PRODUCTION OF ALUMINUM FRYING PAN POT USING SAND CASTING TECHNIQUES

BY

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CERTIFICATION

This is to certify that this project was carried out, read and approved as satisfying the basic requirement for the award of National Diploma (ND) in Metallurgical Engineering Technology, Kwara State Polytechnic, Ilorin.

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DEDICATION

This project is dedicated to Almighty God for spearing our life throughout our stay for this program. Also dedicated to our parents, families, friends and we'll wishes.

ACKNOWLEDGEMENT

With the heart full of thanks and joy we return all glory, honor and adoration to God, the beginning and the end, for making this project a success.

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ABSTRACT

The aim of this project is to produce aluminum frying pan pot which was Produced through sand casting. The casting process involves: creating a pattern, creating a mould, melting and pouring of molten metal and cleaning of the solidified casting. The significance in this process is the use of liquid metal to cast the shape of the object directly, producing a cast aluminum frying pan pot.

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CHAPTER ONE

1.0 INTRODUCTION

Aluminum casting is a process which involves the melting of the aluminum into molten state, poured into a mould to come up with a final product. Aluminum project in producing aluminum frying pan pot as the area of study involve the participation evaluation of the aluminum casting process in which the aluminum process is improved and tackling the issue of aluminum waste and also looking to reduce the high unemployment rate in our area by coming up with appropriate technologies through co-creation and sustainability.

Aluminum has a high strength-to-weight ratio that is approximately one third the weight of the cast iron, steel, brass and zinc. Aluminum pots are made from scraps. The shape of the aluminum pots yard according to the purpose for which they are produced. With excellent corrosion resistance, reduced machining cycles, and the ability to anodize, buff, electroplate and powder coat, aluminum casting make it more cost-effective than a welded component, stamping or frying.

Hence, there are various shapes of aluminum frying pot such as cylindrical flat bottom pots, spherical bowel pots etc. In some cases means of production of the frying pan pots also determine their shapes. It has different sizes like 40,20,10,E5,E4,E3,E2,E1 etc.

The collection of the aluminum scraps as it is the initial stage of the process which is followed by the by the preparation of the furnace while the sorting of the aluminum is ongoing. Preparation of the mould is the immediate preparatory step s the aluminum is been heated. On melted aluminum, the test for readiness of the aluminum is done and then the pouring thereafter, which leads to the breaking of the mould and then finishing of the final project. The casting of aluminum as found, involves a tedious process that has very little safety, this being the biggest problem.

Today, the production of aluminum frying pan pot has grown so much that the use of aluminum frying pot is common in our societies especially in every occasion where

cooking is required. Aluminum frying pots are commonly used cookware because of their ability to heat and cool more quickly.

Foundry technology is one of the vital bases for rapid industrial development of any nation. Sand casting is the most versatile, widely used and important method of casting and accounts to about 70% of all foundry products (Guma and Ogboi,2019).

1.1 Reason For Casting

Metal alloys that are used in the industrialization of the economy can be divided into two large groups namely: Wrought or forging alloy and casting alloys.

Wrought alloys are those which can be shaped into various semi-finished products (Kashish,2013). They are initially cast into ingots which are later shaped by plastic working. While casting alloys are used for making shaped casting for machining. As a result, the difference between wrought and casting alloys cannot be clearly defined. This shows the reason why casting is involved either directly or indirectly in every sector of the economy.

Many metal casting find wide application because they enable casting of a few grams to hundreds of tons with dimensions upto tons of meters to be manufactured from alloys of practically any compensation, including those which are different to shape by plastic work.

1.2 Aim

The aim of this project is to produce aluminum frying pot using sand casting technique.

1.3 Objectives

1. To learn and analyze the process of aluminum casting.
2. To identify the problems in the aluminum casting process with the benefits and opportunities of the aluminum business.
3. To formula the solutions for identified problems and to improve the efficiency of the current process.

