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STUDY ON THE SUITABILITY OF SOME SELECTED SCRAPS BRASS WASTES FOR JEWELLERY PRODUCTION USING LOCAL TECHNIQUES

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Abstract

Production of jewelleries of brass scraps from Samples collected from various places in Gombe metropolis through random sampling techniques was perform and presented in this study. The study uses local techniques for jewellery production using the available brass scraps collected. The samples collected from various site were casted in to various forms, shapes and design and compared with established practical values (visual quality) entailed for jewellery production. It was discovered that brass scraps collected are of different type's base on the nature of its colour, weight, surface and mechanical structure (i.e. malleability and ductility). Samples 1 (tap heads) and 2 (car part) are not malleable and ductile as samples 3 (ornament) 4 (trumpet), 5 (car pipes) and 6 (dishes). The study concluded that sample 1 and 2 can be water cast to produce abstract shapes or to be modified by adding other elements to improves their mechanical properties, whereas using samples 3, 4, 5, and 6 produces high quality surface finishing jewelleries which was easily produced by cold working. Finally, this study will help local jewellery producers in selecting quality scrap brasses that will be suitable for jewellery production.

Introduction

Jewelleries are consisting of small decorative items worn for personal adornment to enhance the beauty of the wearer, such as earrings, rings, brooches, and bracelet (Google Arts and Culture, 2018). Local jewellers normally use simple hand tools for their productions these is due to high cost of the machine and sometimes unavailability of machines. The use of the simple hand tools for the production of jewelleries comes with its difficulties and as a result it is necessary for local jewellers and new intake in the profession to source for raw materials that can easily be hand – tool to produced are high quality jewelleries that can even compete with the ones produce with machines. Mining and processing of materials for brass is capital intensive more especially for local jewellers and new intake in the industry therefore, it is more economical to recycle the scraps around us for jewellery production. This method involve collection and sorting the scrap materials and then processed the material into fibres and ingot ready for manufacturing into

Vol. 4, No. 03; 2019

ISSN: 2456-3676

finished product (Harrison 2015). Fothergill (2004) sited that metals are eminently and repeatedly recyclable without degradation of their properties, that metals from secondary sources is just as good as metal from primary sources. He added that recycling extends the efficient use of minerals and metals, reduce pressure on landfills and result in major energy saving relative to primary production. The challenged associated with jewellery production using recycled materials requires skilful hands to select, prepare and fabricate. Forging is one of the ways adopted in this research work to produced different designs of jewelleries. This involves stretching, flattering, curving and shaping metal by applying force from different direction by means of specially shape hammers supported by stake or anvil. Bgregory (2017) reported that, hand forged jewellery has a distinct and uneven surface that reflect light an eye catching manner and bring a sense of intricacy to even the most basic signs. In his work he produced a ring out of silver, to achieve that he makes use of fire brick, gas cylinder, hammers, pliers, anvil and ring mandrel as tools. Jinks (2010) narrated how 18 – carat yellow gold has been forged to make an earring. In their work they use hammer, files as tools. Jinks (2010) also describe how they produced jewellery from scrap, they bent scrap piece of a silver in to the approximate shape of a ring, cover the silver with flux and place it on a soldering block then heat to the level the surface begins to mold to each other, shape the ring, rinse, pickle, rinse and clean. Gonzalex (2012) describe how a meteorite was used to produce jewellery, the meteorite was heated and drown in to a bar, the heated bar was wrapped around mandrel to get the required size. Also, Leaf TV Editor (2017) constructed their jewellery from gold scraps. In their processes of production, they create the design of the product on a piece of paper and create a ring mold. They melt the gold using ceramic crucible and poor the melted scrap gold in the ring mold. Vanttemert (2010) produce a ring using white gold, rose gold and moissanite. In his own work, he anneals the metal using oxy-propane torch and bend the metal in to a circular form, he folds the end of the ring using hammer and solder it using flux and white gold solder. Azo, (2013) sited out that to produce a ring they progressively reduce the distance between the mandrel and the rollers and the exterior and interior of the ring can be forge using a mandrel and the rollers. Siegel (2009) embark his work on corrugated knot chain bracelet. In his work, he produced a ring by placing a stretched ring over the Conner of a bench block and used flat hammer to flatten the ring to about twice its initial width, he then flattens the side of the ring repositioning the ring. Different processes can be used to fabricate jewellery in every situation jewellery fabrication requires part preparation and handling, Sometimes the part to be fabricated are created through jewellery forging or casting. During working on brass scraps, local jewellers use to come across brass scraps that are too heavy, strong and brittle to work cold. These scraps can be casted using water casting method, to produce abstract shapes. The result of the cast piece will be pickle and polish to be used as pendant, bottle and earrings. Water casting therefore is the process of pouring molten metal into cold or hot water in different method, this shocks the metal and immediately solidifies creating spontaneous forms and unusual shapes (Flippin, 1955; Na'omi and Marcos, 2011). Xexos (2016) defines water casting as the process of melting metal and pouring the molten metal in to a pot of boiling water. In his work, he ties small pot with t-shirt using copper wire, He put the small pot inside big pot and fill both with water. after then he poured the melted metal directly in the centre of the small pot. Maule (2012) produced jewellery using scrap

