Research on Creative Thinking of Ceramic Product Design Based on Style Characteristics

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Objectives: Ceramic product design is a process that is the most purposeful, practical and aesthetic product system design made of ceramic materials. It is a creative process of conception, behavior and realization. Design is a creative process, and the power of creativity comes from the use of creative thinking by designers. As a kind of design type, ceramic design, in the face of constantly updated market environment and market demand, naturally cannot exist independently from creative thinking. Methods: The innovative design of ceramic products, once accepted by the society, is not only the decisive factor for the quality leap of ceramic products, but also an important condition for ceramic products to gain competitive advantage in sales. The application of ceramic decorative art in modern decorative design is undoubtedly a new fashion element in the development of modern decorative design. Results: Based on the perspective of the style characteristics of product design, this paper interprets the ceramic decorative art and studies the combination of ceramic product design and creative thinking. Conclusion: In the process of design, creative thinking is used to show the value of products, which provides inexhaustible power for the innovation and development of product design.

Key words: ceramics; product design; creative thinking; decoration
Tob Regul Sci.™ 2021;7(5): 2082-2093
DOI: doi.org/10.18001/TRS.7.5.127

Ceramic product design is the pursuit of the most purposeful, practical, aesthetic and systematic design. It is the product as the medium to obtain the coordination between products and products, products and people and the environment [1]. The design of ceramic products is the process of conceiving, improving and innovatively designing ceramic products under the conditions of certain production and comprehensive use of science and art. For ceramic art designers, this ability must be possessed, and mastering this ability can lay the foundation and inspiration for the later design of works of artistic value [2]. Class consciousness has caused the pursuit of cognitive function and symbolic function of ceramic product modeling. Different social classes have made the appearance of ceramic products show a colorful face due to the difference of aesthetic taste and aesthetic needs [3]. Creative thinking is a unique thinking activity of human beings. We can't deny that all creative achievements of human beings are the result of creative thinking. Product development and design are no exception. The innovative design of ceramic products, once accepted by the society, is not only a decisive factor in the leap of the quality of ceramic products, but also an important condition for ceramic products to gain competitive advantage in sales [4]. In the teaching of ceramic art design, we must emphasize the development of students' creative thinking and the cultivation of their abilities.

After human beings enter the handicraft industry, the era style of ceramic product modeling is characterized by the pursuit of

decoration and skill under the conditions of handicraft production [5]. Just as the development and progress of human society is inseparable from creativity, the innovation and development of product design is inseparable from the exertion and application of creative thinking in design. Ceramic decoration is not only artistic and cultural, but also practical [6]. After thousands of years of development, Chinese ceramics have formed an artistic style with ethnic characteristics and presented different artistic characteristics in different historical periods. Traditional decorative art is like a bright pearl inlaid on the necklace of art history, which has left us a huge treasure house of art, and the deep accumulation has made it impossible for future generations to enjoy. Applying ceramic decorative art to modern decorative design is undoubtedly a new fashion element that complements the development of modern decorative design. Modern ceramic design develops new artistic styles and forms of expression on the basis of inheriting national culture [7]. The understanding of decorative language, the form of its works have different characteristics, ceramic products and various factors in this relationship together constitute the basic factors of ceramic product design [8]. Ceramic products must have innovative content and vivid artistic appeal, and improve the social value of ceramic products, which is an important means for the survival and development of enterprises.

