
ALUMINIUM
PROJECT
CHAZANGA

Introduction.

Aluminum casting is a process which involves the melting of the aluminum into molten state, poured into a mold to come up with a final product. The aluminum project in Chazanga as the area of study involved the participation and evaluation of the aluminum casting processes in which the aluminum casting process is improved and tackling the issue of aluminum waste management in Chazanga and also looking to reduce the high unemployment rate in this area by coming up with appropriate technologies through co-creation and sustainability.

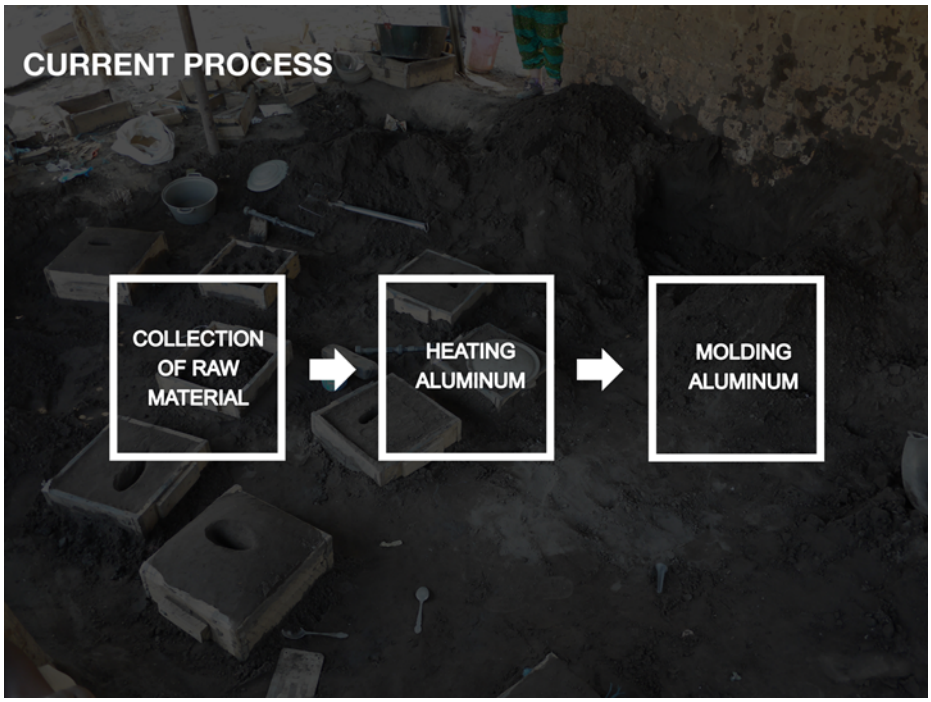
Chazanga situated on the northern part of Zambia's capital city, Lusaka. It is known to host one of the city's largest peri-urban unemployed populations. Chazanga has skilled aluminum metal casters. These casters have for years been learning and perfecting the skill of melting and casting of aluminum for various utensils which is predominantly cooking pots.

Objectives

1. To learn and analyze the process of aluminum casting in Chazanga
2. To identify the problems in the aluminum casting process.
3. To identify the stakeholders and links of the process.
4. To identify the benefits and opportunities of the aluminum business in the area.
5. To formulate the solutions for identified problems and to improve the efficiency of the current process

Background process.

The collection of the scrap aluminum as it's the initial stage is of the process which is followed by the preparation of the furnace while the sorting of the aluminum is ongoing. Preparation of the mold is the immediate preparatory step as the aluminum is being heated. On melted aluminum the test for readiness of the aluminum is done and the pouring thereafter, which leads to the breaking of the mold and then finishing of the final product.



The casting of aluminum as found, involved a tedious process that had very little safety, this being the biggest problem with .After an orientation into the old age conventional process of aluminum casting, the following principle problems were discovered;

Hence the generation of problems in the aluminum casting process;

Safety and efficiency: The process of aluminum casting is unsafe to both the operator and the community around. The safety issues are also interpreted in the reality of health hazards that the current furnace poses.

- The furnace produces fumes that can be toxic and deadly to the aluminum caster and the community people.
- The lid of the furnace is lifted off the furnace and on the furnace roughly, reducing its tear and wear.
- The furnace is stationary and can only get the needed air from one direction.
- In the rain season the production is altered by the weather, this makes the process dangerous as the aluminum can explode because of temperature alterations.
- Pre-heating of the aluminum is done in the furnace
- The furnace lining is made of clay, aiding the loss of the needed heat energy and lengthening the melting process.
- The crucible seats directly on the charcoal in the furnace reducing its lifespan.

These principle problem is basically transferred to the both the user directly which are the foundry workers and indirectly to the different stake holders which is the community, suppliers of the raw materials for casting (collectors) and the neighborhood in areas having casting furnaces.

