

# Research on Innovative Application Path of Sustainable Materials in Contemporary Jewelry Design

Ruisi Li<sup>1</sup> & Yang Yu<sup>2</sup>

<sup>1</sup> College of Arts and Crafts, LuXun Academy of Fine Arts, Dalian, Liaoning 116650, China

<sup>2</sup> Product Design, Dalian Art College, Dalian, Liaoning 116000, China

Correspondence: Ruisi Li, College of Arts and Crafts, LuXun Academy of Fine Arts, Dalian, Liaoning 116650, China.

doi: 10.63593/SSSH.2709-7862.2025.11.006

## Abstract

Taking sustainable development as the constraint and motivation, this paper mainly discusses the performance characteristics, advantages and limitations of recycled metal, natural materials and waste materials in jewelry design, and takes international brands (Cartier and Chopin) and domestic practices (bamboo and wood, broken porcelain and comprehensive recycling) as samples to sort out the systematic strategy of material-technology-design-market. The research shows that sustainable materials not only significantly reduce the environmental load, expand the aesthetic vocabulary of contemporary jewelry, but also enhance brand value and social recognition through supply chain governance and narrative construction; However, its large-scale promotion is still limited by processing technology, consumer mentality and industry standards. Some strategies are put forward, such as process integration of new materials and old technologies/old materials and new technologies, green design language and traceability logo system, and closed-loop mechanism of brand education and recycling for Z generation, which provide executable reference for the green transformation of the jewelry industry.

**Keywords:** sustainable materials, jewelry design, recycled metal, natural materials, waste materials, path

## 1. Introduction

Contemporary jewelry design is deeply influenced by the idea of sustainable development. For a long time, jewelry industry has been accompanied by resource development and ecological destruction. From the threat of precious metals and precious stones mining to soil, water and biodiversity, to the ethical disputes caused by conflict minerals, the industry is forced to reflect on materials and production methods. Sustainable design requires reducing environmental burden in material selection, manufacturing process and life cycle management, and pursuing the unity of social responsibility and cultural value. In recent years, jewelry brands and independent designers are actively seeking for changes in the material dimension: recycling precious metals instead of new mining, using fast-regenerated bamboo and biodegradable organisms as the structure or surface language, and then manufacturing waste glass and plastics to obtain new textures, which have become three main paths of green substitution. Academic research also puts circular economy, material regeneration and local process revitalization into the same context, emphasizing the value conversion and aesthetic renewal of waste to regeneration, but it is different from plane fashion and furniture products. The systematic review of sustainable materials in this field is not enough, especially in the linkage mechanism of performance, technology and market. Based on this, this paper puts forward the analysis framework of material type-typical case-application path, hoping to provide an executable reference for teaching, creation and brand transformation.

## 2. Types and Design Features of Sustainable Materials

### 2.1 Recycled Metals

After refining, the physical and chemical properties of recovered gold, silver and platinum are equivalent to those of primary metals, and they can be recycled many times without degradation. Whether it is high-end texture or environmental protection, it is a priority. Its design advantages are: firstly, the energy consumption and carbon emissions in mining and smelting are significantly reduced (Chen, C., Zhang, W., Song, J., et al., 2025); Secondly, it is highly compatible with traditional metal processing technology, and the process of casting, forging, welding and inlaying do not need major changes; Thirdly, it is easy to build a business narrative of closed-loop recycling, and introduce new products by recycling old ornaments and electronic waste. (Chen, Y., 2025) From the limitations, the stable supply of recycled metals depends on a perfect recycling network and certification system, and there is still a psychological prejudice of recycling = low value at the consumer end, which needs to be solved step by step through quality inspection, source disclosure and brand education.

### 2.2 Natural Materials (*Bamboo, Shells, Horns, etc.*)

Bamboo and wood have a short growth period, low density and visible texture, and are natural carriers of light ecological image. Shell and mother-of-pearl have unique iridescence and cultural symbols, and it is easy to establish the advantages of touch and light perception in a small range (Gong, M., 2024). Its design value is embodied in three points: the source of low carbon and its ability to renew, natural vocabulary that conforms to the oriental aesthetics, and timeliness narrative that can be constructed through imperfect texture. The limitations are mainly the lack of durability and stability (fear of moisture, easy to crack, low hardness), large batch differences, difficult to standardize, and insufficient reliability of structures connected with metals (Jiang, A., 2023). Common technical strategies include: surface painting (varnish/bio-resin) to improve weather resistance; metal skeleton + wrapping/inlaying force transmission; Resin infiltration and the combination of micro tenon or rivet improves the connection strength; And 3D printing and CNC micromachining are used to compensate for the accuracy and consistency.

