($N$), reducing electronic polarization ($\alpha_e$), and reducing molecular polarization ($\alpha_d$) [15]. The reduction of molecular density can be achieved by introducing pores, and the reduction of molecular polarization can be achieved by changing the conformation and arrangement of polymer molecular chains using the following formula:

$$
\frac{K - 1}{K + 2} = \frac{N}{3K} \left( \frac{\alpha_e + \alpha_d + \frac{\mu^2}{3KT}}{\varepsilon_0} \right).
$$

(4)

2.4. Density Test and Porosity Calculation. The nanocomposite films also have excellent UV shielding properties. The nanobioexcited composite film has low transmittance in the wavelength band and high transmittance in the visible light band. The nanocomposite film quickly takes the form of a rectangle, and the mass (mm) of the rectangle is tested with an analytical balance. The length, width, and thickness of the sample are measured with a rocket machine [16]. The volume ($V_m$) of the sample is obtained from the measured length, width, and thickness. The density is measured using the following formula:

$$
\rho_m = \frac{M_m}{V_m}.
$$

(5)

The theoretical density ($\rho_t$) of the nanocomposite membrane can be calculated with the following formula, and formula 6 is obtained.

$$
\rho_t = \rho_{SiO_2} \cdot V_{1-SiO_2\%} + \rho_{PE} \cdot V_{1-PE\%}.
$$

(6)

$\rho_{SiO_2}$ and Vt-SiO$_2\%$, respectively, represent the density of silicon dioxide and the volume fraction of composite materials [17]. PPE and Vt-PE% represent the density of polyethylene and the volume fraction of composite materials. The porosity of the nanocomposite membrane is obtained from the measured and theoretical density, as shown in the following formula:

$$
P(\%) = \left(1 - \frac{\rho_m}{\rho_t}\right) \times 100%.
$$

(7)
In the experiment, 3 g of the prepared pH = 10 NaOH aqueous solution was put into two flasks, 2 g of silica and 6.2 g of GPS were added, and the mixture was mechanically stirred at room temperature for 30 minutes to make it completely dispersed. Then, it was reacted at 100°C for 12 hours. The reaction process is shown in Figure 3.

As shown in Figure 3, after the reaction, the product was cooled to room temperature, and the colloid was precipitated with ice methanol [18]. After washing, the tail gas containing a very small amount of methanol leaves the system, and the washing water containing a small amount of methanol is sent to the methanol-water separation tower after heat exchange. After completely standing still, the upper layer of denatured silicon was transferred to other beakers with ice methanol. Suction filtration and methanol washing were performed, and this was repeated three times. The THF is washed and filtered with suction 5 to 6 times. Next is the reaction which followed.

2.5. Product Design Method Combining Chinese and Western.

The prosperity and development of the handicraft industry have further improved the quality of pottery craftsmanship. Coupled with the prosperity of the Tang Dynasty, the style of thick burials prevailed, so the colorful Tang Sancai became the first choice for emperors and generals to accompany each other. Tang Sancai is a wonderful piece of the Tang Dynasty. The patterns and colors of the Luoyang Tang Sancai boats reflect the combination of Chinese and Western cultures [19]. The high level of politics, economy, and culture of the Tang Dynasty made the ceramic industry prosperous at that time. The three-color pottery of the Tang Dynasty was an important symbol of the prosperity of this ceramic craft. In the hands of many art galleries and individual collectors in the world, there are many glamorous works of Tang Sancai, sculptures of three-dimensional pottery, and props of various shapes [20] as shown in Figure 4.

As shown in Figure 4, whether it is the strong or weak contrast in color, the repetitive arrangement, approximate arrangement, or the composition relationship of virtual reality on the pattern, it reflects that the cultural and artistic level of the Tang Dynasty has reached the peak of that era. Seeing galloping horses, camels called “desert ships,” civil servants of various shapes, warriors, women, and animals and birds of various shapes, the advanced ceramic craftsmanship of the Tang Dynasty aroused people’s heartfelt admiration.

Glazed pottery originated in the Neolithic Age. The first glazed pottery pot in China was born during the Cishan culture period in what is now Hebei, about 7000 years ago. Glazed pottery is a type of pottery that uses low-temperature glaze, which can usually only reach 700 to 900 degrees

Figure 3: Surface bromination of the silica structure diagram.