4. To identify the stakeholders and links of the process.

1.4 Scope Of The Project

The project does not exceed beyond the casting of the production of aluminum frying pot using aluminum scraps and sand casting method. The molten aluminum will be poured into a mould whose internal cavities (impression) reproduce the configuration and dimension of the required cast articles with maximum accuracy.

1.5 Limitations Of The Project

Some of the casting limitations are as follows:

1. Some surface and casting dimensional accuracy could not be achieved by casting process except by machining.
2. Welding which provides a convenient method of joining could hardly be carried out on the cast component.
3. Casting process is very dangerous to health with the smoke that is emitted during melting.
4. Casting process requires a physical fit, strong and healthy person for it's production. **1.6 Justification**

The project (production of aluminum frying pot) is widely approved by the society because of the widely use of aluminum pot for cooking and for some other purpose. Casting has advantage over other methods of producing metallic articles (molten metal). Some of these advantages are:

1. Casting may be simplified.
2. Casting is economical, because some defect cast are not wasted since they can be melted and used again.
3. Metal casting is a process highly adaptable to requirement of mass production.

CHAPTER TWO

2.0 LITERATURE REVIEW

Casting is the process of producing (making metallic articles) alloys of desire shapes and dimensions, composition and of specific properties directly from the super heated molten metal poured into a mould whose internal shape (impression) reduces the configuration and dimension of the required cast articles with maximum accuracy.

The casting manufactured cycle includes a number of main and auxiliary operation that are carried out simultaneously or successively in various department of the foundry workshop. Pattern, core boxes and other appliances are made in the pattern making shop.

Process of casting is controlled by mould material, moulding method, chemical composition of alloy and smelting method, heat treatment, molten metal pouring, special casting method, fetting transport and material handling in foundry.

2.1 Properties Of Moulding Sand

Moulding Sand are usually produced by mixing fresh silica sand refractory clay with a definite amount of used sand and various addictives. The moulding Sand must adequately satisfy the following properties before it can be considered suitable for casting.

2.1.1 Sufficient Strength

Sufficient Strength refers to the ability of a mould or molding sand to withstand shock/force or wearing away under the influence of the molten metal i.e no destruction of the moulding Sand should take place during converging and during pouring of molten metal. No washing of the mould cavity. When the mould is filled with molten metal, it breaks the wall it is subjected to at a high metaloplastic pressure.

2.1.2 Sufficient Plasticity

Sufficient Plasticity refers to the ability to achieve its predetermined shape and to relative it's shape when the pressure is removed. High Plasticity is required of the moulding Sand to obtain a good impression of pattern in the mould.

2.1.3 Sufficient Gas Permeability/Porosity

Sufficient permeability means the ability of the moulding Sand to allow gases to pass through it's hole thickness and escape. It is expressed in volume per unit time (m^3/s) for grey iron sand with the following gas permeability are usually used. Grey oron-30.80m^3/s (campbell,2003).

2.1.4 Sufficient Collapsibility

Collapsibility is referred to the ability of the moulding sand to decrease in volume to some extent under compressive force developed by the metal during shrinkage and subsequent cooling. Lack of Collapsibility in the moulding sand may result to the formation of cracks in the cast.

2.1.5 Sufficient Refractiveness

The grains of the moulding sand must not melt, soften or sinter under the action of high temperature developed when the molten metal is poured into the mould. Molten sand of the alkaline earth metal (Na_20,K_2O,MgO and CaO) for example lower the refractiveness of the silica sand therefore their counter is limited from 1.5% to 2% for steel casting, 5% for heavy grey iron casting limit of 7%, for small and medium iron-grey casting are not more than 3% ferric acid (Fe_2O_3) may not be allowed in moulding sand. (Campbell, 2003 and Richard,2006).

2.2 Tools and Equipments For Preparing Moulds

- Shovel: This is used in the mixing of sand and separation of sand or breaking of solidified sand.