### 2.3 Waste Materials (*Re-Manufactured Glass/Ceramic Fragments, Recycled Plastics, Electronic Waste Parts, etc.*)

This path is centered on the reverse quality of degradable materials, and it is endowed with new forms and values through cleaning, sorting, harmless treatment and reprocessing. The advantages of the design lie in minimizing waste, low cost and unique random texture forming visual recognition; At the same time, the material narrative of past life-present life can strengthen the expression of the wearer's value. The challenge lie in the scattered material sources and different specifications, potential safety risks (sharp edges, volatility), and the complexity of processing and standards. The corresponding technical strategies include chamfering and polishing ceramic/glass fragments, and using cold inlay/coating to ensure stress safety (Lei, L., 2024). Encapsulation (transparent resin, micro-cavity) between the circuit board and metal chips to achieve skin isolation; Hot-pressing lamination or in-mold coloring is used for recycled plastics to obtain stable color and strength.

## 3. The Typical Case: From International Brand to Local Practice

### 3.1 Cartier (*Cartier*)

Cartier takes the lead in responding to the Responsibility Jewelry Committee (RJC) certification system in the international jewelry market to ensure that gold and diamond are purchased in compliance with ethical and environmental standards. In recent years, Cartier has increased the proportion of recyclable materials in its product line, which has promoted the transparency of the supply chain and reduced the environmental burden through a strict supplier audit mechanism. At the same time, Cartier actively participated in the global sustainable fashion and luxury summit, promoted the concept of sustainable development to brand strategy, and emphasized the value orientation of responsible luxury goods.

### 3.2 Chopard

In 2018, Chopin announced the full use of fair mining gold and became a pioneer in the field of high-end jewelry. On the international stage, such as the Cannes Film Festival, Chopin's Green Carpet Series jewelry focuses on responsible mining of metals and sustainable gems, which has strengthened the public's awareness of sustainable luxury goods. This dual orientation of high-end + environmental protection not only enhances the brand influence, but also provides a demonstration role for the industry's sustainable development.

### 3.3 China Designer's Re-Invention of Local Materials

First of all, light jewelry is woven from bamboo. Through the process of cooking and pest control-drying and setting-worsted-metal wrapping, the structure of bamboo jewelry is stable; At the same time, with the help of material languages such as knot, pattern and toughness, visual images with oriental aesthetic implications are presented. This kind of jewelry not only highlights the technological advantages of natural materials, but also

conveys the tenacity and poetry of oriental traditions at a cultural level (Nie, R., & Ceng, J., 2023).

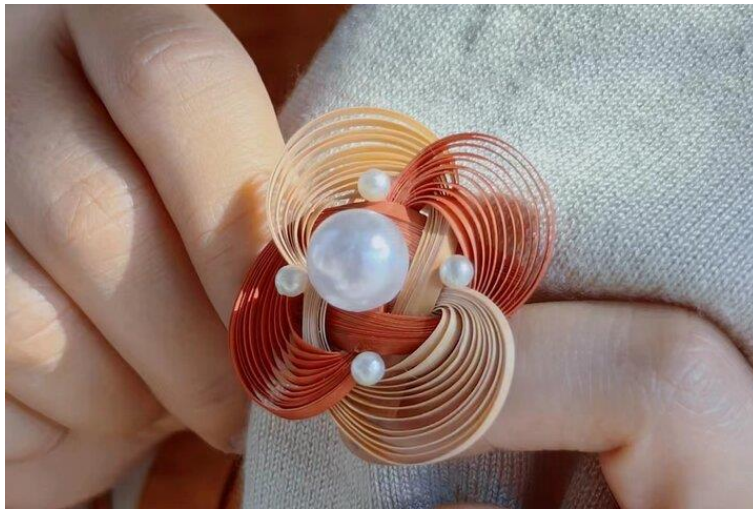


Figure 1. Bamboo brooch

Contemporary expression of broken porcelain mosaic. The historical fragments such as Song porcelain are chamfered and polished, and then designed with metal brackets to highlight the aesthetic concept and cultural continuity of incomplete beauty. In this way, the fragments originally in the archaeological or collection context are put back into the daily wearing scene, and the dialogue between traditional remains and modern life is realized.



