

Restoration of an artwork of a ceramic tile by artist Hassan Heshmat, with cleaning the external canvas support from jute

Dr. Mohammed Tharwat Mohammed

Lecturer in Conservation Department, Faculty of Fine Arts, Minia University, Egypt
muhmada.tharwat@mu.edu.eg

Dr. Moushera Ismaiel Hussien

Lecturer in Conservation Department, Faculty of Fine Arts, Minia University, Egypt
moshera.mohamed1@mu.edu.eg

Abstract:

The field of ceramics has changed over time, leading to an enrichment of ceramic art with various expressive artistic trends, each with its own philosophical and technical dimensions. This has influenced many artists, including Hassan Heshmat, who developed distinguished techniques seen in the artwork discussed in this study. Over time, the artwork suffered damage, including a deep crack that affected the glaze layers and reached the internal ceramic lining. Additionally, the external jute fabric supporting the artwork's frame was also damaged. This study focuses on restoring the artwork using modern scientific and technical methods, ultimately restoring the piece to its original state—one of the primary goals of restoration. One of the most important steps in the various stages of treatment and maintenance is to complete the missing parts of ceramic tiles. The crack was filled with materials such as (kemaboxy 150 + Fiber glass) with microballoons, small glass fillers, and layers of porcelain colors, and finally a transparent layer (Araldite 2020).

الملخص:

لقد تغيّرت بعض المفاهيم التي سادت مجال الخزف حقبة طويلة مما جعل هناك إثراء في المجال الفني الخزفي بالعديد من الاتجاهات الفنية التعبيرية لكل منها أبعاد فلسفية وتقنية، وأثر ذلك على عدد من الفنانين منهم حسن حشمت والذي قدم تقنيات متميزة نجدها في العمل الفني المطبق عليه فكرة البحث، ومع مرور الوقت حدث تلف في ذلك العمل متمثل في شرخ نصف غائر متلف طبقات الجليز وصولاً للبطانة الداخلية من الخزف وطالت تلك المظاهر للتلف القماش الخارجي المعروض عليه برواز العمل الفني وهو من قماش الجوت، لذا تم التعامل مع مظاهر التلف تلك بالطرق العلمية والفنية الحديثة والمناسبة مما أتاح رجوع العمل الفني لحالته الأصلية وهو هدف رئيسي من أهداف الترميم، حيث أن استكمال الأجزاء المفقودة للبلاطات الخزفية يعد من الخطوات ذات الأهمية الكبرى في مراحل العلاج والصيانة المختلفة، وتم ملأ الشرخ بواسطة مواد مثل الكيمابوكسي 150 مضاف له فايبر جلاس، مع الميكروبالون، وقطع زجاج صغيرة مألئة وطبقات من ألوان البورسلين، وفي الأخير طبقة شفافة من أراالديت 2020.

Keywords:

Ceramics, Glaze, Hassan Heshmat, Jute, Restoration.

الكلمات الدالة:

ترميم ، جليز ، جوت ، حسن حشمت ، سيراميك.

Research objectives:

- Analyzing the theoretical frameworks of contemporary ceramic arts.
- Analyzing an artwork by Hassan Heshmat.
- Scientific and technical methods for restoring and completing this work and how to preserve it.

Research Methodology:

The research is conducted using a descriptive approach in its theoretical framework and a practical approach in the following steps:

-**Theoretical Framework:** A technical and analytical study of an artwork by the artist Hassan Heshmat

-**Applied Framework:** Restoration and completion of that work

1. Introduction:

The 20th century witnessed significant awakenings, research, development, wars, revolutions, inventions, and creative endeavors. This period saw renewed interest in ceramic art across the world ^{(1) (2)}, the evolution of ceramic forms has been closely tied to the individuality of ceramists, their environment, and their cultural background.

The art of pottery is one of the most important handicrafts that humans have used since the Stone Age in their home and work lives. It is considered one of the most famous handicrafts and industries in primitive and modern societies ⁽³⁾

Hassan Heshmat (1920–2006) was born in Menouf, Egypt. He graduated top of his class from the Faculty of Applied Arts and later received a study grant from the Ministry of Culture from 1958 to 1964. He also studied porcelain in West Germany between 1957 and 1958. Upon his return, he created thousands of small porcelain sculptures representing Egyptian life and society.