- Bottom Board: This is similar to the moulding board. It is placed on the top of the drag after the sand has been rammed and the drag is about to be turned over.
- Strike Off Bar: This is a wooden bar with square cross section used for texappin the drag scraw to loosen the pattern in the mould, so that it is easy to remove.
- Flask or Moulding Box: Is a box filled with moulding sand remade to form a mould. A moulding flask is either in one or two halves. The top half is called the cope and the bottom half is called the drag.(Jain,2014).
- Moulding Board: Is a flat wooden board placed under the drag filled with moulding sand.
- Crucible: A vessel or melting pot, composed of some very refractory substance, as clay, graphite, platinum, and used for melting aluminum.
- Spring: It is an equipment used for tightening the flask of the cope of the drag together.
- Trowel: Used in smoothing of the surface of mould and also in smoothening of sand to provide the line or co-ordination.
- Zinc Plate: Used in the separation of the drag i.e the left drag from the right, it is locally called flag.
- Spoon: Used in the production of core and used in the dressing of mould to prevent defects.
- Slice: Used in the production of line of co-ordination.
- Rammer: An equipment used to compress or used for stamping the sand in the flask to make it compact.
- Sieve: Is used to separate sand and is used for spreading parting compound/sand on the pattern in the drag.
- Watering Can: Is used for fetching and sprinkling of water on the sand to dampen it.

- Sprue Pin: Is a short tapered wooden rod used for making a hole in the cope through which a molten metal is poured.

2.3 Composition of Moulding Sand

It is a natural substance used for preparing the mould for casting. There are two commonly types of natural clay; the clay-free sand and high clay content sand. (Avner 2006.)

Clay-free sand is also known as high silica sand, it is the type used for preparing foundry mould. It is called synthetic moulding sand, when a certain amount of clay(bentonite) and water is added to high silica sand the mixture is called green send. High clay content is a natural green sand(wet sand) which is generally used for making pottery.

- Saw dust: This are powdery particles of wood produced by sawing.
- Parting compound: Is a compound such as silica or graphite used to facilitate the separation of the cope and drag parting surface.
- Water: Water is used in foundry to wet sand before and after use.
- Bentonite: Bentonite is used externally as a clay poultice, mod pack or in the bath and in skincare recipes, a good bentonite should be grey/cream color and anything bordering pure white is a suspect.
- Aluminum Scraps: Are used extensively in the construction industry project such as roads and bridges in the transportation industry and manufacturing of automobiles, air craft and other modes of transportation,it is used for casting in foundry workshops.

2.4 Types of Casting

There are mainly two types of casting

I. Sand casting

ii. Die casting

2.4.1 Sand Casting: The process of sand casting takes three stages. Preparing the pattern, preparing the mould, melting and pouring of the molten metal into the mould.

2.4.2 Die casting: Is the process of forcing molten metal under high pressure into mould cavities (which are machined into dies). Most die casting are made from non-ferrous metal specifically zinc, copper and aluminum base alloys but ferrous, die casting are suitable for application where many small to medium sized parts are needed with good details.

Types of Die Casting Method

There are basically techniques of die casting

- In gravity die-casting
- In pressure die-casting

1. **In Gravity Die-Casting:** The molten metal is fed into a metallic mould by action of gravitational force that is under its own weight as a sand casting.

2. **In Pressure Die-Casting:** The metal is injected under great pressure into a metallic mould. The pressure is maintained until molten metal solidifies.

Types of Die-Casting Machines

- **Hot Chamber Machine:** It is a system in which the melting pot is an internal part of the main body of the main machine.
- **Cold Chamber Machine:** Consist of horizontal cylindrical pressure chamber generally operated hydraulically.

Advantages of Die-Casting

The die casting process is more economical than sand casting for the following reasons, the process is quicker and therefore suitable for mass production. The mould can be used over and over again. Casting produc d by this method are more accurate and need no further process.