In the process of modern ceramic art design, creative thinking is its source, not only from real life, but also higher than real life, belonging to a special creative ability [9]. The folk-style ceramics made of ceramics existed from the time of its invention, and the official kiln ceramics were derived from the folk ceramics. The influence of Chinese traditional culture on Chinese ceramic decorative art is far-reaching [10]. From ancient times to the present, it has exuded its special artistic charm, affecting the ceramic art of all generations. Traditional Chinese decoration mainly refers to artistic decoration with graphics with distinctive Chinese regional characteristics and strong national flavor. Creative thinking guides the design creation through the design, not only can improve the efficiency of design, but also is a key factor to enhance product innovation and market competitiveness [11]. The emergence and development of modern industry makes the design follow the creative process of practical and aesthetic law, that is, the designer makes artistic creation on the basis of considering the practicality and economic value of the design object [12]. The main trend of the modern ceramic industry has been transformed from meeting people's material needs to satisfying people's spiritual and cultural needs [13]. Based on the perspective of the style characteristics of product design, this paper interprets the ceramic decorative art and studies the combination of ceramic product design and creative thinking.

In this article, we present a perspective based on the style characteristics of product design, aiming at the creative thinking of ceramic product design.

In summary, our contributions are as follow:

1. This research method is a new technology proposed for the research of creative thinking of ceramic product design based on the style characteristics of product design.

2. The article proposes a model for the combination of ceramic product design and creative thinking.

3. This perspective can clearly show the results of the operation in the combination of ceramic product design and creative thinking.

The function of a ceramic product refers to its efficacy and function. The functional factors of ceramic product design mainly include practical functions, cognitive functions and aesthetic functions [14]. Beall GH believes that the birth of a new ceramic product begins with creative thinking [15]. Creative thinking refers to people's thinking process of comprehensively solving various kinds of relevant information, re-combining according to scientific ideas and using association, imagination and inspiration to form a novel and unique method of solving problems. Chen HC pointed out that every ceramic material product and spiritual product created by human society is the crystallization of creative thinking. It is precisely because people have fully and continuously created in practice that they can create human society. Civilization [16]. Hwang GJ

puts forward the idea of system theory, and defines the system as an organic whole with certain functions formed by a number of interconnected and interacting elements in a certain structural form [17]. Saporta A et al. believe that the practical function of ceramic products is to meet the material needs of users through the exchange of substances and energy between ceramic products and users [18]. Schacter DL and others believe that ceramic art is one of the art of plastics. Ceramic art refers to the artistic characteristics of ceramic daily necessities, the firing process of decorative articles and their styling, glaze and decoration [19].

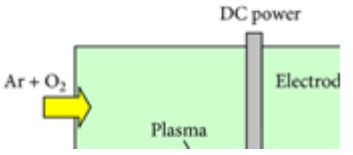
METHODS

Main Features of Ceramic Products

The cognitive function of ceramic products is to receive various information stimuli from ceramic products through the user's vision, touch, hearing, etc. , to form a holistic perception of ceramic products, thus generating corresponding concepts and appearances. From the perspective of human history, art has always been a part of life [20]. The relationship between art and life is inseparable. Art comes from life. It reflects the content and form of people's real life. The artistic language of ceramic decoration has a limitation, a limitation of craft materials and artistic requirements, and at the same time, it completes artistic creation in various feasible ways. Only by ensuring that their basic knowledge is solid enough, ceramic art designers can lay the foundation for the development and cultivation of post-imaginative and intellectual innovation, and produce a series of new ideas. The study of the rheological properties of ceramic materials is mainly based on the measurement of the macroscopic dynamic viscoelasticity of the material and the theory of a low-filled blend system. Figure 1 is a schematic diagram of plasma treatment of ceramic materials.

Figure 1

Principle of Plasma Treatment of Ceramic Materials



Modern ceramic design is part of industrial design. With the advancement of the times, creative thinking is getting deeper and deeper. Ceramic design is not simply a representation of material form. It covers functionality, economy, aesthetics, and other content that arises from it, including profound social implications. As a material carrier with a certain function, the ceramic product itself has various elements and reasonable structure, and the interconnection between the elements and the structure constitutes the internal system of the product itself.

