Vol.7 Iss.3 2026
https://doi.org/10.37420/j.adr.2026.012
Art & Design Research

Research on the Application Model of Shu Brocade Pattern and Color Genes in Ceramic Cultural and Creative Product Design

Shiyu Xu*
Chengdu Qinggong Polytechnic University, Chengdu,Sichuan, China
***Corresponding author, E-mail: 519013205@qq.com**

Abstract:

Shu Brocade and ceramics both serve as significant material carriers of Chinese civilization. Their integration within the contemporary cultural and creative context represents not only an exploration of the living transmission of intangible cultural heritage but also a practical proposition for cross-media innovation in traditional crafts. Based on a theoretical analysis of Shu Brocade's pattern and color systems, this paper proposes a four-stage application model—"cultural decoding, gene extraction, material translation, and scenario adaptation"—and systematically elucidates the design logic and methodology for transforming Shu Brocade's visual elements into ceramic carriers. The study argues that the orderly structure of Shu Brocade patterns, their auspicious symbolism, and the color philosophy of the "Five Orthodox Colors" constitute "cultural genes" that can be translated through ceramic techniques. Through strategies such as pattern simplification and abstraction, color glaze translation, and structural texture bionics, a cross-media design language can be established from woven brocade's two-dimensional ornamentation to ceramic's three-dimensional objects, achieving the integrated goal of "form endowed by patterns, resonance endowed by colors, and meaning endowed by culture." This research aims to provide an operable methodological framework for the contemporary design transformation of intangible cultural heritage elements, as well as theoretical support for the development of cultural and creative products derived from Bashu cultural resources. The study systematically examines the typological characteristics of Shu Brocade patterns across different historical periods, from Warring States geometric motifs to Tang clustered-bead roundels and Song Eight-Direction Halo patterns, revealing their underlying structural logic of orderly composition, auspicious symbolism, and temporal stratification. Concurrently, the paper analyzes the Shu Brocade color system as a three-tiered structure comprising philosophical cosmology (the Five Orthodox Colors), technological constraints (limited loom palettes), and visual expression (high-saturation primary colors harmonized with neutrals). In addressing the design challenges posed by medium differences between flexible woven fabric and rigid ceramic surfaces, the paper identifies current bottlenecks in superficial pattern appropriation versus deep material integration. The four-stage application model is then elaborated in detail: cultural decoding involves scholarly decontextualization to extract formal rules and semantic structures; gene extraction selects pattern units and color lineages with high ceramic translation potential based on criteria of clarity, typification, and readability; material translation operates through three integrated strategies of form endowment (adapting patterns to vessel logic), resonance endowment (converting color relationships to glaze language), and meaning endowment (simulating weave texture through ceramic tactility); and scenario adaptation balances aesthetic expression with

© 2026 by the author(s); licensee Mason Publish Group, this work for open access publication is under the Creative Commons Attribution International License (CC BY 4.0). (http://creativecommons.org/licenses/by/4.0/)

functional utility across lightweight lifestyle products and display-oriented artistic works. Case studies of Shu Brocade ceramic refrigerator magnets and the "Warp-Weft Weaving Splendor" tea vessel series demonstrate the model's practical applicability while revealing limitations including pattern homogenization, color translation bottlenecks, and insufficient scenario differentiation. The paper concludes that Shu Brocade's visual elements constitute active cultural genes amenable to systematic design transformation, and proposes future research directions encompassing comprehensive pattern pedigree documentation, experimental glaze-color database development, and user-centered acceptance studies. This framework contributes both a methodological reference for intangible cultural heritage design translation and theoretical support for Bashu cultural product innovation.