Figure 2. Broken porcelain ring

The idea of comprehensive recycling of ornaments. Using recycled materials such as waste circuit boards, aluminum tabs, and ocean drifting plastics as media, through packaging or geometric cutting, ornaments with strong identification and environmental protection declaration are created. Some works have entered the niche consumption channel, which shows the effective transformation path of concept-product and further demonstrates the experimental and practical value of sustainable design in the jewelry field (Qiu, C., 2024).



Figure 3. Composite material ornaments

#### 4. Application Path of Innovation: Three-Dimensional Coupling of Technology, Design and Market

##### 4.1 Process Path: New Materials and Old Technologies and Old Materials and New Technologies

Compatibility and substitution. For recycled metals, the traditional metalworking process can be directly used to realize smooth transition. In the application of natural and waste materials, a new process combination needs to be formed in each link of surface treatment-structural construction-connection mode-protection measures to ensure function and beauty.

Cross-domain empowerment can effectively solve the problems of micro-scale precision and assembly consistency by juxtaposing emerging technologies such as micro-CNC, laser cutting, ultrasonic welding, and 3D printing (FDM/ photo-curing) with traditional metal processing. At the same time, the durability and tactile safety of the product are improved with the help of bio-based resin and degradable coating.

Standards and testing: For ornaments that are in direct contact with skin, standards for material safety and durability (such as migration, volatile organic compounds, sweat corrosion, coating adhesion, etc.) should be established, and a standardized operating procedure (SOP) suitable for studios and small brands should be formed to reduce the risks caused by hand-made differences.

##### 4.2 Design Path: Green Language and Narrative Strategy

The materialization of the natural color of materials emphasizes the ring texture of bamboo and wood, the iridescent luster of shells, and the layering of recycled plastics. Let the material itself become the visual focus, avoiding the continuation of the old paradigm of covering up new materials with precious metals (You, M., & Zhang, X., 2020).

Imperfect aesthetics accepts cracks, impurities and flaws, and highlights them by means of wrapping, ventilation and contrast, showing timeliness and circulation; In the narration of series design, the complete chain of source-treatment-regeneration is clearly displayed.

Heterogeneous coexistence produces tension through the opposition between soft and hard, bright and dumb and regular and random, such as mirror silver and ground glass, flexible fiber and rigid metal. It constitutes the dialectical structure of physical attributes of contemporary jewelry (Yuan, T., 2023).

Maintainable and replaceable, the spare parts are reserved in the positions of connectors, fasteners and inserts, which makes it easier to maintain and upgrade the parts, thus prolonging the product life and forming a closed loop with the trade-in and core recycling plan.

##### 4.3 Market Path: From Cognition to Brand Equity

Credible endorsement, establishment of material source description and third-party certification (such as recycled content, forest and metal liability standards), and recording material-process-batch-recycling channel through QR code or NFC system, enhancing transparency and trust.

Visual-ethical double-line communication shows the precursor, the recycling process and the finished product wearing video images side by side, which not only conveys aesthetic value, but also provides empirical support, reducing consumers' doubts about green washing.

Subdivide people and price band, and adopt the three-level structure of light experimental mode-main series-limited narrative mode to meet different consumption needs from curiosity to identity expression; At the

same time, the core series is guaranteed to have advantages in cost and reproducibility.

Channels and education, through art exhibitions, design weeks and college courses to build an experience platform, let young people experience the whole process of watching-touching-making; On-line short video is used to record the regeneration journey of a piece of jewelry, and offline through recyclable packaging and setting up recycling points, the closed-loop connection between consumption and circulation is realized.

## 5. Key Points of Implementation and Risk Control

### 5.1 Material Selection Matrix

This study takes environmental performance (carbon emissions, water footprint, toxic effects), safety (skin contact friendliness), processing feasibility (hardness, toughness, thermal sensitivity), brand narrative potential (cultural significance and uniqueness) as the evaluation dimension, and constructs a material selection matrix. Recycled metal and recycled glass are divided into stable production areas, which are suitable for mass production; Bamboo and mother-of-pearl are located in the characteristic expression area because of their strong cultural and visual features; E-waste and mixed plastics are classified as conceptual pioneer area, emphasizing experimental and critical expression. Different types of materials should have different configurations in terms of output, pricing and communication strategies (Zou, Y., Zhang, Z., Yu, Z., & Ren, K., 2020).

