

THE APPLICATION OF TRADITIONAL KOREAN PAINT AND LACQUER TO PAST WOOD AND MODERN WORKS

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Abstract:

This study aims to elaborate on lacquer, East Asia's traditional paint, as a medium for contemporary art as well as the usage and preservation of lacquered wood. Specifically, it introduces past records and practices involving lacquer, uses science and technology to present the reasons behind the durability of lacquered wood, and describes how lacquer is currently used as an artistic medium.

Lacquer is a natural paint made by purifying the sap extracted from the lacquer tree distributed in the East Asian region. Lacquer is mostly composed of urushiol (60%–80%). The other components include water (10%–30%), gum (3%–8%), and additional substances (1%–3%). Once lacquer is dried and the film is formed, it becomes a high polymer that changes little even when soaked in strong acids (e.g., hydrochloric acid, acetic acid, and aqua regia), alkali, salt, and alcohol. Therefore, it outperforms other paints in terms of adhesive strength, waterproofness, antiseptic effect, insulating nature, and durability. Urushiol, whose chemical formula is $C_{21}H_{34}O_2$, is a liquid mixture of catechol compounds bearing a C-15 main chain and unsaturated side chains. Lacquer film is a high-molecular compound with the molecular weight of polymeric urushiol ranging between 20,000 and 30,000. Additionally, the film features a three-dimensional network of molecular binding, making it exceptionally strong. The dried lacquer film is covered with another thin rubbery film, blocking oxygen and thus preventing oxidation.

The use of lacquer for wood preservation varies between Korea, China, and Japan due to differences in geographical location, climate, and cultural influence. Going beyond its previous role of reproducing tradition and making lacquered products, lacquer, with its untapped potential as a new artistic medium, has made its way into contemporary art, whose genres and focus on material characteristics have diversified.

INTRODUCTION

Wood has long been a part of our lives. Early humans used wood because it was readily available and easy to process. Since the Stone Age, wood has been widely used not only as an important building material but also as a tool, weapon, and substance for various daily necessities. Over the course of history, humans have studied the quality and durability of different types of wood and tailored them to suit specific purposes. Despite different growth rates depending on the species, trees usually take a long time to reach full maturity, making them valuable materials from an economic perspective. Furthermore, wooden boards were carefully cut to be customized to their intended uses, and nodes were removed or filled. The advent of the Bronze Age in 3,000 BC further advanced woodworking technologies. Until the 18th century, wood served as a basic material used for architecture, tools, machines, factories, means of transportation, and storage facilities. A wide range of wood products came into existence. The world's first printing press was also made of wood. Almost all machines were composed of wooden parts before they gave way to metal machines. For thousands of years, wood has been employed in various forms. It is not just a material but an invaluable resource that has enriched our lives.

MAIN BODY

Wood is vulnerable to changes in temperature and humidity, as well as insects. Therefore, humans have found it difficult not just to cut and craft wood but also to preserve it. How wood is processed determines the degree of warping and preservation method. The wood that has been cut is particularly susceptible to moisture, sunlight, and insects such as termites. Nevertheless, mankind has used wood, with processing and preservation methods varying depending on the tree species and environment.

Oil stain is a common preservation method used in the West to protect wood from moisture. When applied once every six months, oil stain keeps wood in good condition. Another method is to log trees, steam them, and store them in a cool, airy, and shaded place. Similar methods are used in the East, such as charring the top layer of the wood with a heated iron (wood burning), applying lacquer, and combining these two. All of these methods can expand the lifespan of wood and reveal the beauty of its grain. Lacquering, which is the main focus of this study, uses purified sap extracted from lacquer trees found across East Asia. Multiple (3–7) lacquer coats produce waterproof, antiseptic, and insect-repelling effects.



Wood burning

THE SILK ROAD AND ITS EFFECT ON KOREA

Ferdinand von Richthofen, a German geographer, first coined the term “Seidenstrassen” (Silk Road) in his book *China* (Volume I), published in 1877. This road served as a pre-modern network of Eurasian trade routes connecting China to Central Asia, West Asia, and the Mediterranean Sea via land or sea for a long time. It functioned as a channel for the exchange of not only goods but also cultures. Originally assumed to be a transverse axis connecting east and west, the Silk Road was actually a vast network running in all directions, including numerous north-south passages. According to this view, the Silk Road was a global transportation network consisting of tens of thousands of passages, including three main routes¹ and five branches². Despite drastic changes in modes of transportation and routes, the Silk Road still functions as a conduit for civilization.