Heshmat is regarded as one of Egypt's most significant sculptors, known for developing a unique artistic style. He introduced small-scale sculptures that captured the essence of Egyptian life, which were widely distributed in Egyptian and international homes from 1960 to 1984. Later, he shifted to creating medium and large-scale sculptures ⁽⁴⁾

The field of study and research that is associated with ceramics and combines the stylistic characteristics of ancient sculpture. ⁽⁵⁾, his works are characterized by simplicity, direct expression, dynamic movement, vibrant colors, and an emphasis on sculptural surfaces that enhance the play of light. His approach aligns with traditional Islamic art, which avoids empty spaces and emphasizes decorative repetition ⁽⁶⁾

The prolific sculptor was awarded prestigious local and international prizes, winning silver and gold medals at the International Ceramics Competition in Italy in 1964 and 1965, and winning first prize in a competition to build a memorial monument for a church in Belgium in 1970. Heshmat was later awarded the Egyptian state's Appreciation Award. ⁷

History of Hassan Heshmat Museum

The museum is set to open in the artist's 1200-meter villa located in the Ain Shams district of Cairo Tharwat Okasha, the Minister of Culture, inaugurated it in 1960. It has around 235 sculptures and ceramics on display.. The artist wisely opened a properly equipped

workshop on the first floor. Eager to widen the cultural and artistic awareness of his young neighbors in the district Heshmat decided in 1998 to present the museum to the Ministry of Culture to expand its role in this respect⁽⁸⁾. (Fig.1)

2. Research Problem:

Many significant artworks require scientific and technical restoration to ensure their longevity and preservation for future generations. This study focuses on restoring one such piece by Hassan Heshmat.

3. Research Importance:

The research highlights methods for preserving and restoring valuable artistic works by Egyptian and Arab artists using scientific and artistic approaches.

4. Research Scope:

4.1. Theoretical Framework:

4.1.1. Concept of Contemporary Ceramics:

Ancient Egyptian art provides evidence of the evolution of ceramics in Egypt, and Islamic ceramicists introduced innovations such as reduced-glaze techniques and metallic luster finishes.

In modern times, the Egyptian ceramic movement was revived by master ceramist Said Al-Sadr and his students, who developed new artistic approaches.

Artists, particularly visual artists, play a key role in shaping cultural and artistic transformations. The rich heritage of past artistic traditions continues to influence contemporary art, blending with modern conceptual interpretations. However, societal traditions and political constraints have sometimes limited artistic expression in the Arab world⁽⁹⁾

Until the 1950s, Egyptian art largely focused on historical themes, but from the 1960s onward, it embraced new fields, rejecting traditional clichés while preserving cultural heritage and artistic creativity⁽¹⁰⁾.

4.1.2. Work description:

This study examines a 1976 ceramic tile artwork by Hassan Heshmat, personally gifted to a private collector***

The artwork by Hassan Heshmat is a rectangular ceramic tile measuring 49 cm x 24 cm surrounded by a jute background, making a total area of 68 cm x 43 cm. It is a text in free Arabic calligraphy with the words “Lord, expand my chest.” (رَبِّ اشْرَحْ صَدْرِي)

The work technique is a brown ceramic tile with a layer of blue and white interlaced with transparent glass beads in the artist's special techniques and covered with a full layer of glaze. (Fig.2)

4.1.3. Artwork making technique:

The advancement of ceramics has been greatly aided by the emergence of contemporary art, leading to a significant transformation in its practice. This evolution has contributed to the formal division of ceramics into two distinct branches: industrial ceramics and artistic ceramics.

The use of ceramic art as a solution to social anxiety is due to its ability to explore dimensions and textures that offer a profound tactile experience, in the realm of artistic

*** This artwork is owned by Mrs. Omnia Khodeir, as an inheritance from her late father, Mr. Mohamed Khodeir, as a gift from the late artist Hassan Heshmat.

ceramics, the material itself serves as the primary medium through which artists convey their creative visions and technical expertise. Mastery of this material allows for innovative artistic expression, whether through unique forming techniques, glazing methods, or a combination of both. The versatility of ceramic materials enables artists to achieve remarkable aesthetic outcomes, demonstrating both technical skill and conceptual depth. ⁽¹¹⁾⁽¹²⁾

The process of glass crystallization to produce glass-ceramic materials involves two distinct stages. The first stage, known as nucleation, entails the formation of small nuclei or seeds within the glass matrix. This is followed by a subsequent heating phase, often referred to as the crystal growth stage; these nuclei grow into larger crystals until they reach the desired size.

