

Retraction

Retracted: Research on Digital Representation of Xiaopi Kiln Ceramic Art Design Based on Computer-Aided Technology and IoT Network

Security and Communication Networks

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Security and Communication Networks has retracted the article titled “Research on Digital Representation of Xiaopi Kiln Ceramic Art Design Based on Computer-Aided Technology and IoT Network” [1] due to concerns that the peer review process has been compromised.

Following an investigation conducted by the Hindawi Research Integrity team [2], significant concerns were identified with the peer reviewers assigned to this article; the investigation has concluded that the peer review process was compromised. We therefore can no longer trust the peer review process, and the article is being retracted with the agreement of the Editorial Board.

The authors agree to the retraction.

References

- [1] B. Gong, K. Sukpasjaroen, and T. Chankoson, “Research on Digital Representation of Xiaopi Kiln Ceramic Art Design Based on Computer-Aided Technology and IoT Network,” *Security and Communication Networks*, vol. 2022, Article ID 6496935, 9 pages, 2022.
- [2] L. Ferguson, “Advancing Research Integrity Collaboratively and with Vigour,” 2022, <https://www.hindawi.com/post/advancing-research-integrity-collaboratively-and-vigour/>.

Research Article

Research on Digital Representation of Xiaopi Kiln Ceramic Art Design Based on Computer-Aided Technology and IoT Network

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The development of digital information technology progresses as time passes. Each art category has also experienced its own development and changes. With the rapid advancement of information technology, the traditional ceramic skills left by the older generation can no longer conform to the trend of the times. The digital intervention in traditional ceramic art publishing provides more development space and development mode for the industry and traditional ceramic art publications in terms of dissemination form and dissemination effect. In the current ceramic design, contemporary ceramic art design also has a new development trend of integrating with technology and other art categories. Compared with the traditional ceramic art that pursues craftsmanship, contemporary ceramic art design is more about adding creators' emotional concepts. In terms of material selection, craftsmanship, and aesthetics, there are big progress. The IoT network assisted digital representation of the Xiaopi kiln ceramic art design discussed in this paper is based on the technical conditions of computer-aided technology. It has the advantages of simple structure, being convenient for continuous cutting and shaping of ceramic pieces, high efficiency, numerical control without manual operation, and ease of use.

1. Introduction

With the development of the economy, digital media has been widely used in various fields in our country, especially the ceramic modeling and design industries, and has a huge impact. The art of ceramics comes from life, and our ancestors created the exquisite craftsmanship of ceramics, making them famous all over the world [1]. In the design process of traditional ceramic products, designers need to complete the following tasks: the design of modeling and decoration, the presentation of renderings, the drawing of design drawings, and the production of physical models. The above-mentioned design tasks are mainly done by hand-painting and hand-made, which are all subject to the designer's experience, technology, materials, and other factors [2]. Ancient daily-use ceramics are developed from daily-use utensils. Its design is mainly to meet people's daily needs and

has strong practicability. Nowadays, daily-use ceramics are not only used as utensils, but more as works of art to be appreciated and played by people.

Design drawings are particularly important as a "communication medium," but because the expression of the plane is not intuitive, the feasibility of the design plan needs to be repeatedly verified and evaluated before the actual production and processing, which requires repeated revisions of the design plan, and the design cycle is long [3]. The time gap between research and development is a regular occurrence. As a result, traditional tiny ceramic workshops are unable to adapt to the changing times. The criteria for daily-use ceramics design, including the application of new technologies and the use of new wines in ancient bottles, may not only inherit Chinese traditional culture, but also add distinctive qualities to daily-use ceramics design [4]. For ceramic objects with complicated, irregular forms and thin