Keywords:
Shu Brocade; pattern genes; color system; ceramic cultural and creative products; design translation; application model

1. Introduction

The contemporary dilemma of intangible cultural heritage protection does not lie in a scarcity of cultural resources, but in the "grammatical rupture" between traditional elements and modern life. Shu Brocade, as one of China's four famous brocades, carries over two thousand years of weaving wisdom, and its exquisite patterns and elegant colors have earned it the reputation of "a silk-weaving specimen of Eastern aesthetics." However, with the decline in the number of weaving artisans and shifts in modern aesthetic sensibilities, Shu Brocade faces the risk of sliding from a "living craft" to a "museum specimen." At the same time, ceramic cultural and creative products, as important carriers of intangible cultural heritage transformation, have developed rapidly in recent years but commonly suffer from "superficial symbol appropriation and hollow cultural connotations"—simply printing traditional patterns onto the surfaces of objects rather than achieving a deep fusion of material language and aesthetic spirit.

How can the splendid colors of Shu Brocade be "grafted" onto the warm texture of ceramics? The essence of this question lies in establishing a commensurable design language between two heterogeneous media. This paper proposes a four-stage application model—"cultural decoding, gene extraction, material translation, and scenario adaptation"—in an attempt to construct a systematic transformation pathway from Shu Brocade visual elements to ceramic cultural and creative products. The study decodes Shu Brocade's pattern order and color philosophy as "cultural genes," and subsequently explores translation strategies and application cases on ceramic materials, aiming to provide methodological reference for the contemporary design transformation of intangible cultural heritage elements.

2. Cultural Gene Decoding of Shu Brocade Patterns and Color Systems

2.1 Pattern Typology: Order, Symbolism, and Temporal Stratification

Shu Brocade patterns are not merely decorative motifs, but a triple condensation of weaving techniques, contemporary fashion, and auspicious concepts. From the perspective of morphological characteristics, they

© 2026 by the author(s); licensee Mason Publish Group, this work for open access publication is under the Creative Commons Attribution International License (CC BY 4.0). (http://creativecommons.org/licenses/by/4.0/)

can be categorized into three major types: geometric-order type, animal-auspicious type, and plant-floral type. The tower-pattern brocade from the Warring States period, featuring triangular geometric elements arranged in repetition, exhibits the sense of order and rhythm of early brocade weaving. The paired-rams-and-tree-pattern brocade from the Wei, Jin, and Northern and Southern Dynasties incorporates exotic elements from Persia and India, with animal motifs interwoven with ring patterns, reflecting the cultural convergence along the Silk Road.

The Tang Dynasty represented the peak of Shu Brocade pattern development. "Lingyang-gong-style" patterns are characterized by symmetrical composition and clustered beaded roundels. The beaded-roundel motif originated in Sasanian Persia and entered China via Buddhist cultural mediation, where it merged in Shu Brocade with elements such as treasure-flower motifs and paired deer, creating a unique "Sino-Western synthesis." The "Eight-Direction Halo Brocade" of the Song Dynasty represents another peak of Shu Brocade pattern design—with a geometric skeletal framework as the base, extending in all eight directions and filled with floral and auspicious ornaments, the structure is intricate yet orderly, reflecting the Song aesthetic shift from Tang opulence to Song refinement.

The deep structures of these patterns share common characteristics: first, orderly composition—whether geometric repetition or symmetrical layout, emphasis is placed on visual rhythm and cadence; second, auspicious symbolism—patterns are not merely aesthetic objects but also symbolic carriers of concepts such as fortune, prosperity, longevity, and happiness; third, temporal stratification—each era's patterns inherit and transcend those of previous periods, forming an extractable "pattern gene pool."

2.2 Color System: The Dialectic of the Five Orthodox Colors and Weaving Constraints

The use of color in Shu Brocade appears on the surface to be a matter of craft choice, but at a deeper level represents the material manifestation of traditional Chinese color philosophy. The pre-Qin text Rites of Zhou: Records of Artisans records that "the work of painting and embroidery employs the five colors," establishing green, red, yellow, white, and black as the "Five Orthodox Colors," corresponding respectively to the east, south, center, west, and north—a color symbolism of cosmic order. The color scheme of Shu Brocade has almost consistently revolved around this system—the "Five Stars Rise in the East to Benefit China" brocade features green as the dominant tone, with auspicious clouds and mythical beasts rendered in yellow, red, green, and white, achieving a subdued yet magnificent effect through the simultaneous use of all five colors, serving as a perfect annotation of the Han Dynasty's five-element color theory.