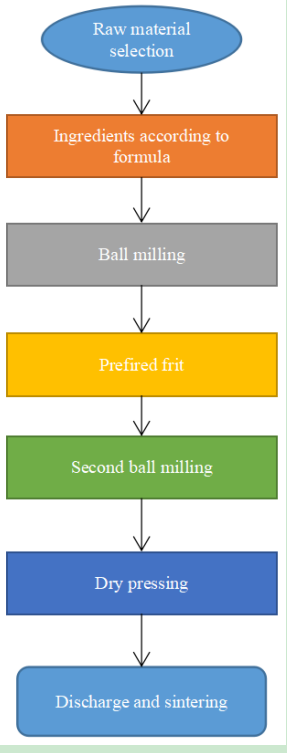
Development of Innovative Thinking in Ceramic Art Design

Due to their different natural conditions and cultural environment, different regions and peoples in the world have adapted their local conditions to local conditions and created ceramic styles suitable for their own national and regional life and aesthetic needs. China's traditional ceramic patterns and Western traditional ceramic patterns emphasize the combination of patterns and shapes in their expression techniques, but they differ in the form of patterns. China's ancient ceramic sculptures have the same ethnic style, and each period has its own style characteristics. The decorative pattern on the ceramic is integrated with the shape of the decorated objects, complementing each other and perfectly combining the perfect artwork. As an added value of products, decorative value is increasingly occupying an important position and even becoming the main driving force for consumers to purchase goods. Creative thinking can comprehensively refine and apply the existing knowledge, memory and experience foundation of

the designer and existing material information in a variety of modes of thinking, and then obtain new product styling and graphic image.

Pottery is a masterpiece of human transformation of nature. Creative thinking is oriented, forward-looking and practical. It has an important guiding role in the design of various categories. It can guide the direction and promote the solution of problems. It is the key to final design [21]. The solid phase reaction method achieves a solid phase reaction by high temperature calcination to obtain a material powder. The solid phase reaction method has many advantages such as simple process and equipment, and is convenient for industrial production. The process preparation process of the samples herein is shown in Figure 2.

Figure 2
Dielectric Material Preparation Process



The ceramic cultures around the world are in a colorful situation, but the excessive pursuit of craftsmanship has led to a styling style that tends to be complicated, trivial and pretentious. The composition, microstructure, and sintering process of the material are designed and determined based on the performance or mechanical properties of the ceramic material. After removing the outliers, the mass fraction of the dopant is used as the input parameter of the network. A competitive neural network model was established with the performance constant of the composite as the output parameter. The network prediction and evaluation of the training completed with the experimental data of the doping scheme without training, the comparison between the learning value of the flexural strength and the resistivity and the experimental values are shown in Table 1 and Table 2.

Table 1
Comparison of Experimental and Predicted Values of Flexural Strength

Group No	Experimental value	Predictive value
1	32. 3	31. 6
2	44. 5	45. 5
3	46. 2	46. 3

Table 2
Comparison of Experimental and Predicted Values of Resistivity

Group No	Experimental value	Predictive value
1	44. 51	43. 15
2	46. 63	42. 32
3	32. 54	31. 87

Modern ceramic art emphasizes the role of works in people's spirit and psychology. The learning rate is large, the convergence speed is fast, and the reverse is slow. The model uses a variable learning rate approach:

$$K_c = K_p^{\Phi}\left(\frac{RT}{p^{\Phi}}\right)^{-\sum_B \gamma_B} = K_p (RT)^{-\sum_B \gamma_B} \quad (1)$$

The sample is sent to the hidden layer unit by the connection weight, and the new activation value of the hidden layer unit is generated:

$$\frac{d \ln K^{\Phi}}{dT} = \frac{\Delta_r H_m^{\Phi}}{RT^2} \quad (2)$$

The correct choice of learning rate is very important for the convergence of competitive neural networks. Calculate the output layer unit error:

$$V = V_m \frac{Cp}{(p_S - p)\left[1 + (C-1)\frac{p}{p_S}\right]} \quad (3)$$

The data of the crystal structure can be obtained by the crystal structure refining method, and the phase content can also be quantitatively analyzed. The formula for quantitative analysis of the phase by the crystal structure refinement method is as follows:

$$S = S_{as} = \frac{4P}{\pi d E_a \alpha} ch\left(\alpha \cdot \frac{L_a}{d}\right) \quad (4)$$