bodies, the grouting procedure is ideal. The classic grouting method requires the creation of a seed mould, followed by the creation of a mould based on the seed mould. To a considerable measure, the quality of the completed product is determined by the manufacture of the ceramic seed mould [5]. The conventional manufacturing technique often uses turning processing or clay moulding to achieve the desired final quality. The drying shrinkage rate and the fire shrinkage rate should be addressed while designing and producing the seed mould, and the seed mould should be increased according to the total shrinkage ratio to assure the size of the final product after firing. There are still some issues with the application of digital interactive technology in ceramic modeling design, which necessitates the prompt intervention of relevant personnel, and the portable ceramic modeling design can fundamentally change, providing technical support for educational reform, which is also an intellectual reform [6]. This has a significant impact on the future development of digital interactive technology in ceramic modeling design. Many everyday ceramic objects are still made using conventional moulds. Most modern people pursue characteristics. The products designed and produced by ancient moulds are not enough to meet people's spiritual needs [7]. Today, although the design process of daily-use ceramics is passed down from generation to generation, the required design skills are extremely fine, and such craftsmen are not common in today's society [8]. The traditional glaze modeling design method is similar to the ceramic modeling design method in some aspects. Before designing, we must first understand the needs of customers and the actual situation of the target market, formulate an overall design plan, prepare processing facilities and materials, and determine the processing technology [9]. The next step is to conceive a plan and draw creative sketches, and traditional design methods are expressed in flat graphics. There are still many problems in the modern ceramic industry [10]. First of all, there is no new idea in design and no innovation in technology, which leads to the stagnation of the ceramic industry. Only by introducing advanced digital technology into the design and development of daily-use ceramic products will it greatly promote the development of the daily-use ceramic industry. After the Industrial Revolution, due to the division of labor in social production, design and manufacturing were separated, and manufacturing and sales were separated, so design gained an independent status. The division of labor in the design industry is becoming more and more refined and specialized, and at the same time, many software programs serving various design directions have been produced. These software tools generally include two-dimensional plane software and three-dimensional modeling software.

Although the current ceramic products have reliable quality, it is precisely because of the lack of their own brands that when selling in the international ceramic market, they must borrow international famous brand labels to sell, which is extremely unfavorable to the

development of the ceramic industry [11]. The daily-use ceramics industry is an "old" industry. The daily-use ceramics industry is huge, but it has not developed into a large-scale enterprise because it has been following the old path of the past without innovation [12]. Technological progress can drive the progress of the industry. Digital interactive technology can better promote the development of ceramic modeling design. It can not only innovate ceramic modeling design methods, but also improve the quality of ceramic modeling design, which can also make better use of digitalization to achieve further development of ceramic modeling design [13].

2. Related Work

Abstract of [14] proposed an example of distinguishing authenticity by the difference in device type. Abstract of [15] proposed that modeling and ornamentation are the key issues in the identification of ancient ceramics. By grasping these two aspects, the reliability coefficient of identification can reach 85%. Abstract of [16] proposed to replace qualitative analysis with digital quantitative analysis research. Abstract of [17] proposed that self-sensing actuators can be used for vibration control of larger space structures, which will also be a direction for future research. Abstract of [18] indicated that based on the basic knowledge of the finite element method, the piezoelectric sensor and actuator equations were deduced, and the effectiveness of applying PVDF self-sensing actuator to vibration control was verified. The bridge circuit approach is examined and discussed in the abstract of [19]. Abstract of [20] suggested employing self-sensing actuators to create a speed negative feedback closed-loop system and analysed the performance of active and passive control in terms of piezoelectric layer thickness and piezoelectric sheet position. Abstract of [21] demonstrated that, for self-sensing actuators, an observer technique is provided; a charge drive circuit is developed and the drive voltage acquired; and the strain and stress of the piezoelectric sheet are observed and computed using the drive voltage and induced charge. The estimated value of the state vector may determine the stability of the whole system, and the state feedback controller can be utilised to bring the tested system to a generally stable state, according to the abstract of [22]. Abstract of [23] recommended that the sensing function be included in the piezoelectric ceramic bending actuator and that the execution and sensing functions be realised using strip-shaped electrode segmentation in order to promote the ceramics sector on a daily basis.

With the development of the traditional production process, we "take the essence and get rid of the dross" of the traditional production process, introduce digital technology into the research and application of daily-use ceramic design, and use digital technology to inject new vitality into the design of daily-use ceramics [24]. The method used in this paper is computer-aided, which provides a computer-aided mouldless moulding device for ceramic parts to solve the problem that various moulds need to be made by die-casting moulding of ceramic parts.

3. Digital Technology and Ceramic Art Design

3.1. The Importance of Digital Technology to the Ceramic Industry. After the baptism of the new era, the ceramic industry is on the brink of crisis. In order to pass the risk and turn the crisis into a safe place to become a daily ceramic industry, owner needs to overcome the difficulties. It has been proved by practice that only on the basis of stabilizing the traditional daily ceramic industry and only by achieving breakthroughs and development in the high-tech field can the daily-use ceramics industry undergo a successful transformation and take the daily-use ceramics industry to a higher level [25]. The application of digital interactive technology in ceramic modeling design can innovate and improve the level. Moreover, digital interactive technology can also promote a comprehensive understanding of ceramic modeling design, thereby enhancing the inspiration for ceramic modeling design. In the traditional identification of ancient ceramics, the age and origin of the ceramics are generally identified and judged from the aspects of the shape, decoration, glaze color, carcass, and brand recognition of ceramics through sensory means such as eye observation and hand touch [26]. The rise of the daily-use ceramics sector has been fueled by digital technologies. Only by consistently inventing and bringing out the new can the daily-use ceramics industry remain invincible in the harsh worldwide ceramics market, allowing the company to continue to expand and build its own daily-use ceramics brand. Three-dimensional digital technology may be utilised to finish ceramic modeling and decorative design in the early stages of ceramic design. Modern ceramic items feature a lot of free-form surfaces with subtle modifications, which necessitates highly stringent curve curvature criteria, even though the curvature demands for ceramic products are not as rigorous as the curvature specifications for automobiles [27]. Even it is so tight, but in order to ensure that the ceramic goods have a smooth aesthetic effect and ideal handed comfort, the premodel design of the job must be completed using the Rhino software surface modeling tool.