General Sequence for Operating Die-Casting Machines

- Open the die and clean it
- Put cares and insert it position (if required)
- Spray the face of the die with a lease fluid
- Inject the molten metal into the die
- Allow time for solidification
- Open the die and remove the Casting
- Remove the cares inserted from the casting if necessary
- Inspect the casting for possible defect s

2.4.3 Permanent Casting

Are made of a suitable metal by machining from block: usually cast iron or die steel, which have resistance to heat. permanent mould are unusable, the metal can be used to cast a large number of castings. Therefore, the casting quickly cooks down because a permanent mould can conduct hey faster than sand.

2.4.4 Centrifugal Casting

As the name implies, the Centrifugal Casting process uses Centrifugal force to distribute the molten metal materials into a die or a mould. The molten material is poured into a continuously rotating die. This process is used to cast products such as late sewage pipes, wheels and cylinders.

2.4.5 Shell Mould Casting

Shell mould casting provides a better finish face than that obtained from sand moulding; better dimensional accuracy with smooth surfaces, and a higher rate of

production. In this type of casting, a mixture of sand and thermosetting plastic binder is dropped onto a heated metal pattern.

This forms a solid region adjacent to the metal pattern. The shell segment are stripped from the metal pattern and assemble when the poured metal solidifies, the shell is broken to take out the finished casting.

2.4.6 Investment Casting

Investment casting derives it's name from the term investing or putting in. In this casting process, a war pattern created using injection moulding is invested in sherry of refractory material. A pattern is repeatedly dipped into the dirty, the casting of the refractory material over the pattern thickness and the mould is reached. It is allowed to dry. The mould is then heated to a temperature of 90°C or about so that the wax can be reused. The mould is heated to a temperature of 650°C or above to remove moisture. The molten material is then poured into the mould cavity. Once the metal solidifies, the mould is broken to take out the casting.

2.5 Pattern

Pattern are appliances designed to form a cavity in mould, the shape of which correspond to that of the casting to be made with maximum accuracy. Vast qualities of shaped moulds which necessitate the use of suitable moulding outfits for making parts and cores and for moulds.

2.5.1 Assembling

Patterns are different from casting in shape and dimension. Depending on the shape of casting, patterns may either be integral(unsplit) or composition (split). A slipt may be two or more parts.

2.5.2 Wooden Pattern and Pattern Plate

Are mostly used individually and for the production of small and medium size.

2.5.3 Tools and Equipments Used in Making Wooden Pattern

Layout Tools: Measuring tape, retractable steel rule, square level, plumb bob, Centrifuge (location), edge line make comb, marking gauge, mortise gauge (for scribing parallel lines), vernier calipers, micrometer, contraction role, wood working bench which uses clamps, clamping devices and weight.

Carpentry Marking Tools: Hacksaws, hammer, mallet, nail brace, hand(manual) drill bits, emery cloth, files e.t.c

Hand Tools Planning: Jack plane, smooth plane, shaping plane, reveting plane.

2.5.4 Electric Tools and Equipments

Wood working machine, circular saw, surfacing machine, molder planners, boring ban saw, big saw, wood turning machines and wood milling machine.

2.5.5 Wood Used for Production Pattern

There are various woods used for producing patterns which are pines, alder bench, lime and ash are more popular in Pattern making. Pines are used for making medium size and large Patterns. It is the cheapest wood easily workable, and no liable of rotting. Alder, having a smooth surface after machining is used to make medium and small size pattern for contours application. Beech are used to manufacture strong pattern. Lime is a soft wood and therefore used for producing small pattern. The best type of wood available in Nigeria is OPEPE, it is very strong,light in weight and does not warp easily.

2..5.6 Metal Pattern and Plates

Metal pattern and plate are mostly use in large or big size and mass production of casting compared to the wooden patterns they have some advantages like a longer service life, high accuracy and are use in machine moulding.