However, Shu Brocade colors are not entirely free aesthetic expressions but are subject to the rigid constraints of weaving technology. From the Warring States to the Western Han period, with limited loom conditions, Shu Brocade employed warp-faced patterning and was mostly two-color or three-color brocade. Even in later periods with mature weaving techniques, the color palette of a single piece of Shu Brocade typically did not exceed five colors—one as the ground, with the remaining four colors interchanged during the shuttle-throwing process. This "limited-color" technological characteristic constitutes precisely the source of Shu Brocade's color identity: achieving richness within constraints, and realizing infinite variations from a limited palette through the blending of silk threads (such as yellow and blue interwoven to produce green).

Thus, the Shu Brocade color system can be summarized as a three-tiered structure of "philosophical frame-

© 2026 by the author(s); licensee Mason Publish Group, this work for open access publication is under the Creative Commons Attribution International License (CC BY 4.0). (http://creativecommons.org/licenses/by/4.0/)

work—technological constraint—visual expression": at the philosophical level, it adheres to the cosmological view of the Five Orthodox Colors; at the technological level, it is constrained by the loom's color limitations; and at the visual level, it presents a dialectical unity of high-saturation primary colors and black-white-gray tonal harmonies. This structure holds significant reference value for the subsequent translation into ceramic glazes.

3. Design Challenges in Translating Shu Brocade Patterns and Colors to Ceramics

3.1 Medium Differences: The Linguistic Gulf from Flexible Warp-Weft to Rigid Glaze Surface

Shu Brocade and ceramics—one soft, one hard; one a two-dimensional fabric woven from silk threads, the other a three-dimensional object fired from clay—the medium differences between the two constitute the primary obstacle to translation. The refinement of Shu Brocade patterns derives from the delicate organization of warp and weft threads, with visual effects dependent on the luster of silk threads, the texture of the weave, and the juxtaposition of colors. The surface language of ceramics, by contrast, employs the flow of glazes, the weight of brushstrokes, and the contours of vessel forms as its expressive means. Translating the "brocade sensibility" of Shu Brocade into the "glaze sensibility" of ceramics is not a simple transplantation of patterns, but a systematic translation of design languages.

The difficulty of this translation lies in: how can Shu Brocade patterns' pursuit of order—repetition, symmetry, continuity—adapt to the curved surfaces and volumes of ceramic vessels? How can the layered and blended effects of Shu Brocade colors be rendered through the firing characteristics of ceramic glazes? These questions point to a fundamental design proposition: translation is not replication, but rather the search for "commensurability" between two languages while respecting the properties of each material.

3.2 Current Bottlenecks: The Gap between Superficial Appropriation and Deep Transformation

A review of current Shu Brocade-themed ceramic cultural and creative products on the market reveals two extremes: first, the simple printing of Shu Brocade patterns onto porcelain tiles or vessel surfaces using decal technology to achieve "pattern relocation," which, while visually identifiable, lacks the design depth of material integration; second, the complete disregard of Shu Brocade's cultural semantics in ceramic forms and decoration, using "Shu Brocade" merely as a marketing label with no actual connection to its visual genes. Chengdu New Southwest Ceramics' "Shu Brocade Ceramic Refrigerator Magnets" condense Shu Brocade patterns onto small porcelain tiles, employing high-temperature ceramic firing combined with traditional brocade color schemes—a worthwhile attempt at lifestyle integration[1]. However, overall, there remains a methodological gap between "pattern borrowing" and "gene fusion."