Ceramic enterprises should attach great importance to the role of digital technology in daily-use ceramics, regard digital technology as a magic weapon for enterprises to win in product competition, strengthen the application of digital technology in the production of daily-use ceramics, and continue to innovate and transform digital technology, to keep pace with the times, to ensure the healthy growth of enterprises. Traditional design methods have many technical difficulties in dealing with free-form surfaces on ceramic shapes. However, with the help of Rhino software, designers become flexible and deal easily with some complex surfaces. Ancient ceramic is not only a technical product but also a carrier of culture and art [28]. Although these two technical identification methods have different characteristics and advantages than traditional identification methods, they also have their own limitations and shortcomings. Although the market modernization is unprecedented, people still favor traditional national culture, so the development of daily-use ceramics must keep pace with the times. V-Ray and Keyshot were two of the most popular renderers in the past. Keyshot

is suited for generating still photographs and animation movies, and it is now frequently utilised in the area of industrial design since it is simple to use and has excellent real-time effects. The conventional identification model's creative expression forms and qualities (vessel shape, decoration, etc.) provide a significant reference value for the chronological and geographical placing of ancient ceramics.

Using digital technology to expand the design capabilities of ordinary ceramics, we can seize the market and take the lead. Digitalization of ceramic technology refers to the use of CAD ceramic design software to develop ceramic product drawings, synthesise product data, and acquire final design drawings of ceramic goods. A large variety of preset shaders are included in the application, making it simple for users to choose them quickly during rendering. We will be able to obtain clear digital characteristics and laws if we can learn from, absorb, and apply the essence of ancient ceramics' traditional identification mode, combine it with modern information processing technology and mathematical analysis methods, and try to quantify and systematise sensory information and experience as precisely as possible in order to obtain clear digital characteristics and laws. The utilisation of digital high-tech design has sped up the development in the ceramic sector. Rapid prototyping technique based on 3D digital technology may complete the design and fabrication of moulds in the ceramic production stage. Some experts and researchers have shown the importance of quantification methods for the structure of ancient ceramics in the investigation and identification of ancient ceramics in the early days. These procedures, however, are time-consuming. The most essential point is that only a portion of the information about ancient ceramics' structure can be recovered, and it is impossible to properly portray the features of ancient ceramics' structure. The employment of digital technology in the daily-use ceramic design business will be an unavoidable growth trend, as well as a legacy of traditional daily-use ceramics. People's concepts and thoughts may be perfectly conveyed thanks to digital technology. Color and texture of everyday ceramics are more expressive thanks to digital technology. The market for daily-use ceramics is rich and monotonous, with more distinct strata.

3.2. Combination of Digital Technology and Ceramic Design Industry. The traditional ceramic design process also limits the design and development of daily-use ceramics to a certain extent. The designer's design process requires repeated careful deliberation. Sometimes, the original material cannot leave the designer's design inspiration, and it is lost. Maybe this is a good design work. The powerful surface modeling capability of the 3D software can quickly present the designer's design intent, and the convenient renderings can not only present complex shapes, but also quickly express the different textures and decorative requirements of ceramics. Pottery is a material cultural product with universal significance in the world, and porcelain is a great creation of ancient China. As a comprehensive product of science and art, ceramic is not only a product of the material

world, but also a product of the spiritual world, and at the same time, it provides services for the material and spiritual life of human beings. Modern civilization has an important influence. Modern digital technology can not only record the designer's creative inspiration, but also achieve the best realization effect of the design work and make a satisfactory ceramic art shape after a variety of design effects. In the production stage, based on the rapid prototyping technology, the three-dimensional digital mould is directly processed by the CNC machine tool, which ensures the accuracy of the mould and avoids errors caused by the manual production process, thereby improving the quality of the product. The production of digital models plays a vital role in the entire design phase, and its role runs through the entire product development and manufacturing.