2.6 Things Used for Producing Metallic Pattern

The most common material for making metal patterns are pattern plate and aluminum alloys, cast iron, steel, bronze and brass.

Hallow patterns have a smaller mass then solid ones, while the required rigidity is ensured by stiffening ribs which are arranged on the internal surface.

2.6.1 Metal Pattern

Aluminum Pattern: Have a low strength and can be easily machined. They are convenient in use, they do not oxidize easily but have. smooth machined surface, their draw back are low strength and poor wear resistance which is seriously a hindrance, it is especially sensitive in mass production.

Cast iron: Are strong and expensive and easily machined to a high surface finish. Their resistance are higher than that of aluminum alloys but they are heavy and easily oxidized.

Steel Pattern: These are characterized by high strength and wear resistance. Bronze and brass pattern have a very smooth surface after machining and do not oxidize easily. They have a higher corrosion resistance than steel and cast iron pattern but they are much heavier. Bronze and brass pattern are employed, preferable for making small intricate casting where high accuracy and surface finish are required.

2.7 Pattern Protection and Color Coding

Painting or varnishing can prevent wearing of patterns. Pattern are painted with oil paints and then covered with shelves vanish to obtain a smooth working surface in other to protect them against the action of atmospheric moisture and moulding sand. When not in use, they are kept on shelves, away from moisture, heat and dust.

For easy identification of the purpose of casting, patterns are painted particular coding colors. Red color is used for iron casting, grey for steel and yellow for non-ferrous metal, casting core pans and other portions being not in contact with metal are painted black.

The pattern used for producting big frying pan pots in an integral (unsplit) pattern. An integral pattern is used because the frying pan pot has an oval shape and can be easily removed from the mould.

CHAPTER THREE

3.0 MATERIAL AND METHOD

3.1 Material

The following items are materials to use for the production of aluminum frying pan pot

S/N	Material Used	Quantity
1	Moulding sand	Four wheel barrow
2	Transportation to workshop	From Agbo Oba to Sabo oke
3	Pattern	1
4	Aluminum scrap	30kg
5	Charcoal	1bag
6	Paint (silver)	1 litre
7	Kerosine	1litre
8	Body filler	Small
9	Laboures	4

3.2 Tools used for the Project

1. Sieve
2. Rammer
3. Watering Can
4. Slick and Spoon
5. Moulding Board and Core

6. Flask

3.3 Methods

3.3.1 Sand Preparation

Sand is supplied to the workshop with some gangue which accompanied it, separation of the gangue from the sand were by sieving is done twice with different sieve size for proper separation of the gangue. The floor was properly cleaned to ensure no more other particles is mixed with the moulding sand, and the mixing of the sand sand was done with little addition of water which are made readily moldable and produce defect free casting.

3.3.2 Steps for Moulding

The following are steps for moulding

The moulding sand is poured on the floor and it is rammed to a height of about 3inches to cover the space that corresponds to the width of its moulding box. This is to form a mould bed.

The pattern (frying pan pot) is filled with moulding sand to the rim, and the sand is then rammed to ensure compactness of the sand.

Then the pattern (frying pan pot) is the formed upside down on the moulding bed. Pressure is then applied on the pattern so that the sand in the frying pan pot produced the accurate shape of the frying pan pot on the moulding bed.

The natural moulding sand is poured on the moulding box and slightly spread around the pattern to form a layer of the facing sand (10-100mm) thick and then rammed. Care is taken not to strike the pattern to the of the moulding box

On the completion of the ramming, gating and venting on the mould are carried out. The pattern is rammed to produce clearance. It is withdrawn by hand with caution and care to avoid dimensional error from excessive shaking.

A light coating of parting compound is being dust over and on the form surface of the sand on the mould bed. It can be customize if necessary.

The removed core is returned to the moulding bed, the molten aluminum is poured in the mould through the sprue and it is left for some minutes to solidify.

After solidifying, spread little water on it the cassting with a spoon because of the temperature.

