Scientific Research Publishing

Open Journal of Metal, 2023, 13, 1-17
https://www.scirp.org/journal/ojmetal
ISSN Online: 2164-277X
ISSN Print: 2164-2761

Design Intervention: An Artistic Strategy (A Strategy) to Minimize Text Fading and Metal Commemorative Plaque Theft in Ghana

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How to cite this paper: Junior, A.-A., Ebenezer, M.F., Charles, V., Sampah, S.N.A., Barfi-Mensah, H.M. and Toffah, A.A. (2023) Design Intervention: An Artistic Strategy (A Strategy) to Minimize Text Fading and Metal Commemorative Plaque Theft in Ghana. *Open Journal of Metal*, **13**, 1-17.
https://doi.org/10.4236/ojmetal.2023.131001

Received: January 30, 2023
Accepted: February 28, 2023
Published: March 3, 2023

Abstract

The Commemorative Plaque Industry thrives at the hands of the local craftsmen in Ghana. Techniques, methods, tools, and materials used as handed to them by their previous masters have remained the same over the years. As a result, plaques produced had peculiar problems such as text fading, degrading the actual effect of the plaques. Additionally, metals once widely used for making plaques devoid of text fading in the industry seem to have lost their relevance due to metal plaque theft, rust on metal plaques, and the continuous rise in metal prices. This research uses descriptive, experimental, and case studies of the qualitative research method to examine the problems associated with locally produced commemorative plaques. A total of hundred (100) artisans, including metal scrap dealers, and plaque buyers, were selected for the study. Direct observation and face-to-face interviews were conducted with the local craftsmen, art lecturers and students, scrap dealers, and plaque buyers who were purposively sampled for the study. The study revealed that existing materials like ceramic and aluminium could be integrated innovatively to produce commemorative plaques devoid of text fading; a corrosion-resistant text could be made using anodized or coated metals used in smaller quantities to reduce costs while also making them unattractive for theft and lastly, silicone sealant was found to be a viable option for permanently inscribing text on porcelain bases. The results clarify and underline the necessity to grow the local plaque industry in terms of plaque production as another essential basis to assure high-quality plaques with no text fading that will survive for generations to serve their intended purpose.

Keywords

Commemorative Plaques, Strategy, Porcelain, Silicone Sealant, Anodized Metal

1. Introduction

The term "Plaque" has varied meanings in professional sectors such as microbiology, arts, and institutional organizations. According to the oxford dictionary [1] commemorative plaque is a flat piece of stone, metal, or other material placed on a wall in honour of a person or event, generally with a name and dates. In other words, plaques are forms of memorials, built with solid or hard materials such as metal, wood, ceramics, marble, plastic, cement cast, and others with text inscriptions or images used to remember an object, persons, or events, houses, parks, and others. The use of hard and solid materials implies that memorial plaques are intended to last for decades, allowing them to tell a story or efficiently convey a message.

The country's many ethnicities have different beliefs about remembering deceased relatives in the past. These philosophies originate from the use of carved heads and sculpted figures and the use of stools. For instance, the Akans of the Ashanti region believed that their ancestral spirits governed every element of existence; nevertheless, to win or gain their favours, they honoured them with things they enjoyed or cherished during their lifetime. The Asantes of Ghana also utilise the darkened stool to symbolise and honour their deceased kings. The names of the Asantes' newly enstooled kings derived from these ancestral stools. On the contrary, today, people honour their deceased relatives with commemorative plaques. The paradigm of these beliefs among different ethnicities in the country toward the dead and the need to remember and honour deceased relatives has generated a great demand for these commemorative plaques. Although these local craftsmen workshops are spread across the country, the production of the plaques is conventional in the country. These conventions are evident in the choice of materials, quick fading of the inscribed text on the support, corrosion on metal plaques, and less innovative plaques produced as a result of the traditional master-apprentice system of training, which promotes copying [2].

However, there has been advanced research in technology in terms of materials, tools, equipment, and techniques that are not farfetched. Chemical engineering and material science research have opened up possibilities for producing innovative results in this field [3]. Observations made at the plaque-producing centres attest that these plaque craftsmen are not abreast with modern technologies, hence the constant production of the same number of plaques pregnant with the same problems that have existed over the years. The researchers are of the view that problems that exist with the plaques can be resolved with advanced technologies. However, these problems need further examination to adopt technologies that would be suitable to solve them.