Figure 4: The three colors of Tang are three combinations of Chinese and Western.
Chinese glazed pottery appeared in the middle of the Warring States period in the 4th century BC. In the Wudi period of the Western Han Dynasty, lead-glazed pottery with clay as tires and lead compound as basic flux appeared. The main colorants were copper and iron, and they were fired in an oxidizing atmosphere. Copper is emerald green, iron is yellowish brown, and brown is red. The glazed surface is transparent, and the glazed surface is smooth and shiny. Lead-glazed pottery was very popular in the eastern Han Dynasty, but it was basically Ming pottery, as shown in Figure 5.

As shown in Figure 5, with the advancement of society and the continuous improvement of replication and imitation technology, there are more and more varieties of Tang Sancai. The people of Luoyang developed a flat three-color Tang Sancai based on the traditional three-color form of the Tang Dynasty, and they will also develop better works of the Tang Sancai on this basis. Tang Sancai, as a traditional cultural relic and handicraft, not only occupies a certain position in the history of Chinese ceramic art but also plays a very important role in cultural exchanges between China and foreign countries.

3. Experiment and Analysis Based on the Nanomaterial Technology Questionnaire Survey Method

Composite materials usually have good comprehensive properties that different materials complement each other. Composite materials have the characteristics of two or more materials. In the early 1990s, Japan’s Fukuhara reported for the first time that nanocomposite ceramics containing nanosized SiC particles as the second stage have high mechanical properties and many unique characteristics. It contains 20% nanocobalt powder cermet which is a high-temperature resistant material for rocket spray guns. At this point, oxide nanomaterials are equally superior to the previous ceramic materials. He also studied the effect of adding other nanoparticles to the ceramic matrix. The application possibilities of nanotechnology in ceramics are immeasurable. Oxides are an important chemical substance, and various oxides will be formed according to the different elements of composition with oxygen.

3.1. Case Investigation and Analysis of Color Elements. In the Luoyang Tang Sancai ware pattern, there are many decorative elements combined with units, symmetrical elements on the central axis, and symmetrical figures up and down at a certain angle. Some are not completely symmetrical, but they can achieve a sense of visual balance and give a sense of visual balance. The symmetrical graphic is simple, but it has a pure and quiet beauty. Therefore, this article will investigate two Tang Sancai ceramics with similar symmetry and similar prices, as shown in Table 2.

As shown in Table 2, this article will be similar to these two models, but the color difference is large. Next, the research conducted a questionnaire survey on different groups of people. Ten people from China and ten people from abroad got the results as shown in Table 3.

As shown in Table 3, the survey results show that the preference for AB and AB is the same in price, each at 50%. In terms of style, the preference for AB and AB is the same in style, which is also 50%. But in terms of color, 7 people chose style A, and 3 people chose style B. It can be seen that both domestic and foreign people prefer simple and elegant Tang Sancai crafts, so in the color scheme, the design is mainly simple and elegant.

Tang Sancai uses only a few color glazes, juxtaposed and blended, similar tones, adjacent tones, or clear and turbid contrast. By using the aesthetic effects formed between colors, Tang Sancai naturally and skillfully constitutes a beautiful “relational color.” It neither pays attention to conditional colors (light source color, environment color, and air color) nor to natural inherent color, which produces an unexpected amberlight. In this paper, another 20 people were surveyed, and a comparison chart was obtained, as shown in Figure 6.

As shown in Figure 6, 20 people choose the two styles AB in price and style. Both are about 50%, but in terms of color, people choose style B to reach 75%, so in terms of color, people prefer plain colors. The key to creating the beauty of color is harmony. As Bergtu once said, “What is beauty? Harmony is
beauty.” In color paintings, to organize various colors in a picture to achieve a kind of harmony, we must follow the principle of unified change. However, in real life, people admit that colors have a sense of unity and inconsistency, and people often use the words unity or coordination to evaluate colors. Tang Sancai often uses black, color, and gray in the use of colors to adjust the relationship with other colors to achieve color coordination, so they are called coordinated colors.