© 2026 by the author(s); licensee Mason Publish Group, this work for open access publication is under the Creative Commons Attribution International License (CC BY 4.0). (http://creativecommons.org/licenses/by/4.0/)

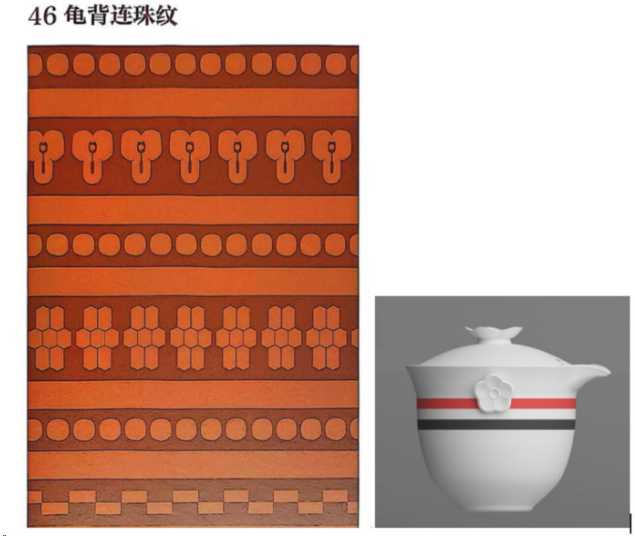
4. "Cultural Decoding—Gene Extraction—Material Translation—Scenario Adaptation": Constructing a Four-Stage Application Model

In response to the aforementioned challenges, this paper proposes a "four-stage model" for the application of Shu Brocade pattern and color genes in ceramic cultural and creative design. The core logic of this model is: treating Shu Brocade's visual elements as "cultural genes" that can be extracted, transformed, and regenerated, achieving cross-media integration from brocade to ceramics through systematic design operations.

4.1 Cultural Decoding: Scholarly Reduction of Pattern Semantics and Color Structure

Cultural decoding is the starting point of transformation; its task is to conduct a "de-contextualized" scholarly analysis of Shu Brocade patterns and colors—stripping away their specific historical attachments to extract their formal structures, symbolic semantics, and color logic. This process is analogous to gene sequencing in biology: focusing not on individual expressions but on the underlying rules that govern those expressions[2].

For patterns, decoding focuses on: the skeletal system of composition (geometric frameworks, symmetry modes, repetitive rhythm), thematic elements (animals, plants, geometric symbols) and their auspicious meanings, and period-style markers (such as Tang clustered-bead roundels or Song Eight-Direction Halo). For colors, decoding focuses on: the correspondence between hue selection and the Five Orthodox Colors, the interaction between palette scale and technological constraints, and color-matching principles (such as cool-warm contrast and value gradation). Through decoding, the "cultural genes" of Shu Brocade are abstracted from specific artifacts or textiles, becoming formal principles and semantic resources available for subsequent design operations.



4.2 Gene Extraction: Extractable Pattern Units and Color Lineages for Translation

Building upon cultural decoding, the task of gene extraction is to select pattern units and color lineages suitable for ceramic material expression. Not all Shu Brocade patterns are equally suited for ceramic translation—overly dense brocade details may appear cluttered in underglaze painting, and visual effects dependent on silk luster may disappear entirely on matte glaze surfaces. Therefore, gene extraction should follow the

© 2026 by the author(s); licensee Mason Publish Group, this work for open access publication is under the Creative Commons Attribution International License (CC BY 4.0). (http://creativecommons.org/licenses/by/4.0/)

principles of "clarity of pattern, typification of structure, and readability of meaning."