The study finds the local plaque industry an untapped field that needs investigation. To bridge the gap in the literature on this area, we explore its avenues to determine where it comes up short and how it may be enhanced to help cultural, social, and national development.

The Origin of the Plaque Industry in Ghana

In Ghana, information on the early production of commemorative plaques and their first usage is unknown. There is no documentation or oral tradition to support their first usage and early production in the country. Craftsmen interviewed speculate that the Dutch introduced commemorative plaques to Ghana, the then Gold Coast (**Figure 1**). The Christiansburg war cemetery, constructed in 1941, also shows evidence of early usage of memorial plaques in Ghana [4].

As stated earlier, how and when the industry came to the country could not be ascertained, but it is that the locals, who were very dexterous, tried their hands on it after observing the headstones found at the British cemeteries in the country. However, because the country's production processes are conventional, the plaque business is concentrated in the country's major cities, particularly Accra, Kumasi, Tema, Cape Coast, Takoradi, and others. Another factor explaining the concentration of the industry in the cities is the ready accessibility and availability of materials.

Fofo, a plaque craftsman and a pioneer in the industry at Tafo Cemetery, asserts that the industry came to Tafo due to the cemetery. According to him, plaque-making at the graveyard used to be done by very few people. However, with the constant demand for plaques, the industry suddenly began to boom; this attracted people to the industry who learned as apprentices before setting themselves up [5] (**Figure 2**).

Figure 1. Plaque dedicated to a Dutch governor who died at post, Elmina Castle—Ghana. (Source: http://www.indonesia-dutchcolonialheritage.nl/historicalsites-southafrica/ghanaheritage/Elmina,%20Dutch%20heritage.pdf) ©2009 drs (Msc) D. Teeuwen-Rendezvous Batavia—The Netherlands).

Figure 2. An apprentice in one of the plaque centres visited.

2. Methodology

The objective of this research is to come up with new ways to deal with the challenges associated with locally made commemorative plaques. The methodology used in this study was in three parts: 1) the first research method utilised was the case study. In the case study, activities included the following: the researchers examined the processes, methods, materials, tools, and equipment used by the local craftsmen to produce plaques at their various workshops. We examined them to figure out what was causing the problems. This was done because the researchers wanted to discover the true nature or inner relationships of the issues as they exist and the needed interventions necessary to curb the phenomenon [6]. 2) The descriptive method was used to describe the working processes and the experiments conducted by the researchers to determine the suitability of some selected materials and techniques based on the data collected for the sample plaques' fabrication. It offers researchers the strategy for accounting for the status of a phenomenon under study by obtaining appropriate information that can best describe, interpret or explain the nature of a phenomenon [7]. Unquestionably, it is the best technique for studio artists whose main goal is to have their works of art have a positive social impact. Artists might thus use descriptive research techniques to add meaning to their practical processes. This is the rationale behind using it as a research methodology in this study [8]. 3) The experimental method was used to examine the characteristics of a few chosen materials to determine their applicability and effectiveness for producing plaques. This was done through careful manipulations of materials (taking into account the properties of the materials).

Direct observation and face-to-face interviews were utilised in the data collection. This was done to gather verbal and nonverbal cues from the respondents. Face-to-face interviews were used to collect data in an unstructured interview that allowed the researchers to speak with respondents directly and gather information about the study's facts. Consequently, the face-to-face interview method guaranteed the accuracy of the data and boosted the response rate.

The purposive sampling was used to select artists or artisans. This sampling technique was used because the researchers needed artists or artisans who produced plaque(s) and persons with relevant experience in the field [9]. In all, one hundred (100) plaque artisans, scrap dealers, and plaque buyers were selected as the sample for the study, as detailed in **Table 1**.

3. General Working Procedure

This section deals with the systematic processes followed to produce the intervention plaques with the collected data on technologies, tools, equipment, techniques, media, and materials adopted.

3.1. Tools and Equipment, Materials and Media for Making Plaques

Tools and equipment included: felt saw, hack saw, cutter, metal ruler, filing tools, sandblasting machine, laser cutting machine, hand trowel, soldering iron, scissors, knives, pencils, caulking gun, squeegee, and hand driller. For materials, the study used ceramics-porcelain as the base material for the project. Other materials were metal (alloy and anodized aluminum), silicone sealant, rubber sticker material, cement, sand, iron rods, lead, and wooden frames.