Vol. 4, No. 03; 2019

ISSN: 2456-3676

sterling silver, in the process she melted the silver scrap inside a crucible with some borax. The flux was used to reduce the like hood oxidation of the silver after then she poured the metal into water. Maule (2012) concluded that different pouring method will lead to the production of different forms. Because of the economic incentive and reduction in solid waste disposal this research study groups different samples that at the end favour's forging as method of jewellery production and the ones that are suitable for water casting.

1.1 Motivation

The cost of production of jewelleries more especially those produced using machine are usually expensive and local producer has less information on the favourable scrap brass available locally that can produce good jewelleries using simple tools. Environmental concerns due to the disposal of these scrap brasses (solid waste) will be controlled by the utilization of these wastes to useful products.

1.2 Novel Contribution of the paper

The findings of the study will help local jewellers to improve their skills in making different designs of jewelleries and also select the best brass scrap that suite the method for the production of jewelleries. The objectives of this study is to establish appropriate local techniques of jewellery production using available brass scraps and at the end protect the environment by converting waste to wealth

2.0 Materials and method

2.1 Tools used for the production of jewelleries

The tools used for the production of the jewelleries are shown in Plate I. The tools use for the study are Forge, crucible, tong, anvil, pliers, files, snipers, gas blower, stamping sets, vice, chisel, punches, mallets, try square, scraper, water, bucket, metal sieve and moulds.

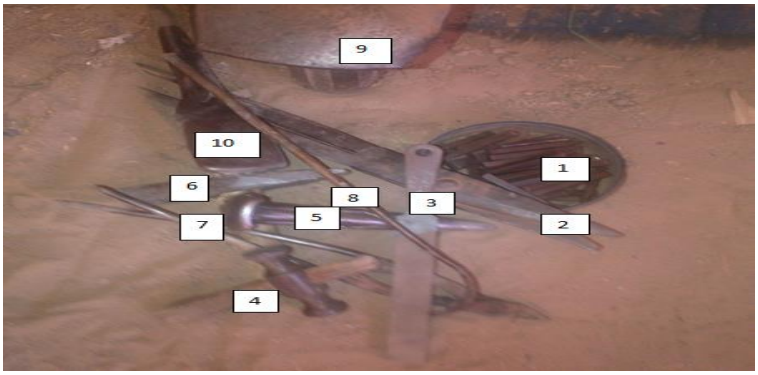

Plate I. Tools used for the production of jewelleries: 1. Inscribing materials, 2. Sniper, 3. Files, 4. Hammers, 5. mandrel 6. Small stakes, 7 and 8. Tongs, 9. Stake, 10. Mallet

Vol. 4, No. 03; 2019

ISSN: 2456-3676

2.2 Method

For this study, qualitative experimental design method was adopted. Six different groups of brass scraps were collected, such as Tap heads, car parts such as (bracket gears and key bowls), Ornament, Trumpets, fuel pipes and Dishes from different locations in Gombe metropolis of Gombe State Nigeria. Brass scrap that were collected from different metal merchant and on side pick were categorised into six different groups, based on the mechanical nature of the samples.