The significance of the ecologicalization of ceramic products is not only the diversification of the functions sought in its complex external cultural environment, but more importantly, the creation of more rational and diversified ways of thinking. Contemporary ceramic art designers must have enough knowledge to form new design ideas and ideas, and lay a solid foundation for the stimulation of creative thinking in the later period. Traditional Chinese decorative art originates from traditional culture and is like a microcosm of Chinese history and an important part of Chinese traditional culture [22]. It satisfies the decoration designer's pursuit of simple style and meets the simple and natural psychological needs of consumers. Thinking determines design, design reflects thinking, product design is born on the basis of objective reality, and generates sparks of creativity under the stimulation of creative thinking [23]. The art of pottery in China shows that traditional decorative art emphasizes the decorative form of beauty, which gives the original painted pottery an eternal artistic life. Under the constantly updated technical conditions, it is the essence of design to promote the original design elements into creative products with more profound meanings and broader visual changes.

RESULTS

Innovating the Teaching Mode of Ceramic Art Design

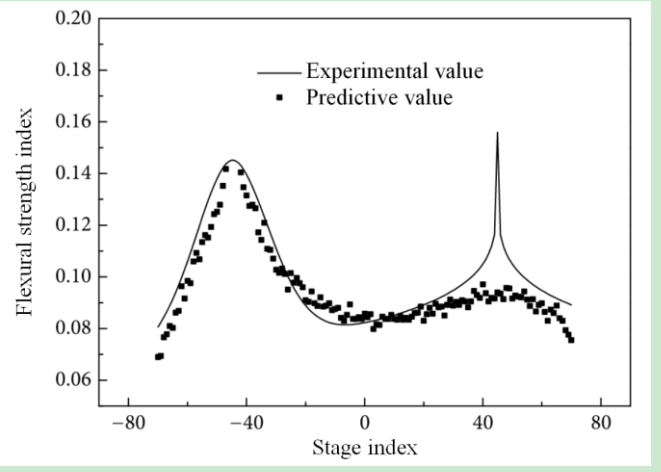
Innovation is the essence of product design, while creative thinking is the soul of product innovation design. The development of any thing has its regularity, and the ceramic decorative pattern also has its own regularity of development and evolution. The combination of folk art and ceramic art, then the use of folk art symbols in ceramic decoration is a concrete manifestation of the fusion of culture and art. The external form of ceramic products' special shapes and colors shows its functional characteristics and usage, which affects the user's cognitive orientation, behavioral attitudes and psychological trends. The formation of an ideal ceramic design, or the solution of a problem, is often the result of people's creative thinking activities. In the teaching of ceramic art design, in order to carry out scientific and rational teaching goal positioning, we must first carry out talent development and training target positioning. Ceramics can draw on these folk elements and use ceramic beauty to make a second appearance. Human observation of things in the early thinking is relatively simple, and the generalization of things is also depicted in the simple outline that is the easiest to remember. The ultimate goal of design is to solve the problem. If the product does not have a certain function, it loses its meaning of existence, so the function becomes an important aspect of innovation.

Due to the non-harmonic effect of the vibration mode, the intrinsic loss is even present in the ideal lattice. The non-harmonic effect of lattice vibration can be simply described as a monophonic absorption peak accompanied by a fixed damping coefficient resulting in the existence of dielectric loss. After optimization, the hidden layer structure of 10 neurons was selected. The comparison between the learned value of the flexural strength and the experimental value is shown in Table 3 and Figure 3.