Table 1. Summary of sample size.

Population	Location	Size
Local plaque craftsmen	Tafo cemetery, Awudome Cemetery, Centre for National Culture—Accra and Kumasi	40
Lecturers Students	Department of Communication Design, KNUST, Kumasi	2 8
Lecturers Students	Department of Industrial Arts (Ceramics) HTU, HO	2 8
Lecturers Students	Department of Painting and Sculpture KNUST—Kumasi	2 8
Lecturers Students	Department of Industrial Art (Metal Section) KNUST—Kumasi	2' 8
Lecturers Students	Department of Integrated Rural Art and Industry KNUST—Kumasi	2 8
Plaque buyers	Kumasi and Accra	6
Scrap buyers and Collectors	Suame Magazine and Aboabo, Kumasi	2 2
TOTAL		100

3.2. Techniques Adopted

1) Stencilling;
2) Sandblasting;
3) Joining techniques used: adhesion and soldering.

3.3. Experimental Test on Some Available Adhesives on Ceramic and Metal to Determine Their Possible Adhesion

Adhesives work best when joining materials with the same properties [10]—joining two dissimilar materials, such as metal and ceramics, requires adhesives that can adhere to both materials. Researchers reviewed data collected and identified several potential adhesives to test and choose from that can bind aluminum (smaller unit) to porcelain base (bigger unit).

The adhesive sample selected for the study was Acetic silicone sealant (standard name silicone), based on the following properties, which were the fundamental requisite for the experiment:

- Ability to withstand very high and low temperatures.
- Good resistance to water, ultra-violet beams, oxygen, and ozone.
- Very low toxicity.
- Resistance to chemicals such as acids, alkalis, salt, and others.

3.4. Procedure

The surface area of 1 × 1 inch of aluminum and porcelain was roughened; this allowed both surfaces to receive enough sealant for adhesion necessary for joining. The sealant was applied between the aluminum and porcelain using the same surface dimension to ascertain their adhesion strength. After this, the joining was left for some time to cure. Observations were made after curing to determine how well the bonding is between the two materials, followed by a lifting test (with a thumbnail and the chisel edge) which also checked the strength rate of the bond. The bonding compatibility between the two materials is denoted by the ticked (√) symbol as seen in (Table 2).

Table 2. Test result of adhesive and material compatibility.

Type of Adhesive Material Compatibility		
	Metal	**Ceramic**
Acrylic	√	√
Epoxy	√	√
Phenolic		√
Polyurethane	√	√
Silicone Cyanoacrylate (super glue)	√	√
Anaerobic/Surface-Activated Acrylics		√

Key: the ticked (√) means the adhesive type is compatible with the material.

3.5. Cutting Text from Aluminum Plate

Step 1: An aluminum plate size of 12 × 12 inches with a thickness measuring about 0.5 mm was selected, and the surface was thoroughly cleaned.

Step 2: A text-printed sticker measuring 12 × 12 inches was pasted on the aluminum smoothly.

Step 3: The texts were then cut out leaving the stencilled text to receive the sand grit.

3.6. Cutting of Tiles into Smaller Units

Step 1: A white tile of about 14 × 14 inches was cut into sections about 2 inches apart into rectangular shapes using marked outlines as a guide.

4. Production of Plaques

4.1. Designing of Sample Plaques in Rhinoceros

The plaque's ideas and inscription were sketched up first. The sketches were digitally developed in Rhinoceros (Figure 3), which guided and determined how the final works may look.

Figure 3. Sample designs in rhinoceros.

4.2. Production of Plaque 1

Step 1: To support mortar that would later receive cut rectangular shaped ceramic tiles, a 21 × 18 inches wooden frame was made.

Step 2: Plywood was used to support the frame's base (a little bigger than the frame). After that, a metal mesh was inserted into the frame to act as an armature for the mortar.

Step 3: To get the proper consistency, a mixture of tile sand, cement, and water was mixed. The mortar was then used to fill the wooden frame and level it.

Step 4: On the inner section of the aluminium cut-out text, the adhesive (acetic silicone sealant) was applied. Following that, the texts were arranged and glued to the rectangular ceramic tiles.