Ancient porcelain has a 10,000-year history that is unrivalled anywhere in the world. Its long development process has a wealth of scientific, technological, and aesthetic overtones, making it a valuable addition to human civilization. Ceramic has had an unparalleled impact on the globe. The Internet is the most effective and direct communication medium in current digital technology, and it plays a significant role in people's work and lives. Digital model creation is a basic and straightforward process that everyone can learn and master. Digital models may be created in a fraction of the time it takes to hand-paint static drawings and construct physical models. During the design phase, the highly customizable digital model is subjected to repeated modification and editing. There is a lot of old Chinese pottery in the region's historic ruins, tombs, museums, and personal collections. These precious ceramics are important study artefacts in the history of human civilization and cultural treasures across the globe. This is a crucial position. The current daily-use ceramic manufacturing process is distributed through cultural network communication and online sales of daily-use ceramics: ceramic designers promote their works and ideas over the Internet while also obtaining other designers through the cultural exchange of daily-use ceramics to learn from and exchange expertise with ceramic specialists both at home and abroad to create ideas.

New challenges may be addressed at any point throughout the design process, allowing the design cycle to be significantly reduced. The use of computer manufacturing has resulted in a reduction in personnel and material usage, as well as a reduction in the production cycle and cost. With the advancement of people's material and cultural lives, a growing number of individuals are becoming interested in ancient pottery. The collecting of cultural artefacts and antiques is also gaining popularity. Many cities around the nation are seeing an increase in the number and size of cultural relics and antiques markets and stores, with old pottery accounting for a significant percentage. Designers may also learn about the ceramic industry's evolution and fashion trends by visiting professional ceramic theme websites. Designers may create their own websites to supply the globe with everyday ceramics in order to continue to carry forth Chinese traditional culture and increase its impact. The transmission and distribution of everyday pottery is aided by design and information. The use of digital

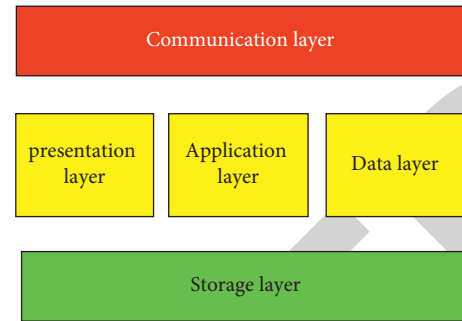


FIGURE 1: Three-tier structure system.

technology in product creation makes design expression more intuitive, and digital product design is more conducive to exhibition and communication. Designers use the Internet to easily and quickly communicate with customers, manufacturers, and target consumer groups. When people study, research, and collect ancient Chinese ceramics, they all need to identify the ceramics they see. The pricing standards for the purchase and sale of ancient ceramics are based on the appraisal opinions of the artefacts, so the appraisal opinions are critical to the economic value of the artefacts. Using virtual reality, animation demonstration, and other methods, the appearance of the product can be displayed in an all-round and three-dimensional manner, which is convenient for the online display of the product.

4. IoT Network Assisted Digital Expression of Ceramic Art Design Based on Computer-Aided Technology

4.1. New Features of Traditional Ceramic Art Presented in Digital Environment. For the national traditional printing and publishing model, the application and expansion of digital and new media in publishing are not so much a huge impact on the traditional publishing industry model, but an inevitable development when we are facing increasingly serious practical problems. The physical model expression has a certain degree of intuition, but the production is inconvenient, time-consuming, and labor-intensive. The number of extant ancient porcelain fragments or whole utensils is innumerable. The workload of analysing and classifying them is extremely huge. If only traditional manual measurement and statistical comparison are used, the task is extremely cumbersome. At present, in the field of ancient ceramics scientific research, the research on the digital structure of ancient ceramics is still in its infancy. Under this trend, ceramic art in the traditional sense has been severely tested. Relatively speaking, the design method based on 3D digitization can be modified and edited in real time. In practice, some scholars gradually realised the importance of digital quantitative research and consciously or unconsciously used mathematical methods in ancient ceramics scientific research, which has become the consensus of many scholars and experts. We must first know that, under the circumstance that the inherent value of traditional ceramic art cannot be changed, ceramic art in