Table 3
Experimental and Predictive Values of Flexural Strength of Lnt Materials

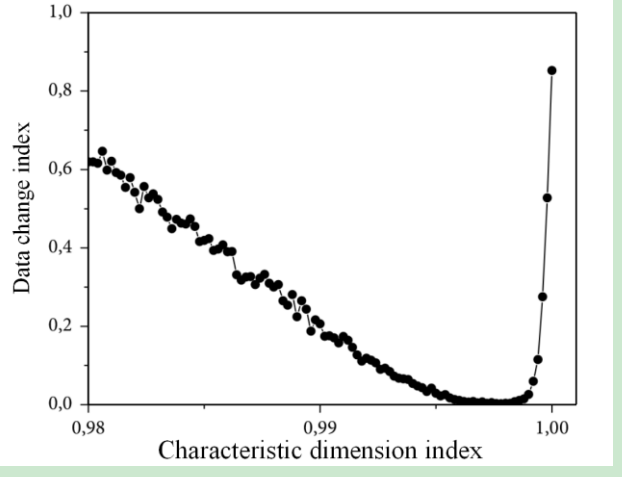
Group No	Experimental value	Predictive value
1	57. 58	56. 62
2	58. 62	59. 14
3	62. 86	61. 75
4	65. 41	63. 47

Figure 3
Comparison of Experimental Values and Predicted Values of Flexural Strength of Lnt Materials



The aesthetic function of ceramic products is the aesthetic feeling of people who are aroused by their internal and external forms. The aesthetic needs of people are the high-level spiritual function factors of the relationship between ceramic products and people. Ceramics belong to folk art. Because of its own characteristics and experience, it has been influential and influential. Traditional Chinese decorative art originates from traditional culture and is like a microcosm of Chinese history and an important part of Chinese traditional culture. It satisfies the decoration designer's pursuit of simple style and meets the simple and natural psychological needs of consumers. Figure 4 shows the relationship between the dimensions of the mechanical model features and the discriminant results for the two batches of experiments in the same batch of samples.

Figure 4
Data Changes Based on the Mechanics Model Construction Pattern



When the heat capacity of the heat exchange fluid is small, especially for air, the temperature difference between the inlet and outlet of the heat exchange fluid is large, and the temperature drop of the heat exchange fluid will inevitably affect the phase change heat storage process. The phase change driving force is the difference between the initial molar free energy and the final molar free energy in the system:

$$D=\frac{RT}{L}\frac{1}{6\pi\eta r} \tag{5}$$

For solution crystallization systems:

$$r=k_2\theta_A\theta_B=\frac{k_2a_Aa_Bp_Ap_B}{\left(1+a_Ap_A+a_Bp_B\right)^2} \tag{6}$$

For melt crystallization systems, the melt is in a supercooled state when the melt temperature is below the melting point of the crystal. The difference between the melt temperature and the crystal melting point is subcooling, ie:

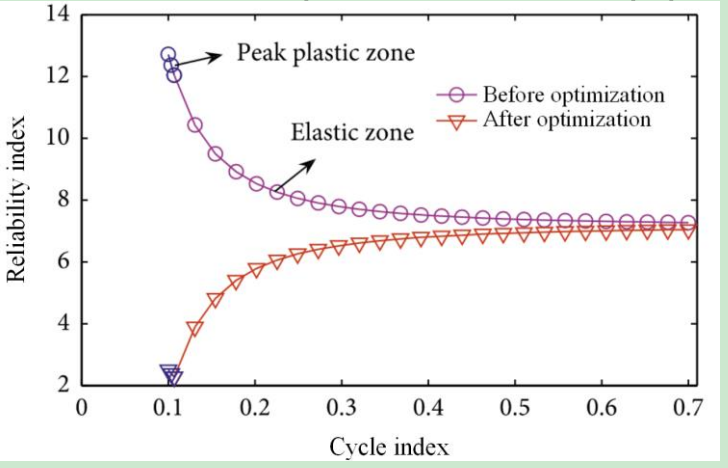
$$V=V_m\frac{Cp}{\left(p_s-p\right)\left[1+\left(C-1\right)\frac{p}{p_s}\right]} \tag{7}$$