Two primary mechanisms are necessary for crystalline phase nucleation to occur: homogeneous and heterogeneous nucleation. In inhomogeneous nucleation, nuclei originate from the melt composition itself, occurring independently of external surfaces or interfaces. When crystallization is caused by foreign boundaries, heterogeneous nucleation occurs, such as grain borders or interfacial surfaces. These differing nucleation pathways significantly influence the structural characteristics and properties of the resulting glass-ceramic material (Fig.3) ⁽¹³⁾

Glaze Crackle: The surface of various ceramic products is coated with glaze, which is a glassy layer. It gives ceramic surface hardness and high resistance to chemical and abrasion which contribute to enhancing the chemical and physical properties in addition to the aesthetics of the ceramic products. The production process of glaze is complex and expensive, as it requires accurate compositions of different materials most of which are expensive. ⁽¹⁴⁾

This type of glaze creates decorative effects that enhance the aesthetic value of the artwork. The glaze layer and the ceramic object's surface have a different coefficient of expansion, which causes this, which results in cracking in the glaze, when the coefficient of expansion of the glaze material is higher than the coefficient of expansion of the ceramic surface, this is what happens. This is due to the shrinkage of the ceramic surface during cooling, where the area of the glaze layer becomes less than the surface area of the ceramic surface covered by it. When the glaze layer is exposed to the body's tensile force, it cracks. ⁽¹⁵⁾⁽¹⁶⁾

The technique of making this tile is based on the idea of glazing. Glaze is a transparent glass compound that merges with the surface of the pottery tile and forms a colored metallic coating. ⁽¹⁷⁾, The use of an underglaze leads to the creation of blue-and-white ornamentation on porcelain. After applying the cobalt pigment to the ceramic body, it is fired under a clear glaze that acts as a varnish., This is what the artist utilized in that artwork. ⁽¹⁸⁾ (Fig.4)

5. Methods and Material:

5.1. Photographic documentation and Visual investigation for deterioration of the tile:

- Documenting damage through visual inspection of the entire tile:
- A layer of dirt and dust covers the entire panel.
- There is a crack extending from the top end down the width of the ceramic tile, which leads to the ceramic tile splitting into almost two halves. (Fig.5)
- Effects of stains and dirt on the outer jute fabric (Fig.6)

5.2. Restoration processes:

It is a complex operation to conserve historical objects made from composite materials; Conservation materials that are suitable for one component may be harmful to the other. ⁽¹⁹⁾, so the ceramic tile was treated with materials and methods different from those used for jute weaving.

5.2.1. Cleaning process:

5.2.1.1. Mechanical cleaning:

This process is the initial step in cleaning the object and is more manageable than chemical cleaning. The nature of both the ceramic and textile support, as well as the encrustations, plays a crucial role in choosing cleaning methods. The purpose of cleaning is to get rid of any foreign matter that is not part of the object's original fabric ⁽²⁰⁾, Mechanical cleaning is done by brushes of different sizes, sometimes spatulas, scalpels, and a blower to clear the surface accumulation and remove dust and sand from the surface ⁽²¹⁾, Mechanical cleaning involves simply breaking the dirt's adhesion and moving it away. ⁽²²⁾ The importance of cleaning lies in its ability to remove encrustations, deposits, and dirt. To avoid irreversible loss of material and a significant loss of time, it is important to approach this type of operation with great care and avoid any damage to the surfaces and decoration ⁽²³⁾

5.2.1.2. Chemical cleaning:

5.2.1.2.1. Chemical cleaning of the tile:

When mechanical cleaning is incapable of completely removing dirt and stains, Acids, alkalis, neutral soaps, and gels are used in chemical cleaning as the next step on the surface. ⁽²⁴⁾, This stage depends on how to use of different solvents and solutions, where these solutions interact with the surface-related materials and dissolve them.