Casting process: looking into conventional casting process which is using the drag and the cope to produce the mold for pouring is full of greater risk and not appropriate for good casting. Looking into these process and taking into consideration the casting design process, we could measure the level of expertise to the casting process and very limited casting issues we noted as the foundry worker had high level of expertise in the processes they us e by just using the drag to print out the mold for pouring, hence the issue of alignment of the mold.

Looking at the various problems some idea generation, research and analysis and also prototyping was looked into and solutions for various problems addressed.

Ideas and solutions.

Considering the work experience and techniques of the foundry workers in Chazanga the issue of using only the drag to make the mold for casting of the various commercial items (pots) was looked into an idea solution to introduce the cope in the molding process was proposed. But considering the task of the workers and the production capacity, introducing this technique will slow the production output of the workers hence a loss in production of pots, hence the solution was to create awareness of the aligning problem and take offer basic advise on the alignment process but maintaining the usage of the drag.

Secondly the issue of safety and furnace efficiency was looked into and the aspect of safety hazards was a major concern as most of the heat energy from the furnace was lost to the surrounding due to improper lining of the furnace and the usage of less insulating material. Hence the concept to redesigning a new furnace which is cheap, durable, efficient, mobile for easy access, taping wind flow form different direction and also for the rainy season since production is closed during his period.

Therefore the issue of safety and efficiency was the driving force of the new furnace design which in its nutshell is the “protek”

Technology.

The protek is a furnace made of different material for proper performance.

Insulation: Clay bricks, mixture of clay soil and saw dust (10% saw dust and 90% clay soil) for the internal linin for proper insulation

Outer lining: 400mm of metal drum, with a 2-3mm thickness, holding the internal insulating lining.

Chimney: 10mm diameter and 1m length chimney for releasing the aluminum gases and a channel for airflow out of the burning furnace.

Support point: wheels, deformed rods, handles, chimney pivot point, crucible and crucible holder

Metal lid: 400mm metal lid with a track point of 150mm to hold the aluminum for preheating.

Testing and experiments.

TITLE: Experiment to compare the insulating property between pure clay soil and additive clay soil (clay and wood saw dust mixture).

Abstract:

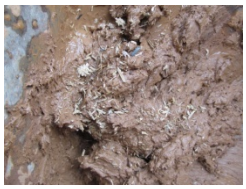
Samples of clay soil were tested for insulation by determining the temperature lost to the body of the heating furnace, hence comparing the rate of heat transfer to the body in time intervals.

Description:

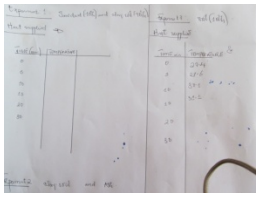
The rate of heat transfer across the body of the insulating material is determined by the amount of heat loss to the body of the insulator and with readings of temperature differences at the outer surface of the insulating material the following data is derived as shown below.

Samples of pure clay soil was experimented to compare the heat insulating property with that of clay soil mixed with saw dust from wood.

Experimental setup and apparatus:



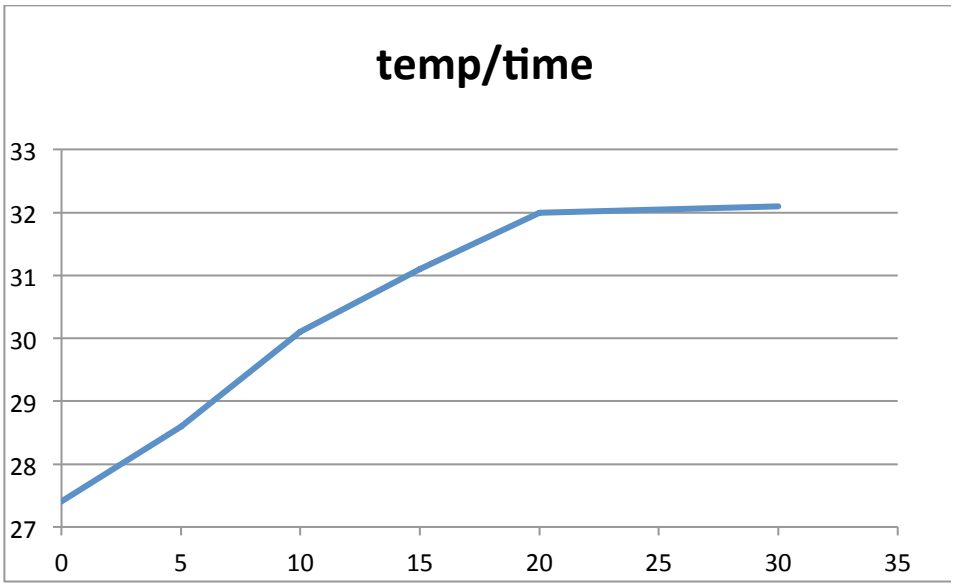




Experiment 1: clay soil (100%)