The phase change driving force of the system is:

$$\ln\frac{c}{c_0}=\frac{1}{RT}\frac{2\gamma M}{\rho R'} \tag{8}$$

The communication and display of folk art culture and the integration of ceramic art play a role through the medium of folk art symbols. As an art and a culture, folk art cannot directly jump on ceramics. The high-voltage electric pulse charging and discharging device based on ceramic material can advance the design problems and quality problems that may occur in the project in the form of collision detection. The topology reliability optimization simulation is compared as shown in Figure 5.

Figure 5
Simulation Comparison of Optimized Topology Reliability of Pulse Charging and Discharging Device



If the output is expected to be less than the given error value, the training of the network is terminated, otherwise the reverse propagation process is entered. The adjustment of the weight of this paper is determined by the following formula:

$$r=k_2p_B\theta_A=\frac{k_2a_Ap_Ap_B}{1+a_Ap_A+a_Bp_B} \tag{9}$$

Output an event to the time sensor. The time sensor then routes these times to other nodes based on changes in time, causing these nodes to change accordingly:

$$I=\frac{24\pi^2A^2\gamma V^2}{\lambda^4}\left(\frac{n_1^2-n_2^2}{n_1^2+2n_2^2}\right)^2 \quad (10)$$

The change of the ceramic kiln is mainly achieved by interpolation points:

$$\frac{\Pi}{c}=\frac{RT}{\overline{M_n}}+A_2c \quad (11)$$

The following is the routing process for this simulation:

$$u=\frac{\xi\varepsilon E}{k\pi\eta} \quad (12)$$

Although traditional Chinese decoration has different artistic characteristics in various eras, the traditional Chinese aesthetics that it has been following are unchanged. The combination of ceramic design function and aesthetic function, aesthetic requirements are not an appendage of ceramic design performance, and it has the same status as function [24]. The visual sensory attributes of the product are the medium of product function, aesthetics, design concept and social value display, giving people the most intuitive psychological feeling. People's observations of nature have become more careful, the level of aesthetics has gradually increased, and the things they have shown have become more specific. We must learn the essence of Western modern ceramic design. On the other hand, we should pay more attention to the continuous research and exploration of Chinese traditional decorative art. The use and application of creative thinking in the same form, both in terms of product functional attributes and visual senses, have an indelible boost.

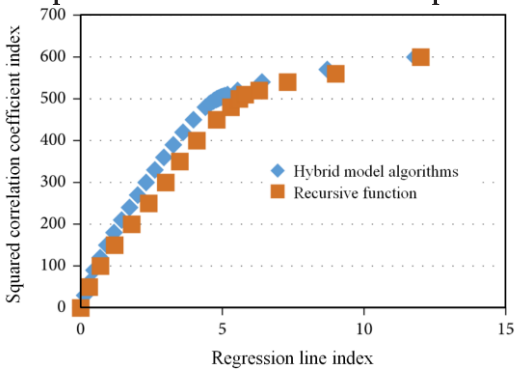
The Promotion of Creative Thinking in Product Design

Whether the ceramic product evokes the beauty of the person in the process of use is the basis for judging whether it has an aesthetic function, and the beauty is obtained on the one hand from the functional beauty and external form of the beauty of the ceramic product itself. Form is the materialization of thinking, the product of human consciousness, and the top priority of product visual senses. Innovative thinking is closely related to the innovative form design. The inheritance and development of traditional decoration is consistent with the inheritance and development of Chinese traditional culture [25]. Innovative design based on its own characteristics is undoubtedly a design that is truly vital and competitive in the market. In production, the dielectric constant can be flexibly adjusted according to actual needs, and can also be used in the preparation of multilayer chip components. To a large extent, problems such as deformation and damage of components due to large differences in sintering shrinkage curves or thermal expansion coefficients between different system materials are avoided. Compare the hybrid model algorithm with the recursive function model. The slope of the regression line is closer to the square of the correlation coefficient, and the regression line intercept is closer, so the prediction result is better. As shown in Table 4 and Figure 6.