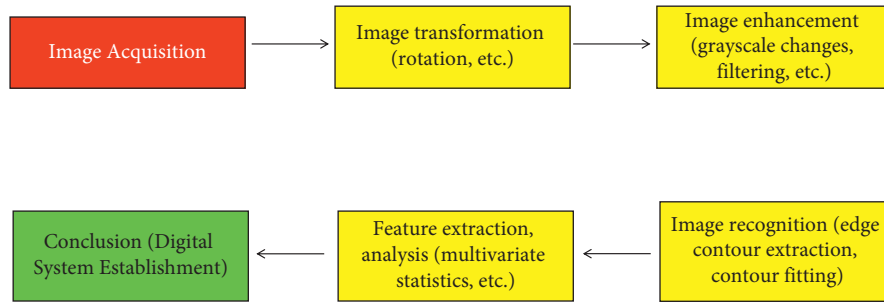


FIGURE 2: Workflow of ancient pottery-type images.

the digital environment is an optimization of the value of books and publishing resources on the original basis. Due to the limitations of the traditional two-layer structure, the system construction should be based on a three-layer structure system, as shown in Figure 1.

The visual effect of the three-dimensional design method is more intuitive, and the virtual rendering can achieve the authenticity of the work, ensure the consistency of the design scheme and the final product, and facilitate the display and review of the scheme in the design stage. The digital model may be immediately built and processed using rapid prototyping technology, which not only enhances work productivity but also saves a lot of material and human resources. There are frequently several distinguishing factors in the data analysis of ancient pottery. As a result, the technique of data reduction factor analysis was employed in the early data analysis of ancient pottery to combine and reduce the distinctive variables and directly produce coordinates to depict the distribution and interaction of ancient ceramics samples. Regarding relationship, its inherent benefits in communication will be fully shown with the involvement of digitization and new media forces. Computer-aided design is driving the fast growth of the design sector with its unique benefits as the era of big data approaches. As an important part of computer-aided design, three-dimensional digital technology and rapid prototyping technology complement each other and accelerate the traditional arts and crafts design. Regarding “intensive” and “intelligent” diversified development, digital hand-over of raw images into a more compact form enables deeper research on image recognition and image analysis, as shown in Figure 2.

In the late 1980s, the multivariate statistical analysis method was applied to the analysis of ancient ceramic data. Multivariate statistics effectively reduced the dimension of the data space. Through the mapping technology, the distribution of the data in the high-dimensional space was projected to the two-dimensional or three-dimensional space, and then the dimensionality of the data space was reduced. Cluster analysis of data is carried out with the help of human recognition ability. Traditional ceramic art exists in the form of physical books on paper. Under this model, the products published by ceramic art go through and rely on a very rigorous and relatively long process before they become formal finished products. For designers, it is not

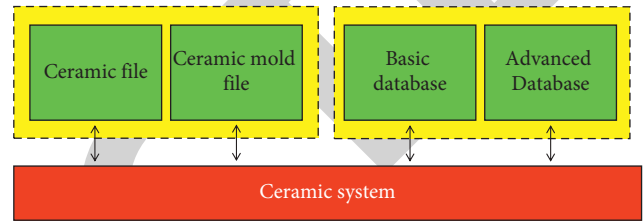


FIGURE 3: Ceramic information integration framework.

just a celestial creation. In the design stage, the moulding process of the design work should be fully considered, and the characteristics of the processing technology should be fully understood to ensure the perfect connection between the design and the subsequent production. Not only the publication of theoretical ceramic art books, but also the publication of plate ceramic books, also need to go through such a process. The ceramic product data management system can transmit product design information, which plays a role in information integration, as shown in Figure 3.

In the era when computer technology has not yet been popularized, the difficulties faced in realising this idea can be imagined, so there are few applicants. However, with the rapid development of computer technology and the continuous popularization of computers, there are sufficient conditions for digital quantitative research on ancient ceramic information with a large amount of data. The publishing of ceramic art in the digital environment, in terms of dissemination, depends on the network information platform and the ever-changing digital technology as the carrier and support to demonstrate its supremacy in dissemination. In the scientific and technical investigation and identification of ancient ceramics, IoT network supported digital techniques of vessel type structure play a large role. Their tactics, on the other hand, are inconvenient. The most essential point is that they can only extract a portion of the ancient pottery vessel type structure’s information, and it is difficult to properly portray the ancient ceramic vessel type’s structure characteristics of the structure. After the effect of digital and multimedia on ceramic art publishing, compared with the traditional publishing mode and publishing environment of the ceramic art publishing industry, the dependence and demand on resources have undergone obvious changes.