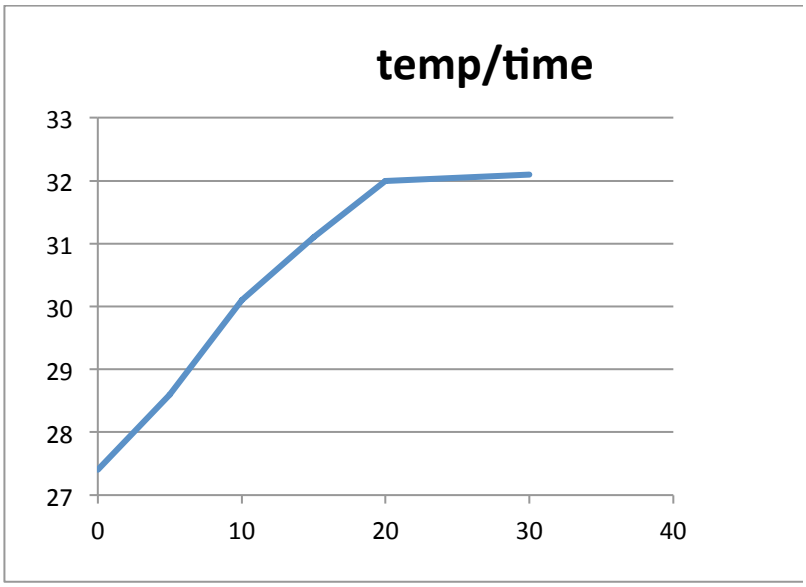
Time (min)	Temperature(^{o}c)
0	27.4
5	28.6
10	30.1
15	31.1

20	32
30	32.1



Experiment 2. Clay soil (90%) and saw dust from wood (10%)

Time(min)	**Temperature(^{o}c)**
0	23.7
5	25.1
10	25.2
15	25.3
20	25.6
30	26



Conclusion:

Hence comparing the gradient of both graphs, clay soil with saw dust mixture has a better insulating property than pure clay.

REQUIREMENTS AND MANUFACTUIRNG COST

REQIREMENTS	**PRICES(K)**
1. 1 x DRUM	**100**
2. 2 x 6m DEFORMED BAR	**120**
3. 1 x 1m STEEL RODS	**60**
4. 2 x METALIC WHEELS	**60**
5. 25 x CLAY BRICKS	**75**
6. STEEL PIPES	**60**
7. 1 x 2Kg WELDING RODS	**27**
8. 1 x 9inchs CUTTING DISK	**15**
9. 1 x Crucible	**50**
10. 10 x 2inhs M6 Bolts and nuts	**100**
TOTAL	**667**

Case study.

Mr. Chanda is a skilled aluminum caster in Chazanga. He has been in the casting business for over 10 years. In his time as a caster he has witnessed a number of furnace accidents that have led to serious injuries. He dreads the whole process of aluminum casting, but he has no option if he has to feed his family. With the introduction of the new furnace design, Mr. Chanda is now able to have all his problems reduced to almost nothing. And most of all he can still produce his products in the rain season, more safely and efficient.

Way forward.

The aluminum furnace that we have co-created has given us positive performance answers in the short time we have created it. However, the furnace still needs further testing to obtain the accurate data information on its safety and efficiency in the short-run of at least 3 months. The results of the use of the product will ensure the answers to the following questions:

- How long the furnace will last under constant production compared to the conversional static furnace.
- How often the lid and the crucible will be replaced
- How much less charcoal the will furnace use?
- How much is the furnace more efficient than the conversional furnace?
- How much heat will be kept in the furnace as opposed to the heat out the furnace?

Hence to answer these questions, the group has decided that one of the prototype be sent to Chazanga to be used for active production by the foundry workers in Chazanga the aim for this is that one of the Zambian group members will work in conjunction with the N.T.B.C to collect the feedback. The feedback will then be sent to all the members of the group for further analysis. Our plan is that collection of the feedback will be done in a 3 weeks intervals spanning on three months. The data collected will be the basis of any design alterations to be made next.

The design of the furnace if altered to the best safety and efficient alterations will then be officially handed to the community of aluminum casters. The model can then be adopted by the casters as a new method or design of the furnace.

Venture.

In terms of the venture opportunities, the furnace can create a very suitable and sustainable business for the people of Chazanga. Those that are willing to actually indulge in the production of the actual furnace are likely to spend about K667 for the whole furnace to be ready and fully furnished. From the returns of the current sales, an average caster makes about 10 aluminum pots on demand every day. To make the pots the caster uses at least 500g of aluminum for the smaller pot. The price of aluminum is not the caster, sales the pots for an average of K40 for the small ones and K120 for the big ones. Thus, our assumption is that, if the caster is able to save money and all the monetary help.