Table 4
Comparison of Model Prediction Capabilities

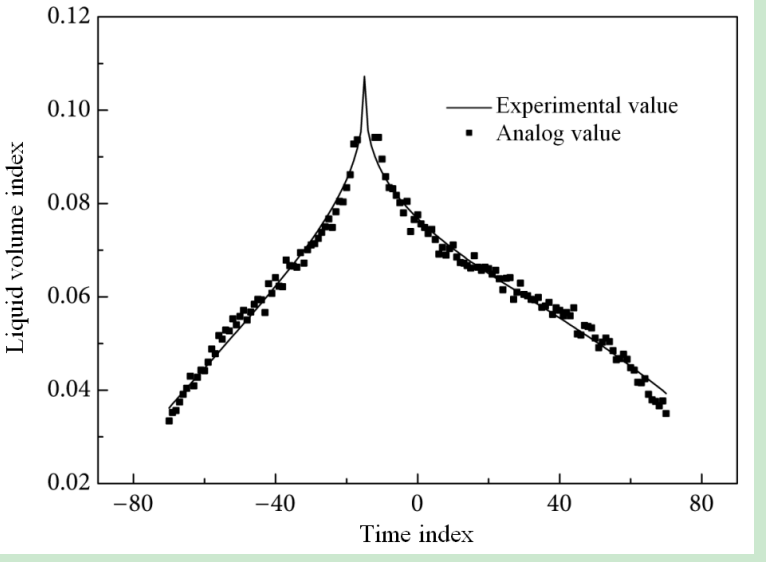
Model	Regression Line	Squared correlation coefficient
Hybrid model algorithms	5. 68	6. 26
Recursive function	8. 96	13. 63

Figure 6
Comparison of Model Prediction Capabilities



The orientation-forming nucleating agent is different from the crystal structure of the adhesion layer, but its nucleating agent surface provides a preferential deposition position on the crystal lattice on the attached crystal. The liquid phase volume fraction change curve and the point temperature change curve of the heat storage process were simulated and compared with the experimental results. As shown in Figure 7.

Figure 7
Change in Liquid Fraction of Liquid Storage Material



If the decorative materials are the material basis of the decorative arts, then the craftsmanship is the means by which the ceramic decorative materials are promoted to the spiritual quality. Artistic content determines the art form, and the art form expresses the artistic content and develops with the development of artistic content. The super-utility and intuition of emotional identity make the aesthetic function of ceramic products appear in the irrational and non-logical complex state, and it can be obtained through the unified perfection of functional beauty and form beauty. Innovative product styling and its unique design concept can not only enhance the aesthetics of the product itself, but also make the product more aesthetic.

DISCUSSION

Creative thinking is the birthplace of product design, a booster for product innovation, and it gives products a lasting vitality and eternal artistic appeal. Ceramic product design is a work that takes into account multiple design factors, combining practical requirements and conditions such as function and form, technology and economy. The innovative combination of ceramic

decorative art and modern decorative design will undoubtedly bring new impact to decorative design elements. The pattern decoration of the ceramic surface, the principle of its style is also the same as the style. It is inseparable from the artist's cultivation and the material technology of each era. The shape of ceramic products has different era styles in different eras, reflecting the lifestyle and aesthetic consciousness of people in that era. How to embody the national characteristics of ceramic decorative pattern art, how to not lose yourself in the face of Western culture is worth pondering. A successful ceramic product design must be combined with these factors to achieve an appropriate and ideal balance. Designers can use creative thinking in a targeted manner in the design process to demonstrate their value to the product, in order to provide inexhaustible power for product design innovation and development.

Human Subjects Approval Statement

This paper did not include human subjects.

Conflict of Interest Disclosure Statement

None declared.

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