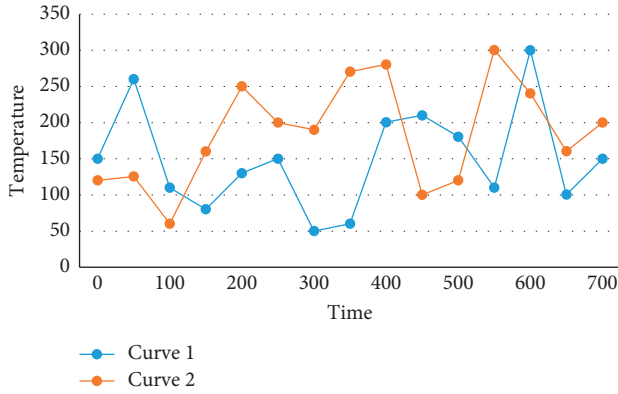


FIGURE 4: Presintering heating curve of ceramic powder.

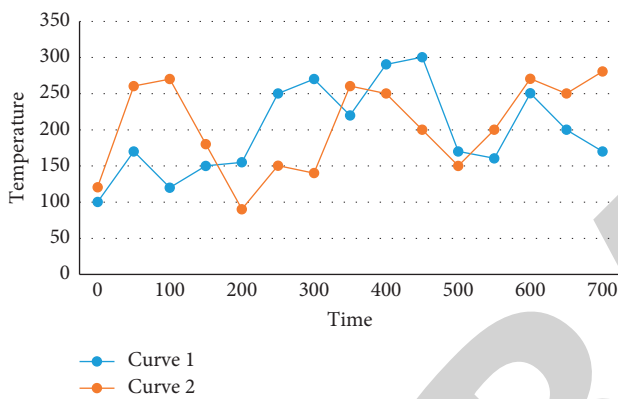


FIGURE 5: The heating curve of ceramic sintering.

4.2. Reasonable Perfection of Self-Development of Ceramic Art Publishing in Digital Environment. In the development trend of social economy and technology, the development of ceramic art publishing in the digital environment has become an irresistible trend. For designers, it is not just a celestial creation. In the design stage, the moulding process of the design work should be fully considered, and the characteristics of the processing technology should be fully understood to ensure the perfect connection between the design and the subsequent production. Ceramics is the unity of technology and art, and science and humanities are perfectly reflected in ceramics. Comprehensive understanding of Chinese ancient ceramics is of great historical significance. In the face of the digital environment, ceramic art publishing should consider the positioning of its own value in the new environment and the response to the changes in the traditional thinking mode. The division of labor in the design industry is becoming more and more refined and specialized, and at the same time, many software programs serving various design directions have been produced. These software tools generally include two-dimensional plane software and three-dimensional modeling software. By detecting prehistoric pottery clay, the age of pottery or the place where it was found can be determined, and the origin of pottery clay can be found, thus providing evidence for the study of the distribution and communication of pottery makers; through the archaeological

typology of pottery patterns, the relative age of remains can be understood. Learn about pottery uses, ancient recipes, and more through the shape of pottery and the food or other remnants in it. Use the gradient heating method to determine the preburning heating curve, in which the temperature is raised to 1255°C for 4 h and then naturally cooled to room temperature, as shown in Figures 4 and 5.

In the positioning of ceramic art publishing in the digital environment, we should get out of a misunderstanding, that is, think that digital ceramic art publications will become a complete substitute for traditional paper ceramic publications. Designers can use two-dimensional graphic design software to complete design tasks such as design sketches and patterns. The shape, decoration, and glaze color of ceramic products are related to the development level of social economy and culture at that time, reflecting some content of social life at that time from a certain aspect. In fact, although art publishing in the digital environment is quite different from traditional art publishing in terms of publishing forms and publishing methods, in the final analysis it cannot replace traditional publishing as the only speaker. Ceramic decorative patterns can also be designed using plane software. Among them, the decals used in ceramic decoration are the most typical. A ceramic image machine prints out the specified artwork, which may then be “converted” to the ceramic surface following low-temperature firing. The production of porcelain has changed from low-level to high-level, the output has changed from less to more, the types have changed from simple to complex, the glaze color has changed from single color to colourful, and the type of ceramic ware has changed from easy to easy due to the long historical process of the development of pottery and the invention of porcelain. The study of ceramics’ profound significance, is extremely essential. With the growth of flow control technology, precision electrical processing technology, fine medical technology, bioengineering, and other sectors, the necessity for accurate control of each microflow component has become increasingly prevalent. Digital microinjection technique for the steps of piezoelectric ceramics is researched.

The piezoelectric material is in boundary conditions (mechanical freedom, electrical short circuit), T and E are independent variables, and S and D are dependent variables, and then the piezoelectric equation is

$$\begin{aligned} S_i &= s_{ij0}^E T_j + d_{ni} E_n \\ D_m &= d_{mj} T_j + \varepsilon_{mn}^T E_n. \end{aligned} \quad (1)$$

In the above formula, $i, j = 1, 2, 3, 4, 5, 6, m, n = 1, 2, 3, 4, 5, 6$, d_{ni} and d_{mj} are piezoelectric strain constants; s_{ij}^E is the elastic compliance constant when the electric field strength is zero or constant, also called the short-circuit elastic compliance constant; ε_{ij}^T is the dielectric constant when the stress D is zero or constant, also known as the free dielectric constant.