Before firmly hammered onto the mortar, the extra projections added to the texts were curled to lock at the back of the tiles as reinforcement (Figure 4).

Step 5: Once all of the texts on the tile have been arranged on the mortar, the next step was to use cement bursts to fill in the gaps between the tiles. As shown in Figure 5, the dirt was cleaned, and the rubber stickers were removed to reveal the colour of the texts.

4.3. Production of Plaque 2

Step 1: We prepared porcelain tile for text registration using a sandblasting technique. A black porcelain tile measuring 21 × 20 inches was used, and the surface was thoroughly cleaned. A plain rubber sticker with the same porcelain

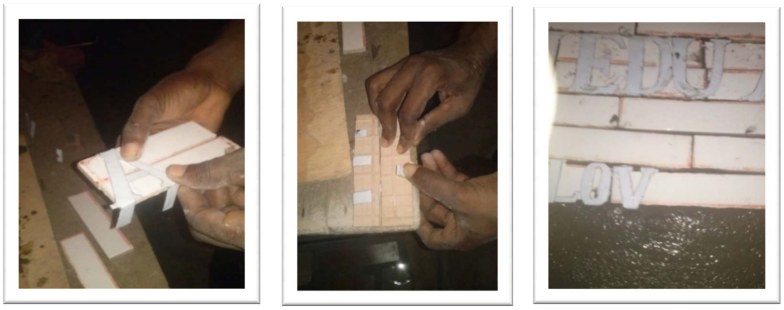

Figure 4. Pasting aluminum texts and reinforcing the texts at the back of the tiles before firmly pressing them onto the mortar.

Figure 5. Sticker removed to expose the coated Aluminium text.

tile size was pasted on the porcelain tile. A second sticker with printed text was pasted over the first on the porcelain. This was to serve as the template text on the base porcelain. The text was stencilled cut, and the cut portions were removed. This was to ensure that the stencilled pieces, which will form the text inscription, are made bare as the only part to receive sand grits from the sandblasting machine to create the text (Figure 6).

Step 2: The sandblasting gun was used for engraving the porcelain tile's surface by directing the gun's mouth towards the stencilled parts. The sandblasting gun used pressure to force out sand grits through the nostrils to the part which needed to be engraved, and the grits gradually cut through the surface, leaving sunk-in text on the porcelain surface.

Step 3: After engraving the text on the porcelain, text areas were perforated (Figure 7). This is to enable the soldered piece of the aluminium rod attached to the back of the text to be inserted and bent to lock at the back of the porcelain as additional reinforcement for the aluminium texts. The acetic silicone sealant was then applied to the engraved text area, followed by pressing the individual aluminium text (Figure 8) firmly on the adhesive areas on the porcelain.

Step 4: After the silicone had cured, the stencilled sticker was removed (Figure 9) from the porcelain, leaving the aluminium pieced text firmly adhered to the porcelain. The finished work was then washed to remove dirt and excess sealant.

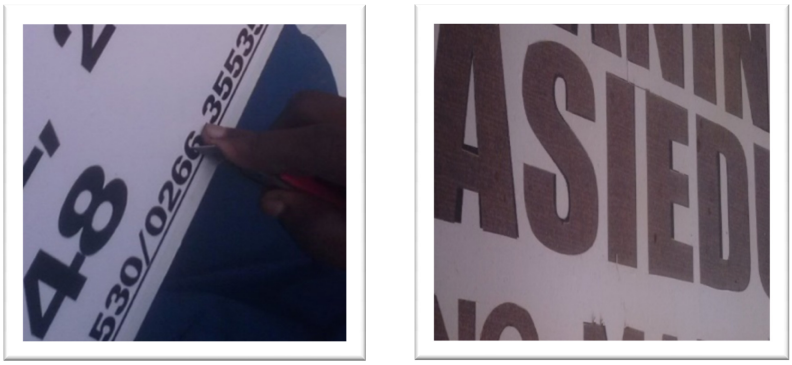

Figure 6. Text inscription on base porcelain.

Figure 7. Perforating the text.