The initial solvent used to remove dirt deposits on the tile that were difficult to remove mechanically was distilled water. Water is the most important liquid cleaning agent in practice, with its three advantages of being very inexpensive, easily available, and without hazard to the conservator. As a solvent, it is rarely used alone, and various additives are used to alter its properties ⁽²⁵⁾ to prevent the high concentration effect on the surface, acetone was mixed with distilled water and ethyl alcohol was used to remove hard stains ⁽²⁶⁾

5.2.1.2.2. Chemical cleaning of jute support:

The conservation process typically begins with cleaning, which is often the most challenging step. It is crucial to take great care when cleaning museum textiles, ensuring that the object's original form is preserved, The traditional approach to conservation treatment involves vacuum cleaning to remove accumulated dust. In some cases, textiles can also be wet cleaned with a suitable detergent. ⁽²⁷⁾ The drying process of wet textiles provides an opportunity to realign deformed fibers. The water acts as a lubricant, taking advantage of the tension in the fibers, thus making the yarn smooth with minimal risk. ⁽²⁸⁾

Our cleaning approach harnesses the power of water mixed with Synperonic N detergent. With a precise 1:100 detergent-to-water ratio, this solution works wonders in the cleaning process. (Fig.7). To maximize dirt removal, the water was vigorously agitated for a full 15 minutes at the optimal temperature of 30°C, allowing it to deeply penetrate between fibers. The process was completed with a critical 10-minute rinse in agitated distilled water, ensuring all impurities were effectively eliminated. ⁽²⁹⁾ ⁽³⁰⁾

5.2.2. Completing process:

Completion reinforces and consolidates fragile ceramic artifacts, including tiles. It maintains structural integrity, strengthens historical revival, and requires materials that are compatible, chemically inert, compositionally similar, and capable of restoring original forms when needed. (—Mastering the completion process is essential for quality restoration work³¹) it's a manual skill developed only through significant experience. Expert restorers carefully select and combine filler materials with precisely matched adhesives, ensuring seamless, durable repairs that stand the test of time. ⁽³²⁾

5.2.2.1. Conditions required for complementary materials:

A perfect material must maintain chemical stability—never reacting with traces or creating substances that alter trace composition. When you're ready to use it, it should transform into a wonderfully flexible state for molding, and then hold its shape permanently without shrinking. Plus, it should readily accept additives, dyes, colorants, and fillers to meet your specific needs.⁽³³⁾ and that the complementary material for ceramic tiles can withstand different environmental conditions.⁽³⁴⁾ The finishing material must be capable of applying surface coatings such as acrylic paints and other colors used for color touch-ups, The finishing material must have a density suitable for ceramic tiles (it must be retrievable and safe upon return).⁽³⁵⁾

5.2.2.2. Ceramic tile completion steps:

- a) After cleaning the crack, the first layer is to complete the crack through two processes:
 - First strengthening it in the depth of the crack with a filling material made of (kemapoxy 150 + Fiberglass).
 - Second, it is prepared by adding a 30% Paraloid-B 72 solution dissolved in acetone and alcohol in a 1:1 ratio. Then, the microballoon (A fine, spherical, white particle that is easy to shape and compress, and gives a smooth surface. It is also characterized by its low weight and increased density when completing large areas.⁽³⁶⁾) is added to Paraloid-B 72 in a 3:1 ratio, respectively. This mixture can be disassembled using acetone with light pressure.⁽³⁷⁾
- b) The second layer used colors that matched the parts of the artwork, which were porcelain colors dominated by shades of blue and white.
- c) The third layer is a layer of small pieces of glass (Fig.8), very similar to the technique used in glazing, and of the same size, and use (epoxy 1092) as an adhesive.
- d) The fourth and final layer features Araldite 2020, a remarkable transparent epoxy that boasts both high viscosity and exceptional luminosity. This versatile material bonds beautifully to complementary surfaces and fiberglass while standing up to harsh chemicals. At its core, Araldite follows the typical epoxy formula—combining epichlorohydrin (ECH) with bisphenol A to create bisphenol A diglycidyl (C₁₅H₁₆O₂). When we incorporate CMB Fiberglass—those short fiberglass strands at just 0.5-1% of the epoxy's weight—the process requires methodical mixing: first blending the epoxy compounds for a full 3 minutes, then carefully folding in the glass fibers until everything becomes perfectly uniform.⁽³⁸⁾ - (Fig.8,9, and 10)