Digital art publishing is an internal expansion of traditional ceramic art publishing functions under the new situation. Based on the background of modern scientific and technological society, ceramic creation from

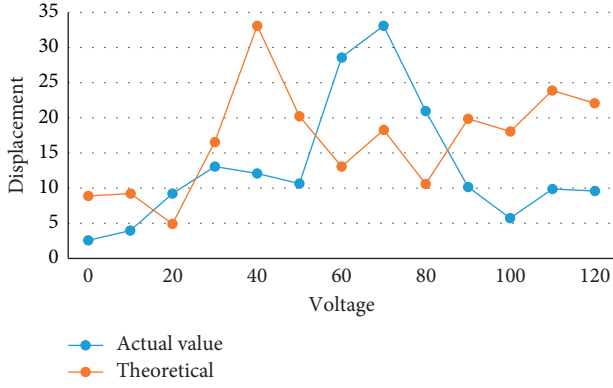


FIGURE 6: Microflow at different voltages.

material preparation, moulding, glazing, firing, etc., is inseparable from the assistance of modern technology, especially the use of electric billeting machines and modern kilns, and the mechanization of large-scale ceramics production, etc. An electronic balance is used to weigh the microflow, and the value is calculated to analyze the relationship between the flow and the driving voltage, and the microflow under different voltages is shown in Figure 6.

All bring greater possibilities to ceramic design and creation. The so-called complementary value positioning of services is a positioning based on the shortcomings and drawbacks of traditional ceramic art publishing in the process of progress, which can make up for this deficiency to a certain extent and improve or even eliminate the drawbacks. In the long history of human development, all kinds of different ethnic groups, and even the same ethnic group in different periods, have different living conditions and habits, have their own unique requirements, especially for the indispensable products such as ceramics, and must have shaped the style of ceramics in different periods and regions. The purpose of publishing ceramic art in the digital world is to augment the surface that conventional ceramic art cannot reach. Materials having a higher atomic or ionic polarisation must be used to generate microwave dielectric materials with a high dielectric constant.

To determine the degree to which the dielectric is polarised in the electric field, we utilise the polarisation vector P , which is the vector sum of the induced dipole moments in the dielectric per unit volume:

$$P = \lim_{\Delta V \rightarrow 0} \frac{\sum_{i=1}^n \mu_i}{\Delta V}, \quad (2)$$

where $\sum \mu_i$ is the sum of the induced dipole moments in the volume element ΔV along the direction of the electric field.

According to the concept of statistical average, let the number of constituent particles of the dielectric in a unit volume be N , the induced dipole moments of each particle are regarded as equal and set as μ , and then formula (2) can be written as

$$P = N \cdot \mu. \quad (3)$$

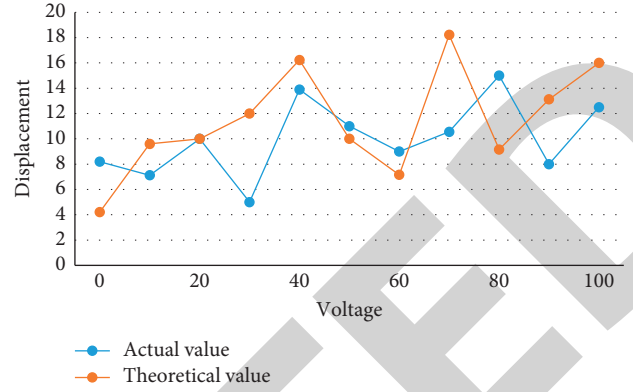


FIGURE 7: Relationship between external voltage and micro-displacement of piezoelectric ceramics.

In an isotropic linear medium, the polarisation strength P of each point is proportional to the macroscopic electric field strength E , and the induced dipole moment is also proportional to the effective electric field strength inside the dielectric, namely,

$$P = \epsilon_0 \cdot (\epsilon_r - 1) \cdot E, \quad (4)$$

$$\mu = a \cdot E_p. \quad (5)$$

In the formula, ϵ_0 is the vacuum permittivity, ϵ_r is the relative permittivity of the dielectric, a is the polarizability, and its physical meaning is the molecular dipole moment per unit electric field strength.