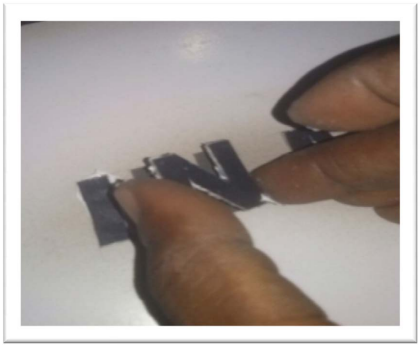

Figure 8. Pressing the texts on the porcelain.

Figure 9. Removing the stencilled sticker and washing the debris.

4.4. Production of Plaque 3

Step 1: Off-white porcelain with size 21 × 21 inches was selected. A plain sticker was used to cover the surface of the porcelain. Another sticker with printed text was pasted on the first sticker. As done in project two, the letters were stencilled and sandblasted.

Step 2: Silicone sealant (black) was applied onto the surface of the cut stencil. A squeegee was then used to spread the adhesive to fill the engraved letters/text receptacle. The silicon was left to cure for hours, and the sticker was removed and cleaned to remove all debris on the surface as shown in (Figure 10).

5. Results and Findings

To minimize and improve the quality of plaques produced in the country. The researchers relied on processes, methods, and technologies gathered from available literature, observations made at the various working sites, and experiments and ideas from lecturers and student artists who are experts in the field. These data gathered were analysed and developed into alternate strategies. The technologies adopted were tested to identify their suitability. Other viable media were proposed to replace some old media to enhance their quality and ensure permanent registration of text inscribed on the base. This has been detailed below.

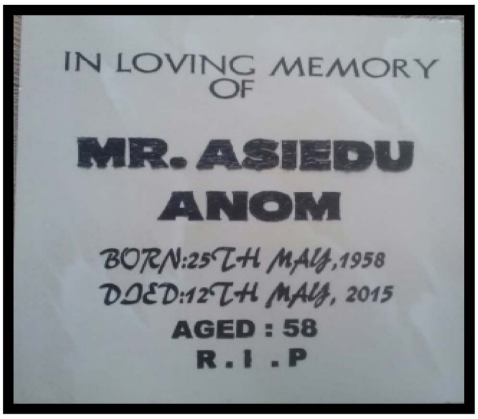

Figure 10. Dried silicone text on a porcelain base.

5.1. Text Fading

The study revealed that text fades quickly on the base material due to the changes in weather conditions, which affect the ink used for the text inscriptions. We noticed the inks used by the local craftsmen were the types mainly used for interior designs. In a few cases where inks used were identified as outdoor inks, the ink gradually loses its intensity with time. Some also fall off their receptacles. This result was due to text receptacles on the porcelain base not being engraved deep enough to hold enough ink on the support to withstand the harsh weather.

5.2. Corrosion on Metal Plaques

Findings revealed that metal plaques at the cemetery rusted over the years due to improper treatment given to the metals. Many of their clients resorted to ceramics and later marble. It was evident that about 75% of the plaques found at the cemeteries were ceramic, predominantly porcelain, with about 20% marble and 5% of metal plaques, respectively. The study revealed that many buyers now prefer ceramic commemorative plaques, which are cheaper, more durable, and aesthetically appealing due to their glossy appearance.

5.3. Metal Plaque Theft

According to the Institute of Scrap Recycling Industries (ISRI), in the United States alone, the recycling industry accounts for nearly half a million jobs in the country and generates more annual economic activity. As a result, this has seen a high demand for scrap metals globally. There has been an increase in metal theft offenses due to the rise in metal prices due to global demand exceeding supply. However, the increase in the price of scraps, especially non-ferrous metals, has sparked an increase in metal theft from the built environment. The desire for copper, for example, has fuelled a noticeable rise in the plundering of the built environment across the world [11] [12] [13].

A visit to two buying scraps centres at the Suame magazine and Aboabo, all in Kumasi in the Ashanti region, indicated that the demand and price for alumi-

num and steel scraps were higher than other metals. As a result, aluminum and steel scraps are the types of metal scraps well sorted for by the scrap collectors. Indications at the cemeteries visited show many old metal plaques removed due to this scrap theft.

5.4. The Apprentice Form of Education

The craftsmen acquired their skills through the apprentice training system, which [14] defines as anyone who learns a skilled trade through participation or observation. From the interviews conducted, the educational levels of the respondents (plaque craftsmen), the majority of them being men, were as follows: about 43.8 percent had no formal education, and 56.2 percent had some education, either at the primary, junior high, or senior high school level. 33.8% of individuals who had received formal education could read or write. Only 59.2 percent of the population can read and write.