6. Research summary and recommendations:

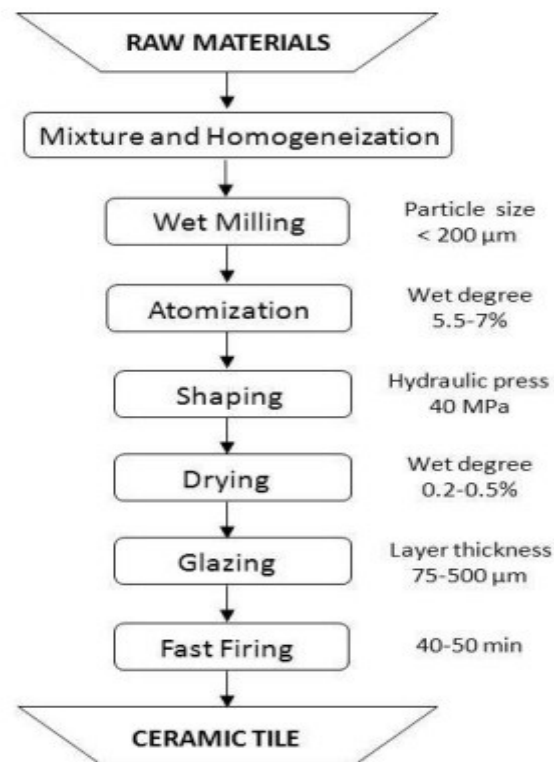
The main objective of the research was to identify the distinctive properties of the various selected finishing materials and to select the most appropriate one for application to the ceramic panel, for cleaning Use materials suitable for porcelain and textiles. For completing materials such as (kemapoxy 150 + Fiberglass), (Paraloid-B 72 + microballon), and (Araldite 2020 + CMB Fiberglass) best results as filler materials, It is recommended that researchers in this field devote more attention to further studies, particularly regarding modern ceramic tile finishing materials and methods, while ensuring that these materials and methods do not affect the shape or style of the ceramic tiles, nor their physical and mechanical properties.



(Fig.1- Hassan Heshmat Museum- Ain Shams district in Cairo)



(Fig.2- The artwork by Hassan Heshmat "Ceramic Tile" - Is a text in free Arabic calligraphy with the words "Lord, expand my chest." (ربِّ اشرح صدري))



(Fig.3. Manufacturing process diagram of glazed tiles according to a single firing process)



(Fig.4. Detail of the artwork showing the technique used in coloring and glazing- "Glaze Crackle technique")



(Fig.5. crack extending from the top end down the width of the ceramic tile)



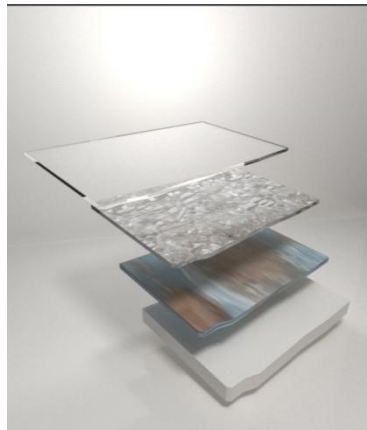
(Fig.6. Signs of stains and dirt on the outer jute fabric-before restoration)



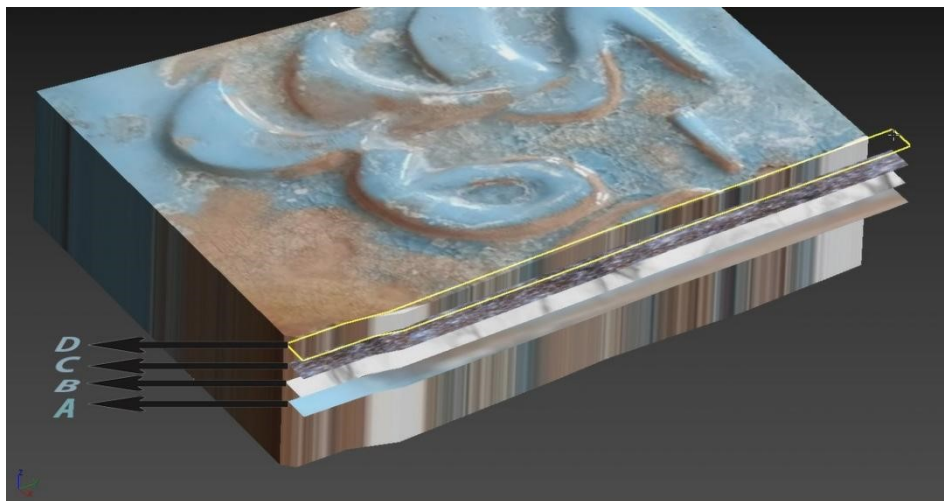
(Fig.7. After cleaning of stains and dirt on the outer jute fabric)