3.2. Investigation and Analysis of Nanomaterials. Ceramic materials are fragile under normal circumstances, but nanoceramic materials made of nanoultrafine particles have excellent toughness. This is because the interface of the solid material formed by the nanoultrafine particles is very large. The arrangement of atoms on the interface is very chaotic, and the atoms themselves are easy to move under the conditions of external force and deformation, showing their excellent toughness and certain strength. In terms of ductility, ceramic materials are innovative mechanical properties. Research on nanocomposite ceramics shows that by appropriately selecting and designing the chemical coexistence of different microstructures and the matching of physical properties, composite ceramic materials with higher mechanical properties can be prepared. Chinese scientists
have developed nanoceramic bowls that will not be damaged. This article will investigate and analyze the sales of nanomaterial ceramics on the market from 2016 to 2020, as shown in Table 1.

From Table 1, we can see that the sales volume of nanotechnology used in 2016–2020 is getting higher and higher, from 35.35 million yuan in 2016 to 10.43 million yuan in 2020, while the sales volume of ceramics that do not use nanotechnology has increased from 35.67 million yuan in 2016 to 26.32 million yuan in 2020. It can be seen that ceramics using nanotechnology are more popular.

Ceramics have excellent heat resistance, corrosion resistance, and appearance (tiles for floor coverings, and so on), so they are widely used in engineering, but because they are vulnerable to brittle damage, people will also pay attention to them when using them. Therefore, they have certain restrictions. Nanoceramics developed using nanomaterials have excellent plastic properties and can absorb a certain amount of external energy. Adding nanoscale metal carbide fibers to the ceramic matrix will greatly increase the strength of the ceramic and, at the same time, obtain excellent fire resistance. The heat-resistant material of the rocket spray gun nozzle uses nanocermet as a material with high wear resistance. Heat-resistant materials are shown in Figure 7.

As shown in Figure 7, ceramic materials made of nano-SiC, Si₃N, ZO₂, SiO₂, TiO₂, A1₂O₃, and others have the advantages of high hardness, high toughness, high strength, wear resistance, low-temperature superplasticity, thermal fatigue resistance, and so on. Nanoceramics are used as new materials because of their corrosion-resistance, heat-resistance, and wear-resistance properties. The mechanical properties of the materials change over a wider range and have a very wide range of uses. This article investigates whether different ceramic technicians in the market want nanotechnology to be used in ceramic production, as shown in Table 4.

### Table 4: Questionnaire on whether ceramic technicians want nanotechnology.

| Investigation classification | 2016 (thousand yuan) | 2017 (thousand yuan) | 2018 (thousand yuan) | 2019 (thousand yuan) | 2020 (thousand yuan) |
|-----------------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------|
| Use nanotechnology          | 3535                  | 5435                  | 6742                  | 8973                  | 10243                |
| No nanotechnology           | 3567                  | 4363                  | 4247                  | 3246                  | 2632                 |

The percentage of the public’s application of nanotechnology from 2016 to 2010 is made into a broken line statistical chart, as shown in Figure 8.

As shown in Figure 8, from 2016 to 2020, the percentage of people who hope that nanotechnology will be applied to ceramic production has become higher and higher, reaching 86%, while the percentage of people who hope that nanotechnology will not be applied to ceramic production has become lower and lower, only about 14%. So, it can be known that there is a wide range of people who want to adopt nanotechnology. By appropriately selecting and designing the chemical coexistence of different microstructures and the matching of physical properties, multiphase ceramic materials with higher mechanical properties can be prepared. Chinese scientists have developed nanoceramic bowls that will not be damaged. The Y₂O₃ nanocrystals prepared by the stearic acid gel method are dispersed in metals to obtain reinforced superconducting heat-resistant alloys and high-strength, high-toughness, and stable zirconia ceramics.

### 3.3. Analysis of Emotional Value Design

Emotion is a special form of human reflection of objective reality, and it is based on people’s attitudes and experiences on whether objective things meet human needs. If this demand is met, it will produce a feeling of comfort and deep love. In the context of this era, we must emphasize communication between people and seek a trace of peace in the souls of the toiling people. Tang Sancai combines the quiet and elegant bamboo culture with ceramic culture and integrates them into household utensils. With the continuous development of social culture, consumers pay more attention to the cultural and emotional connotations of products. With the continuous enrichment of the content and classification of cultural and creative products, potential emotional factors have gradually become the criteria for consumers to choose cultural and creative products.
products. The emotionalization of culturally creative products is produced by the interaction between products and users. Cultural creative products have cultural significance in specific fields. In the promotion process, this cultural meaning is passed on to consumers and arouses their emotional resonance as shown in Figure 9.