### 5.2 Structure and Connection Details

In terms of structural design, for natural materials and broken materials, the embedding technology of surface support point constraint should be adopted to avoid brittle materials from bearing concentrated loads. Inert metals (such as stainless steel, titanium or silver) or medical-grade coating materials are preferably in direct contact with the skin, so as to ensure wearing safety. For the components encapsulated by resin, the thickness and demoulding stress should be controlled reasonably to reduce the risk of cracking in long-term use.

### 5.3 Durability and Maintenance

In the product description, the temperature and humidity conditions and the daily cleaning methods need to be clear. At the same time, establish regular update and local replacement mechanism; For replaceable components, a separate sales catalog is provided to encourage consumers to maintain and re-create, thus extending the life cycle of products.

### 5.4 Regulations and Compliance

In compliance with laws and regulations, we should pay attention to safety limits of nickel release, lead and cadmium content, phthalate esters, volatile organic compounds (VOC) and establish a batch sampling system. For the use of historical fragments (such as ancient porcelain pieces), it is necessary to ensure that they are obtained in accordance with the regulations and attached with legal circulation documents to avoid disputes involving the attributes of cultural relics.

## 6. Conclusion

Sustainable materials provide contemporary jewelry with double opportunities: on the one hand, the aesthetic and narrative space of materials has been significantly expanded through the non-inductive substitution of recycled metals, the natural vocabulary of bamboo and shells and the unique texture presented by waste re-manufacturing; On the other hand, in the brand dimension, the practice centered on traceable supply chain and public education is pushing sustainable development from moral added value to competitive core. To make it truly move from concept to normality, we need to grasp three keys: First, through the process integration of new materials and old technologies and old materials and new technologies, the threshold for transformation is lowered, supplemented by standardized processes and inspection systems; Secondly, in terms of design language, it highlights the true color and imperfect aesthetics of materials, and embeds maintainability and replaceable mechanism in the front-end link; Thirdly, with the help of data and video to present the past life-present life of the material, combined with authentication and recycling mechanism, the transformation from cognition to practice is completed. Looking forward to the future, with the maturity of cultivating gems, bio-based composites and low-energy manufacturing, as well as the application of block-chain and Internet of Things in material traceability, sustainable jewelry will gradually move from small-scale experiment to large-scale practice. By then, the value of materials will not only be determined by scarcity and appearance, but also by ecological responsibility, cultural narrative and scientific and technological wisdom; As a close-fitting micro-architecture, jewelry will continue to participate in the daily dialogue between beauty and ethics with a lighter environmental footprint and a longer service life.

## References

Chen, C., Zhang, W., Song, J., et al. (2025). Innovative integration and application of glass and metal materials in contemporary jewelry design. *Footwear Technology and Design*, 5(07), 33–35.

- Chen, Y. (2025). Application of ceramics and coloured glaze in jewelry design. *Ceramic Science and Art*, 59(07), 192. <https://doi.org/10.13212/j.cnki.CsA.2025.07.046>
- Gong, M. (2024). Application and research value of comprehensive materials in contemporary jewelry field. *Footwear Technology and Design*, 4(15), 106–108.
- Jiang, A. (2023). Research on the application of contemporary jewelry design based on the concept of green design. *Product Reliability Report*, 2023(8), 128–129.
- Lei, L. (2024). Explore the innovative application and challenges of sustainable plant materials in jewelry design. *Tiangong*, 2024(36), 54–56.
- Nie, R., & Ceng, J. (2023). Research on the application of bamboo weaving technology in jewelry design. *Shanghai Packaging*, 2023(11), 172–174.
- Qiu, C. (2024). Analysis on the application of diversified materials in contemporary jewelry design. *Shanghai Fashion*, 2024(11), 17–19.
- You, M., & Zhang, X. (2020). Garbage and jewelry: Sustainable development in modern jewelry design. *Theatre House*, 2020(11), 118–120.
- Yuan, T. (2023). Research on the design of contemporary bamboo jewelry endowed by bamboo culture. *Screen Printing*, 2023(22), 8–10. <https://doi.org/10.20084/j.cnki.1002-4867.2023.22.003>
- Zhang, Y., & Luo, A. (2022). Research on innovative practice of bamboo woven jewelry design: Taking brooch as an example. *Tiangong*, 2022(04), 86–89.
- Zou, Y., Zhang, Z., Yu, Z., & Ren, K. (2020). Reuse of waste in jewelry design. *Journal of Gemology and Gemmology*, 22(2), 55–60.

### Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).