(Fig.8. small pieces of glass very similar to the technique used in glazing and of the same size)



(Fig.9. drawing by the researcher using 3D Max software of the layers used for restoration and completing the crack)



(Fig.10. Cross section by the researcher using 3D Max software of the layers
A. First layer (kemapoxy 150 + Fiber glass) then Paraloid-B 72 solution dissolved in acetone and alcohol in a 1:1 ratio. With the microballoon
B. porcelain colors
C. small pieces of glass
D. Araldite 2020 mixed with CMB Fiberglass)



(Fig.11. the final result of the ceramic tile after restoration)



(Fig.12. the final result of the ceramic tile after restoration complete with canvas jute support displayed on a wall)

Endnotes:

- 1() Ibrahim Al-Hadiri: Anthology of Primitive Arts, **Dar Al-Hiwar Publishing**, Syria.
- (2) Mohsen Abdel Latif Al-Ghandour(1984): Defects in Glass Coating and Their Potential Use in Enriching the Surfaces of Ceramic Forms for Art Education Students, unpublished PhD dissertation, **Faculty of Specific Education, Ain Shams University**, Egypt.
-) Amal Mohammed Hamed Shibli(2008): Philosophical and Technical Dimensions of Contemporary Ceramics 3(and Their Application in Art Education, unpublished PhD dissertation, **Faculty of Home Economics and Art Education, Women's College Branch, King Abdulaziz University**, Kingdom of Saudi Arabia.
- (4) Fathia Al-Dakhkhni(2010): Statues in the Hassan Heshmat Museum Surrounded by Piles of Sand, Gravel, and Reinforcement Steel, **Al-Masry Al-Youm magazine**, October, Egypt.
- (⁵) Amr Abdelkader , Youssef Mahmoud ,and Noura Hosni Ali(2020) : " The Kinetic rhythm of ballet and its use of contemporary field sculpture " , **Journal of Architecture, Arts and Humanistic Science** ,special edition ,October ,pp.970-990.
- (6) Asmaa Ali Abdel Hamid Khalifa(2024): Repetition in Islamic Art as a Source of Inspiration and Its Utilization in Creating Innovative Visions for Egyptian Relief Sculptors, **Journal of Architecture, Arts, and Humanities**, Vol. 9, Issue 48, November, pp. 163–187.
- (7) <https://arttalks.com/exhibition/hassan-heshm>
- (8) <https://www.fineart.gov.eg/Eng/musem.2025>
- (9) Zahraa Hussein Sabih Abdul Ali, Sabah Ahmed AL-Shaya (2023): Contemporary Arabic ceramics (methods and techniques), Conceptual work in contemporary Arabic porcelain, **Russian Law Journal**, Volume XI , Issue 12.
- (10) Fatma Ismail(1989): 29 Artists in the Museum of Egyptian Modern Art, Cairo, p.11
- (11) Omar Mohamad Abd El Aziz , Daa El Din Daoud , Mohamad Samir Mohamad Mohamad El-Gindy(2022): The Development of Ceramics Artistic Firing Techniques And The Capability of Using It in Decorating Industrial Ceramics Products , **Journal of Architecture, Arts and Humanistic Science**, Volume 7, Issue 35 , pp.399-412.
- (12) Ardiles Akyuwen, Inovensius Hugo Bima Wicaksana, Rezki Gautama Tanrere, Ceramics as a Medium for Social Critique: Artistic Reflections on Freedom and Marginalization (2024): **The Kyoto Conference on Arts, Media & Culture 2024 Official Conference Proceedings**.
- (13) R.Casasola, J.Ma. Rincón, M. Romero,(2012): Glass-ceramic glazes for ceramic tiles – a review , **Journal of Materials Science**, 47 ,pp.553-582.
- (14) Rasha Fawzy Ahmed Abd Elrahem , Hamada Mohmed Abdelmotalib , Mohamed Ali Hassan, Ebrahim Desouky Abd-Elmawgoud,(2023) : Possibility of obtaining Transparent Glaze from the Local clays of Qena Governorate ,**Journal of Plastic art and art education** , Volume 7, Issue 2, pp.536-554.
- (15) Mohamed El-Shabrawy Abd El-Aziz (2022): Decorative formulations for the surface of ceramic products to achieve an aesthetic quality , **Journal of Architecture, Arts and Humanistic Science**, Volume 7, Issue 34 , p.450.
- (16) Omar Mohamad Abd El Aziz (et al), The Development of Ceramics Artistic Firing Techniques and the Capability of Using It in Decorating Industrial Ceramics Products, op. cit.
- (17) Ali Khader Mahmoud , Farhan Mahmoud Elia, (2022): Islamic glazed pottery discovered in the city of Balad (Eski Mosul) ("Selected examples"), **Athar Al-Rafedain Journal (AARJ)**, Vol 8, No.8 , P.p.157-180.
- (18) Catherine Hess ,(2004): The Arts of Fire , Islamic influences on glass and Ceramics of the Italian Renaissance , **The J. Paul Getty Museum, Los Angeles** , p.10.
- (19) Omar Abdel-Kareem (2021): Textile conservation past, present and future , **Advanced Research in Conservation Science**, Vol. 2, Issue 2, pp.1-15.
- (20) R. Abd-Allah, Z. Al-Muheisen, and S. Al-Howadi,(2010): "Cleaning strategies of pottery objects excavated from Khirbet Edh-Dharih and Hayyan Al-Mushref", **Jordan: four case studies**, **Mediterranean Archaeology and Archaeometry**, Vol. 10, pp. 97-110
- (21) E. A. Orabi, A. A. Ahmed,(2020): "Analytical study and treatments of the decayed mural paintings at Athribis in Sheikh Ahmed temple, Sohag governorate, Egypt," **Shedet**, Vol. 7, pp. 238-249.
- (22) Mohamed Moustafa Ibrahim , Hamdy Mohamed Mohamed,(2021): Conservation of an Egyptian Pottery Sarcophagus from Saqqara excavation-A Case Study, **Advanced Research in Conservation Science**, Vol. 2, Issue 1, pp., 1-9
- (23) C. altavilla, e. ciliberto, s. la delfa, s. panarello, a. scandurra,(2008) : "The cleaning of early glasses: investigation about the reactivity of different chemical treatments on the surface of ancient glasses," **Applied physics A**, Vol. 92, pp.251- 255.
- (24) Shaimaa Sayed Mohamed El-Sayed (2023): Restoration and conservation of the archaeological Islamic sandstone tombstones applied on a tombstone from the second Abbasid era in Egypt,**Journal of the faculty of archaeology(JARCH)** ,Vol,26, pp.475-491.