As shown in Figure 9, the meaning of having fish every year means that there is a surplus every year, which means that people have a great harvest in one year’s labor. The introduction of emotional design into cultural and creative products not only increases the added value of cultural and creative products but also enhances the aesthetic and cultural power of cultural and creative products and at the same time shortens the emotional and cultural cognitive distance between products and consumers. It satisfies the spiritual and cultural needs of consumers, and it has a powerful role in promoting the commercial power and market competitiveness of cultural and creative products.

4. Discussion

This article first explains the background and definition of Tang Sancai, as well as the definition, classification, properties, characteristics of Bi4Ti3O12 ferroelectric nanomaterials, and the related theories of the elements of product design. This article shows that the design of ceramic crafts based on Bi4Ti3O12 ferroelectric nanomaterials is more popular with the public and provides a theoretical basis for the formation of innovative designs of cultural and creative products.

Based on the dielectric constant method of Bi4Ti3O12 nanomaterials, this article combines relevant cases and summarizes the color elements and emotional elements of ceramic crafts that are popular with the public through the investigation of molecular methods. This part is the focus of this article. Through the demonstration of detailed practical design, the cultural elements are analyzed based on data collection and investigation.

Combining theory and design practice, the concept of emotional design is introduced into cultural and creative product design. It has specific feasibility and demonstrates the user-centered innovative practice route, providing new ideas for cultural and creative product designers. To some extent, it has promoted the development of the country’s cultural and creative industries.

5. Conclusions

Cultural creativity is a cultural phenomenon of reconstruction and innovation constructed with culture as an element, integrating multiple cultures, sorting out related disciplines, and using different carriers. Based on Bi4Ti3O12 nanomaterials, this article mainly develops the cultural and creative design of Tang Sancai products. Through the theoretical analysis of nanotechnology, this article selects the dielectric constant method to highlight the advancement of
nanotechnology and its application in ceramics. Technology is essential for ceramics. It is necessary to seize the current potential opportunities of nanotechnology for the domestic ceramic industry. In the future ceramic industry, nano-uniform technology does occupy an important position. The ceramic market has become a world of high-tech technology. Anyone who can industrialize nanoceramics in the early stage will become a pioneer in the nanoindustry. Due to the author’s limited research level and ability, this article still has certain deficiencies in the content, and further research is needed.

Data Availability
No data were used to support this study.

Conflicts of Interest
The authors declare no conflicts of interest.