From the pattern dimension, the following types of Shu Brocade patterns exhibit high potential for ceramic translation: geometric-skeletal patterns (such as the eight-direction framework of Eight-Direction Halo and the diamond-shaped continuity of the double-square pattern), whose sense of order can create structural resonance with the rim, belly, and foot of ceramic vessel forms; clustered-bead roundel patterns (such as Tang paired-deer with beaded roundels), whose circular compositions suit ceramic circular surfaces, with beaded elements convertible to underglaze dots or embossed roundels; and plant-scroll patterns (such as interlocking branches and scrolling vines), whose continuous flowing forms suit the encircling decoration of ceramic vessels. These pattern units share common characteristics: clear forms, ease of integration with ceramic vessel types, and high cultural recognizability.

From the color dimension, Shu Brocade's "Five Orthodox Color" lineage—green, red, yellow, white, black—corresponds neatly with traditional Chinese ceramic glaze color systems: green corresponds to celadon and underglaze blue; red to sacrificial red and overglaze iron red; yellow to yellow glaze; white to white glaze; and black to black glaze and ink-color painting. This provides a natural material interface for color translation. Furthermore, the "limited palette" characteristic of Shu Brocade colors resonates with the controllable range of ceramic glazes—in ceramic firing, glaze color development is influenced by multiple factors such as temperature, atmosphere, and thickness, and controlling the number of colors actually helps improve yield rates and visual purity[4].

4.3 Material Translation: An Integrated Strategy of Form Endowment by Patterns, Resonance Endowment by Colors, and Meaning Endowment by Structure

Material translation is the core link of the four-stage model and the most design-intensive phase. Its goal is to transform the extracted "genes" into a design language that ceramic materials can carry and express[6]. Translation can be approached from three dimensions:

First, form endowment by patterns—from fabric motifs to ceramic decoration. The key to form endowment lies in adapting to the formal logic of ceramic vessels. For round vessels (bowls, plates, cups), Shu Brocade's roundel and beaded-roundel patterns can be adapted to circular surfaces, creating a "bird's-eye view of brocade" visual effect. For standing vessels (vases, jars, honorific vessels), Shu Brocade's interlocking and scrolling vine patterns can be transformed into encircling compositions that align with the vessels' vertical visual flow. Existing design practice has demonstrated that condensing Shu Brocade's "Eight-Direction Halo," "scrolling vine," and "plum-and-magpie" patterns into modern aesthetic symbols, and reproducing the opulent sense of "an inch of brocade worth an inch of gold" through glaze colors and textural variations, is a feasible direction for translation.

Second, resonance endowment by colors—from silk-thread color matching to glaze tone harmonization. The task of resonance endowment is to convert Shu Brocade's color logic into the color language of glazes. This process is not a one-to-one correspondence of colors, but a transplantation of "color relationships": the contrast between high-saturation primary colors and black-white tones in Shu Brocade can be translated into color contrasts in overglaze painting; the secondary color effects produced by the blending of silk threads in Shu Brocade can be referenced for the blending of layered glazes or kiln-transformation effects. Simulta-

© 2026 by the author(s); licensee Mason Publish Group, this work for open access publication is under the Creative Commons Attribution International License (CC BY 4.0). (http://creativecommons.org/licenses/by/4.0/)

neously, Shu Brocade's "Five Orthodox Color" framework can serve as a structural guide for ceramic color design—taking one orthodox color as the dominant tone, supplemented by accents of other hues, seeking rich variation within a limited palette.

Third, meaning endowment by structure—from brocade weave texture to ceramic tactility. Meaning endowment is the deeper level of translation, aiming to enable ceramic objects to "remember" the weaving characteristics of Shu Brocade at the material level. Specific strategies include: simulating the warp-weft texture of Shu Brocade on ceramic surfaces through carving, relief modeling, and hollowing-out techniques; echoing the luster characteristics of Shu Brocade silk threads through glaze surface qualities (matte, crackle, crystalline); and transforming Shu Brocade's "brocade border" into rim or foot decorative bands on ceramic vessels. When viewers touch the ceramic object, they can not only "see" the patterns of Shu Brocade but also "feel" the textile texture of Shu Brocade, thus achieving cross-sensory translation from vision to touch.