- (25) R. Abd-Allaha, (2013): "Chemical cleaning of soiled deposits and encrustations on archaeological glass: A diagnostic and practical study," **Journal of Cultural Heritage**, Vol. 14, pp. 97-108
- (26) G. Adrian, and M. C. Paez, (2007): "Ceramic conservation in archaeological museums: The current situation in Northwestern Argentina (Province of Catamarca)", **Glass and Ceramics conservation**, pp. 180-188.
- (27) S.Landi,(1998): The textile conservator's manual, **Butterworth & Heinemann**, second edition.
- (28) Ahmed, H., Yahia, D. & Zidan, Y(2018): Restoration and storage procedures of a rare historical textile in the museum of the faculty of applied arts of Helwan university, Egypt, **Egyptian Journal of Archaeological and Restoration Studies "EJARS"**, Volume 8, Issue 1, June ,pp: 35- 43
- (29) Rifai, M. & El Hadidi, N., (2010). Investigation and analysis of three gilded wood samples from the tomb of Tutankhamun, In: Dawson, J., Rozeik, C. & Wright, M. (eds) *Decorated Surfaces on Ancient Egyptian Objects, Technology, Deterioration and Conservation*, **Cambridge**, UK, pp: 16-24
- (30) Tłm-r-Bal-zy, Ł., (2000). Wet cleaning of historical textiles: surfactants and other wash bath additives, **Studies in conservation**, Vol. 45 (3), pp: 46-64.
- (31) Mohamed Moustafa Ibrahim , Elshaimaa Abd Elrahim, Rasha Mohamed Sayed,(2022) : A Study to Assess the Efficiency of some Gap Filling Materials for Ancient Ceramic Tiles, **Journal of Architecture, Arts and Humanistic Science**, Volume 7, Issue 33 , pp.718-737.
- (32) S. Ahmed, M. Abdebar, W. Sabry, A. Ali, "Experimental study of Gap-Filling of Ancient Completely Corroded Copper Bowl Via Nano polymers," **international journal of conservation science**, Vol. 11, No. 1, 2020, pp. 97-108.
- (33) Mohamed Moustafa Ibrahim, (et al), A Study to Assess the Efficiency of some Gap Filling Materials for Ancient Ceramic Tiles ,op. cit.p.721.
- (34) Faulding, R., & Thomas, S., (2000): Ceramic Tiles in Historic Buildings: Examination, Recording and Treatment, **Journal of Architectural Conservation**, 6(1):pp.38-55.
- (35) Buys, S., & Oakley, V.,(1993): The conservation and restoration of ceramic, **Butterworth Heinemann Ltd**, Oxford, pp.121-122.
- (36) J., Training,(1999.): ceramics and glass conservation at Buffalo State College: An American Perspective illustrated by treatment case histories, In: The Conservation of Glass and Ceramics, Editor:Tennent, N. H., **Science Publishers**, William Road, London,
- (37) Burden. et al, (2004): The reconsevation of 105 Bronze Age ceramics, The Conservator.
- (38) Rasha T. Hamad (2020) : Using fiberglass to consolidate complementing materials in archaeological glass " Experimental study " , **Journal of Shedet** , Article 17, Volume 7, Issue 7, pp. 298-312.