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References
[1] Y. Chen, C. Miao, S. Xie et al., “Microstructural evolutions, elastic properties and mechanical behaviors of W/Cr Co-doped Bi4Ti3O12 ceramics,” Materials & Design, vol. 90, no. JAN, pp. 628–634, 2016.
[2] R. Baur and U. Felsing, “On the cultural anchorings of knowledge visualization,” Design Issues, vol. 35, no. 1, pp. 52–66, 2019.
[3] K. C. Samuel, “Neoliberalism, digital communication technologies and the cultural and creative industries,” Advanced Journal of Social Science, vol. 6, no. 1, pp. 96–108, 2019.
[4] C. Long, Q. Chang, and H. Fan, “Differences in nature of electrical conductions among Bi4Ti3O12-based ferroelectric polycrystalline ceramics,” Scientific Reports, vol. 7, no. 1, p. 4193, 2017.
[5] A. Dc, B. Rm, and A. Lz, “Characterizing the chemical composition of Tang Sancai wares from five Tang dynasty kiln sites[],” Ceramics International, vol. 46, no. 4, pp. 4778–4785, 2020.
[6] G. Azar and R. Droogendijk, “Cultural distance, innovation and export performance: an examination of perceived and objective cultural distance[],” European Business Review, vol. 28, no. 2, pp. 176–207, 2016.
[7] O. Felix and B. Bankole, “The effects of cultural dimension on ICT innovation: empirical analysis of mobile phone services [J],” Telematics and Informatics, vol. 34, no. 2, pp. 490–505, 2017.
[8] V. M. Mukhotrov, D. V. Struykov, S. V. Biryukov, and Y. I. Golovko, “Polarization switching along a substrate in thin Bi4Ti3O12 films under different deformation stresses,” Technical Physics, vol. 65, no. 1, pp. 118–123, 2020.
[9] T. Zhang, X. Jin, and Q. Yan, “Surface treatment for efficient photocarriers transfer and separation: a general case of nitric acid activated Bi4Ti3O12[…],” Journal of Molecular Structure, vol. 1247, no. 5, pp. 131–329, 2021.
[10] V. Berbenni, C. Milanese, G. Bruni, A. Girella, and A. Marini, “Synthesis of Bi4Ti3O12 by high energy milling of Bi2O3 – TiO2 (anatase) mixtures,” Journal of Thermal Analysis and Calorimetry, vol. 126, no. 3, pp. 1507–1511, 2016.
[11] K. Qian, Z. Jiang, H. Shi, W. Wei, C. Zhu, and J. Xie, “Constructing mesoporous Bi4Ti3O12 with enhanced visible light photocatalytic activity,” Materials Letters, vol. 183, no. NOV.15, pp. 303–306, 2016.
[12] S. A. Ivanov, T. Sarkar, E. A. Fortalnova et al., “Composition dependence of the multifunctional properties of Nd-doped Bi4Ti3O12 ceramics,” Journal of Materials Science: Materials in Electronics, vol. 28, no. 11, pp. 7692–7707, 2017.
[13] Y. Jiang, X. Jiang, C. Chen et al., “Structural and electrical properties of La 3+-doped Na 0.5 Bi 4.5 Ti 4 O 15 -Bi 4 Ti 3 O 12 inter-growth high temperature piezoceramics,” Ceramics International, vol. 43, no. 8, pp. 6446–6452, 2017.
[14] H. W. Shin and J. Y. Son, “Ferroelectric properties of highly a-oriented polycrystalline Bi4Ti3O12 thin films grown on glass substrates,” Journal of Materials Science: Materials in Electronics, vol. 29, no. 3, pp. 2573–2576, 2018.
[15] W. L. Zhang, M. H. Tang, and Y. Xiong, “Improvement of nucleation and electrical properties of Bi3.15Nd0.85-Ti2.99Mn0.01O12 thin films with an upper Bi4Ti3O12 buffer layer[],” Journal of Sol-Gel Science and Technology, vol. 80, no. 3, pp. 1–7, 2016.
[16] K. Wang, H. W. Zheng, X. J. Li et al., “Effect of top electrodes and light sources on photovoltaic properties of polycrystalline Bi4Ti3O12 film,” Materials Letters, vol. 179, no. Sep.15, pp. 182–185, 2016.
[17] A. Iljinas and V. Stankus, “Influence of deposition temperature on structural and ferroelectric properties of Bi4Ti3O12 thin films,” Applied Surface Science, vol. 381, no. sep.15, pp. 2–5, 2016.
[18] Y. Zhao, H. Fan, K. Fu, L. Ma, M. Li, and J. Fang, “Intrinsic electric field assisted polymeric graphitic carbon nitride coupled with Bi4Ti3O12/Bi2Ti2O7 heterostructure nanofibers toward enhanced photocatalytic hydrogen evolution,” International Journal of Hydrogen Energy, vol. 41, no. 38, pp. 16913–16926, 2016.
[19] C. Gumiel, M. S. Bernardo, and P. G. Villanueva, “Solid state decomposition and reactivity in the multiferroic BiFeO3–Bi4Ti3O12 composite system[,]” Journal of Materials Science, vol. 52, no. 7, pp. 1–10, 2016.
[20] Y. Liu, G. Zhu, J. Peng, J. Gao, C. Wang, and P. Liu, “One-step molten-salt method fabricated Bi2Ti2O7/Bi4Ti3O12 composites with enhanced photocatalytic activity,” Journal of Materials Science: Materials in Electronics, vol. 28, no. 2, pp. 2172–2182, 2017.