4.4 Scenario Adaptation: Dynamic Balance between Aesthetic and Functional Qualities

The final link in the four-stage model is scenario adaptation—adjusting the emphasis of translation strategies according to the usage scenarios of ceramic cultural and creative products. The particularity of cultural and creative products lies in their dual nature: they are both cultural carriers and everyday objects; they require both aesthetic recognizability and functional rationality. Therefore, the essence of scenario adaptation is to seek a dynamic balance between "depth of cultural expression" and "convenience of daily use."

Based on current market practice, Shu Brocade-themed ceramic cultural and creative products can be broadly divided into two directions: lightweight lifestyle cultural products and display-oriented artistic cultural products. The former, represented by refrigerator magnets, coasters, tea sets, and tableware, require simplified patterns, bright colors, controllable processes, and moderate costs—Chengdu New Southwest Ceramics' Shu Brocade ceramic refrigerator magnets and hexagonal tile coasters fall into this category, aiming for "lifestyle integration of intangible cultural heritage aesthetics."[5] The latter, represented by artistic porcelain vases, porcelain panel paintings, and limited-edition ornaments, allow for more complex pattern translation, richer glaze expression, and longer production cycles, serving primarily aesthetic appreciation and cultural dissemination.

These two directions correspond to different design strategies: lightweight products emphasize "pattern symbolization"—extracting the most recognizable pattern elements for simplification and abstraction, realized through efficient processes such as decal and screen printing; display-oriented products emphasize "texture expression"—deeply reproducing Shu Brocade's brocade texture and cultural connotations through hand painting, relief, kiln-transformation, and other techniques. Neither is superior to the other; they serve different consumption scenarios and cultural dissemination goals.

5. Case Review and Practical Insights

5.1 Representative Practices: From "Shu Brocade Refrigerator Magnets" to "Warp-Weft Weaving Splendor" Tea Vessels

© 2026 by the author(s); licensee Mason Publish Group, this work for open access publication is under the Creative Commons Attribution International License (CC BY 4.0). (http://creativecommons.org/licenses/by/4.0/)

In recent years, design practices integrating Shu Brocade and ceramics have accumulated several cases worthy of review. At the 2026 Beijing International Cultural Tourism Consumption Expo, New Southwest Ceramics exhibited "Shu Brocade Ceramic Refrigerator Magnets," condensing the nationally recognized intangible cultural heritage Shu Brocade patterns onto small porcelain tiles. Using traditional brocade color schemes paired with high-temperature ceramic firing, these products distill Western Sichuan's brocade culture into everyday items[1]. The value of this case lies in its "subtraction thinking"—not pursuing complete reproduction of Shu Brocade patterns, but extracting typical colors and pattern characteristics and achieving efficient translation through ceramic decal technology, striking a balance between cultural recognizability and production costs.

More exploratory practice comes from the independent designer's "Warp-Weft Weaving Splendor" tea vessel series[3]. This design extracts Shu Brocade's classic Eight-Direction Halo, scrolling vine, and plum-and-magpie patterns, condensing them into modern aesthetic symbols. The vessel body's texture emulates the fine warp-weft of Shu Brocade, reproducing the opulent quality of "an inch of brocade worth an inch of gold" through glaze color and textural variations. The overall design abandons complex coloration, presenting patterns through single glazes (emerald green, palace-wall red, ink black), achieving "abundance within simplicity." This case demonstrates the deep application of "material translation" strategy—not merely "painting" Shu Brocade patterns, but allowing ceramic textures to "grow" the quality of brocade weave.