3.4 Melting of Aluminum Scraps

The following are the methods for melting aluminum scraps:

- The crucible is filled with aluminum scraps and it is placed on the furnace (crucible furnace).
- Aluminum Scraps are added to the molten metal.
- The temperature increases as the aluminum melts over heated molten metal.
- Flux is added to the molten aluminum and stirred just before attaining the pouring temperature like battery.
- The slag is skimmed off, at this point the pouring temperature is between 700-800 ^{0}C.
- The furnace is switched off and the furnace. The crucible is carried out from the furnace by crucible tong.
- Place the crucible and it is content in the crucible shank for pouring.

3.5 Pouring the Molten Metal (Melted Aluminum Scraps)

- Pour the molten metal (melted aluminum scraps) as quick as possible through the sprue hole into the prepared mould.
- The pouring of molten aluminum is stopped when the risers and the sprue are filled up.
- Return the crucible to the furnace and leave it to cool slowly. Do not not leave surplus molten metal in the crucible, pour it into an ingot mould.
- The cast is allowed to cool for reasonable time before the mould is broken to obtain

CHAPTER FOUR

4.0 DISCUSSION OF THE FINAL RESULTS

4.1 Casting Defects

Casting defects are undesirable features or faults that are found or that appear on the surface of the cast articles which are different from the desired shape, size and dimensions, while some are internal.

Casting are carried out by intermediate checking after various stages of the casting processes, to later subject it to final inspection in order to determine whether they satisfy the standard and work specification.

The metal structure, properties, geometry, dimension and internal surface defect are properly checked.

4.2 Some Common Defect Found on Casting

4.2.1 Porosity: Is caused by the tiny hole that occur in a casting as a result of the escape of gases from metal.

4.2.2 Shrinkage: Is a shallow depression that occurs on the surface of casting, probably caused by insufficient supply of molten metal to withstand contraction during solidification. Shrinkage reduces the strength of casting.

4.2.3 Tears and Cracks: Are linear separation or cut in a casting due to stresses set-up in the mould, during solidification and cooling. There are three types of tear (hot tear, hot shorts and cold shorts).

4.2.4 Hot Tears: Too high of a hot strength of the sand mixture, usually obtained through inorganic binders, may cause this defects.

4.2.5 Chaplets: Are caused by the coldness of inserted chaplet of casting.

4.2.6 Inclusion: Are undesirable matter such as sand particles, slag and oxides buried in the surface of the cast. It makes it very difficult to machine the cast.

4.2.7 Dirt's: Loose or easily erode sand may result in the dirt defect in casting.

4.2.8 Crush: Is a defect on the mould, which is caused during the core setting or closing of the mould.

4.2.9 Metal Penetration ($2FeOSi0_2$): The defect is especially troublesome in large casting where core becomes heated up to the melting point of the metal before it freezes. Metal then seeps into the core, developing an adhering mass of sand and metal.

4.3 Defects are of Two Types Namely

Amendable defects are defects that are minor in which the amendment of the defect in the cast of considerable. While, unamenable defects are those that cannot be easily amended and will cost much to amend.

When the defects are visible, they can be amended, if it is economical to do so.

4.4 The Following Precautions are Factors that can Reduce Defects on Casting

- Pattern should be gently detached from the cast.
- Adequate parting sand and coal chest should be used.
- No distraction of any types should be allowed during casting process.
- Proper ramming should be done.
- The mould should properly tightened with the pins.

4.5 Surface Finishing

The surface finishing of the cast all depends on the fineness of the sand and the mixture content of the mixture. Aluminum pots are produced through natural sand, various degree of fineness are obtained up to AFS 270, clay content may vary from 12% to 28%. A typical natural sand has a fineness of AFS is to 20 and green compressive strength 6 to 8psi, the surface finish of the cast made in green sand mould is commonly 300 to 650 micrometer.

4.6 Cleaning, Fettling and Inspection

After solidification, casting is held in the moulds to cool down to the normal temperature.