Shilla³, one of Korea’s ancient kingdoms, is believed to have traded with the West through the Silk Road. This assumption is supported by the excavation of western archeological artifacts, which were impossible to make in Korea, at many of the nation’s historic sites, including those in Gyeongju, Shilla’s capital. Additionally, westerners appear in murals and are mentioned in books, confirming Korea’s interactions with the West. Moreover, medieval Islamic geography books describe Arabs and Persians who settled in Shilla, implying cross-border travel. All this indicates that Korea resorted to the Silk Road to trade with the outside world, including Europe.

¹ The Silk Road consisted of many east–west routes connecting Eurasia, Africa, and Europe, as well as trading routes that ran across Eurasia in a north–south direction. East–west passages for civilization exchange were referred to as main routes, represented by “Steppe Route,” “Oasis Route,” and “Maritime Route.”

² In addition to these three main routes, north–south routes for civilization exchange were referred to as branches, represented by “Horse-trading,” “Lama,” “Buddha,” “Mesopotamia,” and “Amber” branches. These five representative branches served as key trading routes on the Eurasian continent from ancient times to the Middle Ages. They were so named to reflect the characteristics of trades and exchanges that occurred along their respective branches.

³ Between 57 BC and 935 AD, Shilla, along with Goguryeo and Baekje, formed the Three Kingdoms of Korea. Later, unified Shilla ushered in the era of the South–North Kingdoms with Balhae.



Glass Ewer and Cups from the South Mound of the Tomb

WOOD PRESERVATION IN KOREA

During the Three Kingdoms period (between the 7th century and the 1st century BC), Buddhism, along with its scriptures⁴, was introduced to Korea. When Goryeo (918–1392) adopted Buddhism as the state religion, preserving hard-earned scriptures became a top priority. Since the scriptures were made of cloth and paper, they were vulnerable to moisture, corrosion (induced by ultraviolet rays), and insects. Therefore, special attention had to be paid to the following Buddhism-related wooden items over their entire lives, from production to preservation: boxes for storing Buddhist scriptures, boxes for Buddhist rosaries, boxes for storing incense, and boxes for Buddhist whisks. At that time, wooden boxes were lacquered for perfect preservation and magnificently decorated with mother-of-pearl⁵, turtle shell⁶, and metal wire to showcase the extremely high value of what was inside.



Scripture

⁴ Buddhist scriptures contain the teachings of Buddha and his followers. The same scripture may go by different names as a result of the spread of Buddhism to nations such as Tibet, China, and Korea. Buddha's teachings were compiled by his disciples.

⁵ It refers to cutting and processing a specific shellfish shell into shape.

⁶ It represents a thinly cut turtle shell and has become a rare material following the prohibition of turtle harvesting.



Monk's Duster with Chrysanthemum Scroll Design Lacquerware with mother-of-pearl and turtle shell inlay

As mentioned above, Goryeo⁷ adopted Buddhism as its state religion and worked hard to preserve Buddhist scriptures. The oldest intact version of such scriptures is the Tripitaka Koreana, made of wooden printing blocks. Registered as a UNESCO Memory of the World Program, it is a priceless relic featuring Buddhist texts engraved by hand on 81,352 woodblocks between 1237 and 1248. The manufacturing process involved soaking the wood in seawater for 2–3 years before being removed, cutting it into uniformly sized pieces, boiling them in salt water, drying them in the shade, and adding copper plates to the edges to prevent warping. The texts were individually engraved by hand on both sides of the woodblocks and lacquered to complete a page (block). Even after completion, each block was stored in a cool and airy building called Janggyeong Panjeon⁸ that blocked direct sunlight to prevent warping of the wood. The floor of the building was made with a mixture of charcoal, lime powder, salt, and sand to absorb summer moisture. Although the Tripitaka Koreana was made of wood, it has been well preserved for over 750 years, which can be partially attributed to the effects of lacquer. Dried lacquer is believed to have prevented moisture from contacting wood and protected wood from insects such as termites. In the absence of advanced science and technology, our ancestors employed various processes, including lacquering, to extend the lifespan of wood.



The Tripitaka Koreana

⁷ Goryeo was a Buddhist kingdom that ruled the Korean Peninsula for 474 years (918–1392).

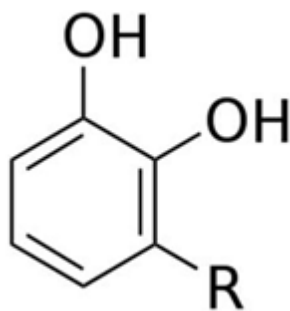
⁸ It is a one-story wooden building on a hill behind the Main Buddhist Hall and is believed to have been built in the 15th century. The building, which preserves its original form, is home to the Tripitaka Koreana.