Bibliography of Arabic References:

1. Ali Khader Mahmoud, Farhan Mahmoud Elia, (2022): Islamic glazed pottery discovered in the city of Balad (Eski Mosul) ("Selected examples"), **Athar al-rafedain Journal (AARJ)**, Vol 8, No.8, P.p.157-180.
2. Amal Mohammed Hamed Shibli(2008): Philosophical and Technical Dimensions of Contemporary Ceramics and Their Application in Art Education, unpublished PhD dissertation, **Faculty of Home Economics and Art Education, Women's College Branch, King Abdulaziz University**, Kingdom of Saudi Arabia.
3. Asmaa Ali Abdel Hamid Khalifa(2024): Repetition in Islamic Art as a Source of Inspiration and Its Utilization in Creating Innovative Visions for Egyptian Relief Sculptors, **Journal of Architecture, Arts, and Humanities**, Vol. 9, Issue 48, November, pp. 163–187.
4. Fathia Al-Dakhkhni(2010): Statues in the Hassan Heshmat Museum Surrounded by Piles of Sand, Gravel, and Reinforcement Steel, **Al-Masry Al-Youm magazine**, October, Egypt.
5. Ibrahim Al-Hadiri: Anthology of Primitive Arts, **Dar Al-Hiwar Publishing**, Syria.
6. Mohamed El-Shabrawy Abd El-Aziz (2022): Decorative formulations for the surface of ceramic products to achieve an aesthetic quality, **Journal of Architecture, Arts and Humanistic Science**, Volume 7, Issue 34, p.450.
7. Mohamed Moustafa Ibrahim, Elshaimaa Abd Elrahim, Rasha Mohamed Sayed,(2022): A Study to Assess the Efficiency of some Gap Filling Materials for Ancient Ceramic Tiles, **Journal of Architecture, Arts and Humanistic Science**, Volume 7, Issue 33, pp.718-737.
8. Mohsen Abdel Latif Al-Ghandour (1984): Defects in Glass Coating and Their Potential Use in Enriching the Surfaces of Ceramic Forms for Art Education Students, unpublished PhD dissertation, **Faculty of Specific Education, Ain Shams University**, Egypt.
9. Omar Mohamad Abd El Aziz, Daa El Din Daoud, Mohamad Samir Mohamad Mohamad El-Gindy(2022): The Development of Ceramics Artistic Firing Techniques And The Capability of Using It in Decorating Industrial Ceramics Products, **Journal of Architecture, Arts and Humanistic Science**, Volume 7, Issue 35, pp.399-412.