This are the recommendation knockout temperature for steel casting 500 ^{0}C-700 ^{0}C, iron casting is 400 ^{0}C-500 ^{0}C, intricate casting proves to 200 ^{0}C- 300 ^{0}C, and 100 ^{0}C-150 ^{0}C for magnesium alloy. The average rate of cooling cast maybe from the range of 82 ^{0}C/min to 15 ^{0}C/min (campbell, 2003).

4.6.1 Chipping of Casting

Knockout casting are usually chipped and cleaned, consist of the cutting of the risers, sprue, runner, vent and other element of the gating system and removal of fins at parting of half mould that is around core prints, chipping is due by means of a hammer, chisel, abrasive wheel cutting or in some cases the risers are cut-off on the lathe machine.

4.6.2 Cleaning of Casting

Cleaning refers to all operation necessary to the removal of sands, scale and excess aluminum from the cast. The cast aluminum frying pan pot is removed from the mould by breaking the moulds, burnt sand scale are removed to improve the surface quality of the cast. Excess aluminum in form of fins, wires, parting line fine and hater is cut off.

The surface of casting is cleaned from sand by tumbling, shit slating, vibration or electro-chemical treatment. Tumbling is done by periodic or constant tumbling barrels. The surface cleaning of casting in tumbling barrels takes place due to their function enhanced by chilled ion/pricks charged together with casting.

4.6.3 Performance and the Durability of Aluminum Frying Pan Pot

Aluminum frying pan pot have excellent heat conductivity, which is one of the major factors which made aluminum frying pan pot very good for cooking and frying. Aluminum frying pan pot can be used continuously for 5 hours straight without any problem and the pot can be used for ten years or more before it starts developing faults.

4.6.4 Analysis on Cost of Production of the Aluminum Frying Pan Pot

Practically, all the detailed operations that enter into the Maki of aluminum frying pan pot by sand casting in a given quantity is influenced primarily by the cast of the casting metal, melting cost, moulding method, number of casting for the method, type of pattern used and type of finishing required.

4.6.5 Comparison of the Quality of the Produced Frying Pan Pot With Those in the Market

There is a great different between aluminum frying pan pot produced in the workshop compared to those bought in the market. A guarantee of ten years of the frying pan pot produced in the workshop and this is as a result of it's good properties (very good conductor of heat and high thickness).

There is a great difference in thickness between aluminum frying pan pot produced in the workshop and one bought in the market with petrol and small aluminum sheet for impregnation. File was used to smoothen the excess part of the surface. Wire brush was used to remove the sand on the surface and other inclusion that stained the surface. The silver paint mixed with petrol was used for coating and surface finishing. The paint was used in regards to polishing.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

Sand casting is the appropriate Method for producting aluminum frying pan pot using aluminum scraps.

Sand additive may not be needed each time. The casting are removed from the sand in preparation for reuse. But the sand must be properly wetter and thin lumps complete crushed to ensure require properties of moulding sand. The melting of aluminum scraps can be easily carried out in crucible furnace fired with charcoal. The pouring temperature must ensure flow of the molten metal to tiny parts of casting such as the handel's of the frying pan pot. The knockout temperature affects the surface appearance of the cast and hence should be properly chosen. The fettling operation is minimal in the production of the pot. It only consist of cutting off the sprue and cleaning the surface with wire brush.

The smoothness of the surface of casting is obtained with high degree of fineness. The casting has less defect and adequate strength, good wear resistance, light weight with high electrical and thermal conductivity.

All these characteristics makes the produces aluminum frying pan pot a good cooking equipment.

5.2 RECOMMENDATION

1. To provide a foundation in the principle metal casting directly and indirectly in the educational preparation of an engineering student.
2. The method used in the casting of the aluminum frying pan pot was cheap and easy. Investigation should be made in the use of die casting method for possible improvement on the economy of the production process.

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