Janggyeong Panjeon

LACQUER

Lacquer is a natural paint made by purifying the sap extracted from the lacquer tree found across the East Asian region. Lacquer is mostly composed of urushiol (60%–80%). The other components include water (10%–30%), gum (3%–8%), and additional substances (1%–3%). Urushiol, whose chemical formula is $C_{21}H_{34}O_2$, is a liquid mixture of catechol compounds bearing a C-15 main chain and unsaturated side chains. Furthermore, lacquer film is a high-molecular compound with the molecular weight of polymeric urushiol ranging between 20,000 and 30,000. The film features a three-dimensional network of molecular binding, making it exceptionally strong. Moreover, the dried lacquer film is covered with another thin rubbery film, blocking oxygen and thus preventing oxidation. Once lacquer is dried and the film is formed, it becomes a high polymer that changes little even when soaked in strong acids (e.g., hydrochloric acid, acetic acid, and aqua regia), alkali, salt, and alcohol. Therefore, it outperforms other paints in terms of adhesive strength, waterproofness, antiseptic effect, insulating nature, and durability. However, it is vulnerable to ultraviolet rays. When exposed to ultraviolet rays for a long time, lacquer film loses its luster and chlorosis occurs. This phenomenon occurs when ultraviolet rays volatilize some of the film, destroying the polymer structure.



Structure of urushiol

Table 1

Chemical resistance of lacquer film

Reagent	Duration (h)	Lacquer film condition
Sulfuric acid (80%)	24	No abnormality detected
Sulfuric acid (34%)	1	No abnormality detected
Sulfuric acid (30%)	24	Slight reduction in luster
Sulfuric acid (15%)	168	No abnormality detected
Hydrochloric acid (30%)	24	No abnormality detected
Sodium hydroxide (50%)	168	Slight reduction in luster
Alcohol (90%)	168	No abnormality detected
Ethyl ether (100%)	168	No abnormality detected
Gasoline (100%)	168	No abnormality detected

Ito Seizo, Japanese lacquer, Tokyo Book Publishing (Corrections, 2nd edition) 1980, p.85

Lacquer dries at a temperature of 20–30°C and a humidity of 80%–85%. Rubbery laccase, one of the components of lacquer that requires a high level of humidity for activation, absorbs oxygen in the air and oxidizes urushiol, turning a liquid into a solid.

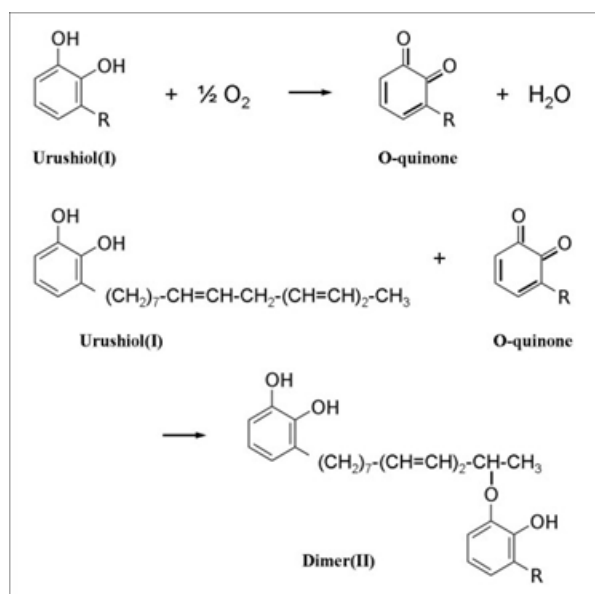
Table 2

Physical property analysis table of lacquer film by thinner type

Type	Adhesion	Luster (60°)	Hardness (pencil)	Smoothness
Kerosene (petroleum)	100/100	36.5	3H	8.0
Turpentine oil	100/100	47.4	H	8.8

Lacquer that has not dried completely is toxic and may cause skin irritation when it contacts the skin.

Lacquer can be collected for about 60 days between July and September from lacquer trees that are 6–10 years old, with lacquer from 10-year-old trees being considered the highest quality. Since lacquer rots when mixed with rainwater, it can only be collected on clear days or three days after the rain has stopped. Lacquer is collected according to the following steps: peel the tree bark; create a cut in the tree (sap may not come out when the cut is too deep); and scrape the sap into a container. After foreign substances are filtered out, the collected lacquer is evaporated at a certain rate to be used as basic lacquer.