5.2 Model Reflection: Achievements, Limitations, and Optimization Potential

The above cases confirm the feasibility of the four-stage model while also revealing several issues requiring optimization. First, the risk of homogenization in pattern extraction—Shu Brocade patterns such as "Eight-Direction Halo," "beaded roundels," and "scrolling vine" are repeatedly used, while other patterns with translation potential (such as the halo-blend effects of "Moonlight Brocade" and "Rain-Silk Brocade," and the geometric nesting of "Square-Square Brocade") have yet to be fully developed. Second, technological bottlenecks in color translation—certain secondary color effects in Shu Brocade (such as the subtle color gradations produced by thread blending) are difficult to precisely replicate in ceramic glazes; finding the balance between "faithful translation" and "material innovation" requires further technical experimentation. Third, insufficient refinement in scenario adaptation—current products largely remain at the level of "ceramic objects with Shu Brocade elements," without forming differentiated design strategies according to different usage scenarios (tea drinking, dining, storage, display).

6. Conclusion

The translation of Shu Brocade pattern and color genes into ceramic cultural and creative products is, in essence, a "cross-media dialogue" between two traditional crafts. The four-stage model—"cultural decoding, gene extraction, material translation, and scenario adaptation"—proposed in this paper attempts to provide an operable methodological framework for this dialogue. The core judgment of this research is that Shu Brocade's visual elements are not closed "cultural heritage specimens" but rather active genes that can be transformed into "contemporary design resources" through systematic design operations. The orderly structure of patterns, their auspicious semantics, and the Five Orthodox Color system constitute the three pillars of

© 2026 by the author(s); licensee Mason Publish Group, this work for open access publication is under the Creative Commons Attribution International License (CC BY 4.0). (http://creativecommons.org/licenses/by/4.0/)

cross-media translation, while the translation strategies of "form endowment by patterns, resonance endowment by colors, and meaning endowment by structure" provide specific operational pathways for the design transition from planar brocade to three-dimensional ceramics.

Of course, the four-stage model remains a framework requiring further refinement. Future research could deepen in the following directions: first, expanding the scope of Shu Brocade pattern extraction, moving from "star patterns" to a systematic survey of the "pattern pedigree"; second, strengthening technological experimentation in color translation, establishing a comparative database between Shu Brocade color palettes and ceramic glaze materials; third, introducing user research to examine the cultural acceptance of different translation strategies in actual consumption scenarios. Only through the two-way interaction between theoretical construction and design practice can the "warp-weft weaving of ceramics" path between Shu Brocade and ceramics continue to widen.

Funding

Key Laboratory of Digital Preservation and Transmission of Weaving and Embroidery Heritage(Chengdu Qinggong Polytechnic University), Sichuan Provincial Department of Culture and Tourism. (Project No:2025SYSZC19).

References

[1] New Southwest Ceramic Art & Culture. "Journey to the Capital, Rendezvous with Porcelain | New Southwest Ceramic Art & Culture Appears at the 2026 Beijing International Cultural Tourism Consumption Expo." Exhibition Report, 2026.

[2] "Research on the Living Transmission of Shu Brocade Pattern and Color Genes." Literary and Artistic Contention, vol. 6, pp. 205–208, 2025.

[3] ARTUNS. "Warp-Weft Weaving Splendor, Cups and Vessels Embroidered with Brilliance." Design Review, 2025.

[4] Ling. Zhong, "Analysis and Research on the Visual Elements of Shu Brocade from the Perspective of Intangible Cultural Heritage Digital Protection." Tiangong, vol. 6, pp. 90–91, 2021.

[5] Chengdu Intangible Cultural Heritage Market. "Youth Vitality Activates Intangible Cultural Heritage." Exhibition Report, 2025.

[6] Wuxia Xie, "Design Pathways for Cultural Derivative Products through Traditional Cultural Gene Translation—Taking Ceramic Patterns as an Example." Ceramic Science and Art, vol. 7, 2025.

© 2026 by the author(s); licensee Mason Publish Group, this work for open access publication is under the Creative Commons Attribution International License (CC BY 4.0). (http://creativecommons.org/licenses/by/4.0/)