Plate II. Sample 1 (Tap Heads) (Joel et al., 2017)

Plate III. Sample 2 (Car parts i.e. gears, bracket and key bowls) (Joel et al., 2017)

Vol. 4, No. 03; 2019

ISSN: 2456-3676

Plate IV. Sample 3 (Ornament) (Joel et al., 2017)

Plate V. Sample 4 (Trumpet) (Joel et al., 2017)

Vol. 4, No. 03; 2019

ISSN: 2456-3676

Plate VI. Sample 5 (fuel pipes) (Joel et al., 2017)

Plate VII. Sample 6 (Dishes) (Joel et al., 2017)

3.0 Production of Jewellery

It was observed that only dishes, ornament, musical instrument and car pipes can easily be forged to produce jewelleries while tap heads and heavy car part cannot due to their brittleness nature, therefore water casting was employed to produce the jewelleries (Joel *et al.*, 2017).

3.1 Procedure for production of jewellery using water Casting

Production of Jewelleries by forging techniques from Sample 1 and 2 becomes very difficult by using simple hand tools due to their brittleness nature, therefore water casting was adopted for these sample leading to the production of abstract shapes that can easily worked to produced earrings and pendants.

To produce the jewelleries, samples 1 and 2 were melted separately on furnace inside crucible. Each of the melted samples were poured in water inside a bucket in the process a metal sieve was used in controlling the speed of pouring and spread of the melted metal. The pieces were form at the bottom of the bucket. The water was poured away to get the pieces formed. Pieces were selected and file to make it smother using file as shown in Plate VIII and IX. Soldering was done to create place for hooks. Work piece was then sand papered to make it smoother

Vol. 4, No. 03; 2019

ISSN: 2456-3676

Plate VIII. Jewelleries from sample 1 (tap heads)

Plate IX. Jewelleries produced from sample 2 (car parts)

3.2 Procedures for Jewelleries produced by Forging

Brass scrap was melted and poured into a straight mould, the work piece was elongated to a long thin for it to be easy for shaping. Flat hammer was used to broaden the end of a strip of work pies on stake to require shape. Ball ended hammer was used to produced round square edges and forms a curve. Plannishing hammer was used to reduce the marks form by hammering. While working, the work piece was heated again to temper the properties and make it easy for drawing and shaping. Names or alphabet are inscribed on the work piece using inscribing tools. The work piece was then wrapped around a mandrel to form a round shape, also files was use to shape uneven edges and to clean up inside curve. Work piece was then sand paper and wash to make it smoother and clean.

Vol. 4, No. 03; 2019

ISSN: 2456-3676

Plate X. Local Open Furnace

Plates XI. Cast scrap piece

3.3 Earing production

From the different samples collected three types of earing were produce: (a) Round earing (b) Twisted earing (c) Flat earing

3.3.1 Round earing

Brass scrap was melted and poured in to a straight mould the work piece was then elongated on a stake using hammer. Work piece was file into a desired shape and then wrapped around a mandrel in to a desired design. Sand paper was use to smooth the surface of the work piece Lemon and water was use to wash the work piece, rinse with clean water, pickle, rinse and cleans up.

Vol. 4, No. 03; 2019

ISSN: 2456-3676

3.3.2 Twisted earing

Brass Scrap were melted and cast. Work piece was then elongated using hammer and stake. The work piece was file in to a rectangular shape and smoothing using sand paper. Work piece was reheated on fire and two fliers was use one at each side to twist the work piece. File was used to smoothen the edges of the twisted work piece and sand paper. Work piece was wrapped around a mandrel to give it a circular shape. Washing of the earing were done with water and lemon,

3.3.3 Flat with creative design earing

In this case the scraps (dishes) Sample 6 were cut directly without melting the metal. Washing of the local dishes were done with lemon and water. The dishes were rinse and dry in an open space to attract sunlight. Dishes were cut using scissors to different shapes and sizes. Different designs were made on the surface of the work piece using inscription materials of different designs after then the, parts were assembled together to make a complete earing. Earrings were wash using lemon and water, rinse, pickle, cleans up and dry.