Hardening process

KOREAN, CHINESE, AND JAPANESE LACQUER

Korean lacquer dates back to the 3rd century BC, which is supported by the fragments of lacquerware⁹ excavated, along with bronzeware, from a stone coffin tomb. Since these relics belong to the late Bronze Age, the practice of lacquering can be assumed to date back a few centuries. Most of the relics were lacquered wood; some were lacquered pottery and bamboo. Lacquer is believed to have initially been used to make items for sacrificial rites. It was later used to produce accessories and household items for royal families and nobles.



Fragment of Lacquerware

The way lacquer is used varies between countries. Seashells are readily available in Korea, as the country is surrounded by sea on three sides. Therefore, the mother-of-pearl inlay technique developed in Korea, with mother-of-pearl lacquerware becoming popular. When Goryeo fell to Chosun and Buddhism gave way to Confucianism, Goryeo's gorgeous mother-of-pearl lacquerware almost disappeared, and instead an attempt was made to preserve the natural beauty of wood by lacquering it.

China pioneered the development of various decorative techniques due to its long history of lacquer. In particular, the most salient feature of Chinese lacquer craft is the “carved lacquer” technique. This technique involves dozens of lacquers to form a thick, hardened layer to be carved by a knife. Notably, a symmetrical swirl pattern stands out from a wide range of patterns expressed by the carved lacquer.



Carved lacquer

⁹ They are fragments of lacquerware that had the shape of a plate. The wooden body has rotted away, and only the lacquer remains.

Japan mainly used a decoration technique called “lacquerware with maki-e,” in which pictures or patterns are drawn with lacquer on the surface of lacquerware and then gold or silver powder is sprinkled before the lacquer is dried. Maki-e has taken center stage in Japanese lacquer techniques and is widely applied to Buddhist supplies, stationery, and cosmetic boxes. Additionally, maki-e is a Japanese painting style influenced by Yamato-e that focuses on the pictorial representation of natural objects.



Lacquerware with maki-e

LACQUER AS A CONTEMPORARY ART MEDIUM

Lacquer in Korea is used for multiple purposes, mainly for making lacquer products, reproducing something that is gone, and serving as a medium for contemporary art. Many lacquer products are made using a substitute called “cashew,”¹⁰ which was introduced to Korea during the Japanese colonial period¹¹ when the country’s outstanding lacquer culture was lost. Due to its shorter production time and lower material cost than lacquer, cashew is easily accessible and can be found at tourist attractions. In the past, deceptive sales practices in which cashew was sold as lacquer were prevalent (even at museums). However, many of such practices have disappeared. In addition, cashew is increasingly used in various industrial products, such as automobiles and ships.

Tabel 3

Comparative analysis of surface tension between lacquer and cashew

Type	Surface tension (dyn/cm ²)	Contact angle (air)
Lacquer	37.1	27
Cashew	25.9	14

*TSUTSUMIASAKICHI/URUSHI

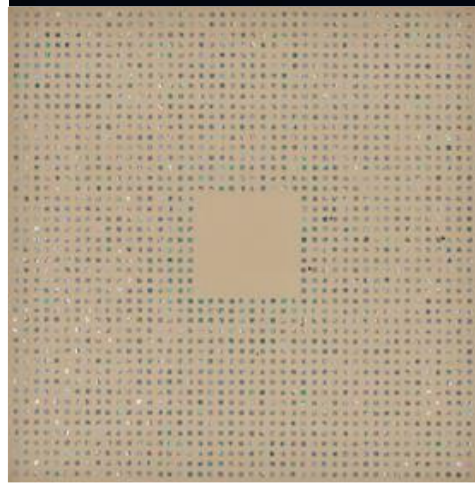
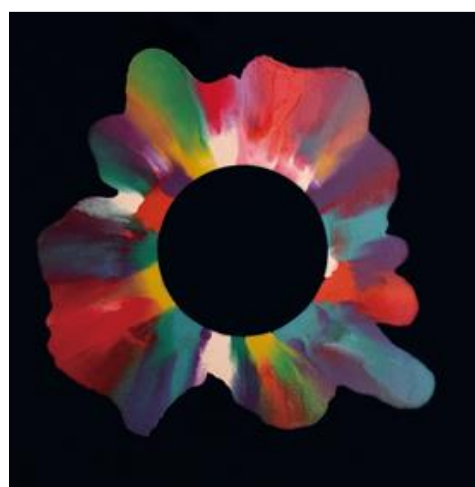
Living human treasures (magisters) play an integral role in continuing the lacquerware tradition. They not only reproduce relics of the past but also create a new version of traditional works in which some modern elements are incorporated. They train young people on traditional techniques and encourage the youth to take their place in due course. Disciples receive apprenticeship training at workshops and take periodic tests to be qualified to continue the legacy. These magisters are committed to promoting lacquer by propelling their knowledge and skills to a higher level, as well as delivering lectures on lacquer at various institutions.