Following the field observation, masters of the trade were the only source for knowledge acquisition at the various sites visited. Larbi [15] explains that the apprenticeship program relies solely on the master's knowledge because no curriculum or reference books are available. He claims that staying current with modernity, science, and technology is impossible. The masters transfer the skills acquired from their previous masters over the years to their apprentices. These skills, developed by the masters over the years, are seen as part of their tradition, and as a result, they are unwilling to adopt new skills or change. As a result, the industry produces the same number of plaques, pregnant with the same problems. Consequently, the apprentices also, in turn, continue in the same manner, which does not support the industry.

5.5. Test Results of Available Adhesives Suitable for Joining Metal and Ceramics

From the experiments conducted, we realized that some bonds are compatible with some materials while others are not. Some adhesion tests using the thumbnail and chisel edge lifting tests were conducted to obtain a suitable adhesive that could adhere to metal cut-out texts on a ceramic base. The test results are summarized in (**Table 3**) below.

5.6. Results of the Thumbnail and Chisel Edge Lifting Test

The test results on the curing and lifting resistibility of the selected adhesives are summarized below

5.7. Ability to Hold after Curing

Key: poor, good, very good, and excellent;

- *Poor*: fall off after drying or curing;
- *Good*: less potent but better than poor;
- *Very Good*: better than good but not as strong as excellent;
- Excellent: very strong after curing.

Table 3. Result of lifting test.

Adhesives **(Metal and Ceramic)**	Ability to Hold after Curing **(Between Metal on Ceramic base)**	Lifting Resistibility	
		Thumbnail lifting	***Chisel Edge lifting***
Acrylic	Good	Very Good	Good
Epoxy	Excellent	Very Good	Very Good
Phenolic	Good	Very Good	Good
Silicone	Excellent	Very Good	Very Good
Polyurethane	Very Good	Very Good	Good
Cyanoacrylate (super glue)	Very Good	Very Good	Good
Anaerobic/ Surface-Activated Acrylics	Very Good	Very Good	Good

5.8. Thumb Nail and Chisel Lifting Resistibility

Key: very poor, poor, good, and very good;

- *Very Poor*: *no/least effort required*;
- *Poor*: *less effort required*;
- *Good*: *much effort required*;
- *Very Good*: *able to resist force*.

From the test results, we realized that epoxy and silicone were found to exhibit strong adhering capabilities between the two materials. However, since the plaques produced were intended to be used outside (outdoor plaques), we needed an adhesive capable of withstanding the changes in the weather conditions. Comparatively, silicone was chosen due to its chemical inertness, water and oxidation resistance, and temperature stability.

5.9. Silicone Thickness Assessment Test

From the test, it was identified that silicon sealant comes in a paste-like form. Depending on the user's discretion, it could be thinly or thickly applied, referring to one of the causes, *i.e.*, the inability of text receptacles to receive enough ink, leading to text fading on the base material. The varied thicknesses of silicone were put on a flat surface to dry, ranging from low, medium, and high. The test proved that once the silicone is set and dry, it does not affect its thickness; this proved that silicone can be used to create text characters ranging from flat to high/emboss on base materials that will be very difficult to wash away by rainwater or fade away by the effect of sun rays.

5.10. Results of Silicone Pliability Assessment

We experimented with silicone to see its workability. Oil was smeared on a

crown cork and filled with silicone to the brim. The silicone was left to cure, taken out of the crown cork, and accessed. The researchers found that silicone, once dry, adopts the shape of its receptacle. The experiment confirmed that silicon could be worked on to take the text receptacles on the base (ceramic).

5.11. Results Assessment of the Effect of Temperature on Silicone

Silicone is known for its thermal stability, ranging from 100˚C to 250˚C. The effect of temperature on silicone on a material's surface may differ from one material to another [16] [17]. However, different temperatures were used to test silicone on a porcelain base to see how it would react to the heat. The results are shown in the table below (**Table 4**).

Table 4. Temperature assessment result of silicone.