Plate XII. Jewelleries produced from sample 3 (ornament)

Plate XIII. Jewelleries produced from sample 4 (trumpet)

Vol. 4, No. 03; 2019

ISSN: 2456-3676

Plate XIV. Jewelleries produced from sample 5 (fuel pipes)

Plate XV. Jewelleries produced from sample 6 (dishes)

3.4 Visual Inspection of Jewelleries Produced

This section shows thirteen (13) optimal quality parameters that were observed and presented based on visual inspection of the produced jewelleries from the samples (Table 1).

Vol. 4, No. 03; 2019

ISSN: 2456-3676

Table1. Optimal qualities of different jewelleries produced

Sample	**Sample Description**	**Optical Qualities**												
		Compact ability	Cracking	Rough	Smooth	Bright	Dull	Thick	Thin	Light	heavy	short	drown	glittery
Sample 1	Tap head		✓	✓			✓	✓			✓	✓		
Sample 2	Car part	✓			✓	✓		✓			✓	✓		
Sample 3	Ornament	✓			✓	✓		✓		✓			✓	✓
Sample 4	Trumpet	✓			✓	✓		✓		✓			✓	✓
Sample 5	Fuel pipe	✓			✓	✓		✓		✓			✓	✓
Sample 6	Dishes	✓			✓	✓		✓		✓			✓	✓

Vol. 4, No. 03; 2019

ISSN: 2456-3676

4.0 Discussion of Result

Brass scrap samples collected for production were used to produce jewelleries in different forms and design. During the production, it was observed that sample 1 produces jewellery Plates VIII which was dull in colour, rough surface, surface cracking, and short in size, heavy and not compactable. Sample 2 produces jewellery Plate IX which was found to be bright in colour, smooth, short items, heavy and compactible. Samples 1 and 2 quality results was in agreement with what was reported in Joel *et al.* (2017) which found that the two samples have high amount of iron (Fe) which makes it have high level of brittleness favouring water casting as a suitable option for production of jewelleries. Sample 3 produces jewellery Plate XII was found to be smooth in nature, reddish yellowish in colour, thick, can be elongated, light in weight and compactable. Sample 4 produces jewellery Plate XIII which looks smooth in nature, yellowish in colour, glittering, thick, elongated, light in weight and compactible. Sample 5 gives jewellery Plate XIV which was found to be smooth in nature, yellowish in colour, glittering, thick, can be elongated (ductile), light in weight and compactable. Sample 6 produces jewellery Plate XV which has smooth surface, reddish yellowish in colour, glittering, thick can be elongated to any length, very light in weight and Compactable. It was observed that samples 3, 4, 5 and 6 produces jewellery through forging with ease this was due to their softness, malleability and ductility property as result of high copper contain as reported in Joel *et al.* (2017). Sample 6 which has the highest amount copper present (Joel *et al.*, 2017) was used to produced jewelleries directly without melting due to its softness. Sample 6 therefore, can be used to produced jewelleries easily by forging with melting or without melting.

5.0 Conclusion

Utilization of waste to wealth was demonstrated in this study by converting scrap brasses to useful jewelleries. From the study it was found that samples 1 and 2 are very strong and brittle to employ forging method for the production of jewelleries except further modification is done. Therefore, it was recommended that water casting method of production of jewelleries be adapted to produce jewelleries from these samples. Samples 3, 4, 5 and 6 are malleable and ductile to the level that local jewellers using simple hand tools can produce jewelleries without further modification. This study provides data bank for selecting the right scrap brasses that can be used to easily produce jewellery with excellent quality of finishing using either water casting or forging method.

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Vol. 4, No. 03; 2019

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