The larger a is, the stronger the particle polarizability is. Substitute equations (4) and (5) into test (3) to obtain the Clausu period equation:

$$\epsilon_r = 1 + \frac{N \cdot a}{\epsilon_0} \cdot \frac{E_p}{E}. \quad (6)$$

From the Lorentz model, it can be proved that

$$E_p = \frac{E}{3} (\epsilon_r + 2). \quad (7)$$

The identification of pottery types is very important in the identification of ancient ceramics, and it is the first perception of the collectors to the objects to be appraised. As a new technology, the application of 3D printing technology in ceramic art design is also developing rapidly. In traditional ceramic preparation techniques, due to the limitations of ceramic materials, the moulding of ceramic works will be limited accordingly, which is also one of the driving factors for the development of ceramic 3D printing technology. The ancient ceramic shapes all have their origins, which can be traced back to the bronze wares of the Xia, Shang, and Zhou dynasties and even the Warring States, Qin, and Han dynasties, or imitated the living utensils of the folk of the past dynasties. The evolution continues and the inheritance is endless. The products of the northern and southern kilns have their own formulae, although they vary owing to regional differences. Their essential qualities, however, are similar to those of the eras. The complementing value of this

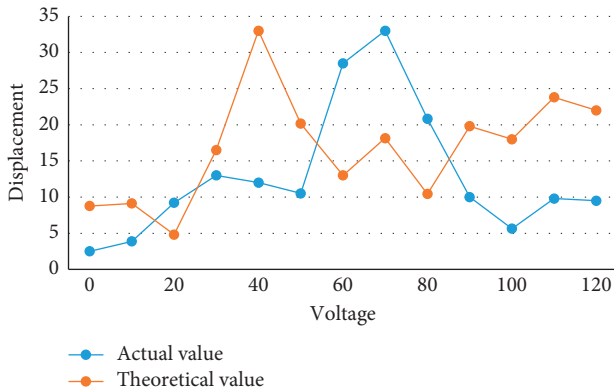


FIGURE 8: Microdisplacement diagram of 10 * 10 piezoelectric ceramics.

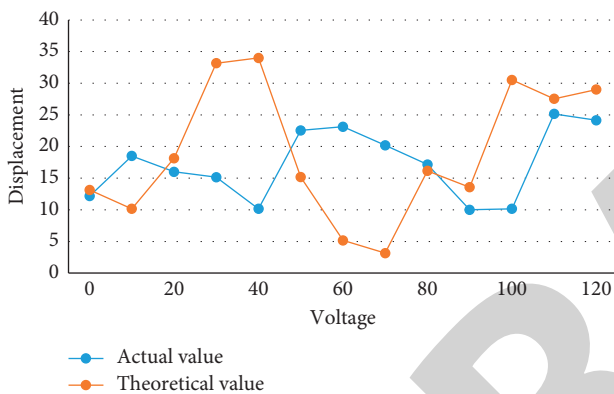


FIGURE 9: 5 * 5 piezoelectric ceramic microdisplacement diagram.

service may be seen in time-sensitive dissemination, on-demand distribution without wasting resources, and interaction between digital publishing and art institutions such as libraries, auction houses, and galleries. It can also be said that it is an objective assessment and review of ceramic art publishing in the digital environment. The data is collected by the data acquisition card, and the data is sent to the computer. The relationship between the external voltage and the microdisplacement of the piezoelectric ceramic is shown in the figure. When the piezoelectric ceramic is applied with an external voltage, the comparison diagram of the theoretical output displacement of the primary inverse piezoelectric effect and the actual output displacement value is shown in Figure 7, and the microdisplacement diagrams of the 10 * 10 and 5 * 5 piezoelectric ceramics are shown in Figures 8 and 9.

5. Conclusions

Economic globalization and digitization have formed a unique and universal impact, and many industrial operations have experienced conflicts arising from the alternate combination of traditional industrial models and digital new industrial methods. With the advent of microcomputers, it is possible for people to create some pottery daily necessities with more complex structures, broader functions, and more

variable forms, which will further promote a more flexible and changeable relationship among product users so that users can order or choose from a visual menu to sample the special features needed from a wide range of categories. The combination of ceramic art design and technology, the combination with other art categories, the infusion of the creator's personal emotions, ideas, and consciousness, and the emphasis on the inheritance of traditional cultural concepts constitute the development trend of contemporary ceramic art design. In addition to the above analysis and discussion, we also cannot ignore the construction of fine ceramic art in the digital environment. The so-called quality is not only the pursuit of the quality of ceramic art, but also the pursuit of content. IoT network assisted digital ceramic art leaves the limitation of paper books in the traditional form and has certain advantages in some aspects, but it also imposes stricter requirements on the quality of publications.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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