In modern art, which is characterized by diversified genres and material properties, lacquer is being approached from a different perspective. Until now, lacquer has been perceived as an important material for

¹⁰ It is native to South America and belongs to the Anacardiaceae family, mainly cultivated in tropical regions. The cashew seed is edible, while its lacquer-like shell liquid is purified and used as paint.

¹¹ It is a period of national tribulation from 1910, when Japan officially annexed Korea, to 1945, when Korea regained its independence. After robbing Korea’s national sovereignty, Japan established the Government-General of Korea, controlling the nation’s administration, legislation, judiciary, and military to oppress Koreans. However, the Korean independence movement and the surrender of the Empire of Japan in the Second World War finally led to Korea’s liberation from Japanese colonization.

crafting artistic objects. This stereotypical perception must be overcome in order for lacquer to be used to facilitate free expression and creative ideas. Fortunately, many have started to appreciate the material characteristics of lacquer, given its untapped potential for formative expression. Lacquer continues to expand its scope while creating an artistic world of its own. Moreover, it adds value to plastic arts with its material characteristics of color, luster, and long-lasting quality, thus arousing interest among modern artists. Lacquer artists capitalize on various shapes and materials to create works customized to their artistic pursuits. Many of these artists develop themes centered on the historicity and unique texture of lacquer. The author of this study is one of them, with a focus on flat art, linking the overlap and repetition of lacquer with thematic consciousness and embodying the linkage through not only procedural implications but also external forms. Overlapping refers to the process of completion. In other words, it is a metaphor for human life that approaches completion over time, and it represents the diversity expressed as the fusion of colors and materials. Like artists such as “Mark Rothko”¹² and “Anselm Kiefer”¹³, the author uses the opaque texture and overlap of lacquer to create abstract geometric works while incorporating modern elements into them through unique combinations and arrangements involving new materials.



One's own work

¹² Mark Rothko (1903–1970) was an American painter who revolutionized the nature and form of abstract painting, significantly contributing to drastic changes in painting style that occurred in the US around the 1940s. Around the 1950s, he distinguished himself with his unique painting style and realized his ideal of “the simple expression of complex thought.” His typical works feature a composition of two to four rectangles arranged vertically on a large color field. Based on this form, Mark Rothko took full advantage of wide-ranging colors, tones, and stylistic relationships to create multiple atmospheres and effects that evoke drastic, simple, and poetic feelings.

¹³ Anselm Kiefer is a German painter and sculptor. He uses straw, ash, clay, lead, and paint for his works. His works frequently feature a large scale and a dull, listless, and almost oppressive and destructive style. In most of his works, he builds his imagery on top of photographs while often mixing earth and other unprocessed materials. What warrants special attention is that one can find historically important or legendary figures, their signatures, or relevant places in almost all his works.

CONCLUSIONS

Wood has long been a critical resource for human development. From the Stone Age until the 18th century, it supported all architectural structures, weapons, and household items. However, wood is vulnerable to changes in temperature and humidity as well as insect attacks, for which various treatments have been developed. These treatment methods, which are still employed, include steaming and drying after logging, applying oil stain, wood burning (charring the top layer of the wood with a heated iron), and lacquering. Among them, lacquering uses a natural paint derived from the sap of the lacquer tree to effectively address the aforementioned drawbacks of wood.

Urushiol in lacquer prevents damage from insects, and rubber properties safeguard lacquered items against moisture. Additionally, lacquer film is a high-molecular compound with the molecular weight of polymeric urushiol ranging between 20,000 and 30,000, so it can help wood withstand the impact to a certain degree. However, the rigid condition (temperature of 20–30°C and humidity of 80%–85%) should be maintained for lacquer to dry. Moreover, undried lacquer may cause rashes when it contacts the skin.

Nevertheless, lacquer, being a natural paint, is an effective tool to protect wood. Although it is not well known, the author hopes that lacquer will be researched and tested further to increase its presence across many artistic fields. When it comes to lacquer applications, the sky is the limit.