Temperature Range (˚C)	Exposure Time (5 minutes)	Effects (Changes)	Remarks
20 - 30	5 Minutes	No Change	Intact
35 - 45	5 Minutes	No Change	Intact
50 - 60	5 Minutes	No Change	Intact
65 - 75	5 Minutes	No Change	Intact
80 - 100	5 Minutes	No Change	Intact
105 - 115	5 Minutes	No Change	Intact
120 - 135	5 Minutes	No Change	Intact
140 - 150	5 Minutes	No Change	Intact

From the results, we observed that the silicone became soft at temperatures between 100˚C and 150˚C but returned to its rubber-like form after cooling.

6. Discussion

"Because plaques will be seen by so many people–both current and future generations–high standards are desired in all aspects of the work involved. This is especially true in plaque design, positioning, inscription (text), and the selection of a suitable and appropriate site, design format, and materials" [18]. From this assertion, the inscription, be it text or image, play a vital role in the design of plaques and indeed need to be made to last the ages.

To correct or find answers to the cause, the data on alternative materials possess characteristics required to withstand the diverse effects of the weather—considering the many uses of silicone, its chemical inertness, water and oxidation resistance, temperature stability, and its compatibility with Ceramic. We tried a variety of activities to see if they were suitable for creating text inscriptions on the base material (porcelain).

This research aims to establish an appropriate strategy to curb metal plaque theft, corrosion on metal plaques, and text fading on plaques produced in Gha-

na. Based on the data gathered for sample plaques one and two, the strategies identified and adopted are as follows.

6.1. Cut Metal Text on Ceramics

From the data collected from the field visit, plaques at the cemeteries come with engraved text inscriptions in either spray paint or acrylic ink. On the other hand, metal plaques are coated with oil paint and have the text inscription etched on them. According to the scrap collectors interviewed, bulk metal collection saves time and attracts reasonable prices compared to the smaller ones. The scrap collectors consider them complements to the bulk ones, so their collection is minimal. However, to restrict its use, the words were cut out of the metal and put in an orderly fashion on the porcelain base. This was to dissuade metal thieves from stealing them.

6.2. Joining Metal and Ceramics

Fernie & Knowles [19] opine that joining ceramics with other materials arises due to their essential roles in conjunction with other materials. For instance, it can add particular functionality or provide added benefits to a component. The researchers also realized that joining is the easiest and most convenient way of creating metal text inscriptions on ceramics. From the data collected, three fundamental options for joining were: mechanical, adhesive, and welding (subdivided into brazing and soldering). Two techniques, adhesion, and soldering were used to strengthen the text's (metal) stability on the porcelain.

6.3. Preventing Corrosion in Metal Plaques

The effects of corrosion on metals have seen research done to enhance metal properties that withstand corrosion and other defects in metals. The properties of metals determine their use and the process by which they can be worked on [10] [20]. Other aspects of the data collected advocate for various treatments that could enhance the life span and appearance of metals [21]. The common ways of preventing corrosion are coating, painting, galvanizing, chemical additives, passivation, cathodic protection, organic coating, and anodizing [22] [23]. In addition to these; one can opt for metals that are known for their corrosive-resisting ability to withstand outdoor conditions. Concerning plaque samples 1 and 2, we used both anodized aluminum and alloyed aluminum sheet due to their high corrosion resistance. The texts were cut from these metals.

7. Conclusion

The researchers believe that developing the local plaque industry in terms of plaque production is another essential step for national development. Because it is a lucrative industry that, if explored, will provide employment opportunities for unemployed graduate artists while also improving the quality of plaques produced by the industry. The direct impact of the local plaque craftsmen's ac-

tions was shown to be the primary cause of the issues at the plaque centres. Strategies adopted to produce the sample plaques were based on ideas gathered from the primary and secondary sources of the data, which were tested and translated into concrete forms. The existing materials, such as aluminum and ceramic, could be creatively manipulated and combined to produce plaques. Silicone and its ability to take the shape of its receptacles, its compatibility with both metal and ceramic, and its properties such as chemical inertness, resistance to water and oxidation, and stability at both high and low temperatures make it an excellent alternative material for forming text on a base material. Researchers offer the following alternative innovation to plaque designs in Ghana to improve the quality of the plaques produced at the production centres.

- Aluminum cut out as text on a porcelain base;
- Anodized aluminum cut-out text on a ceramic base;
- Silicone sealants used as text inscription on a porcelain base.

Conflicts of Interest

The authors declare no conflict of interest regarding the publication of this paper.

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