Short Commentary
Volume 10:2, 2021

Journal of Material Sciences & Engineering

ISSN: 2169-0022

Open Access

Cupola Furnace Design and Fabrication

Zinabie Degu*

Department of Textile Engineering, College of Engineering and Technology, Wolkite University, Wolkite, Ethiopia

Abstract

The Cupola Furnace Capacity of 450 kilograms per hour was designed and fabricated using locally sourced raw materials which include pig irons, crop ends and foundry shop returns, and ferroalloys for the production of quality cast iron which depends on the customer's demand. Metallurgical coke is the main fuel source employed for the production processes. The design parameters were analyzed and the metallic shells were then fabricated into four sections to allow proper lining. A mild 5 mm thick steel sheet was collected, marked out according to the required specification. slit and formed into cylindrical shapes. The sections were coupled and joined together through a welding process. Sodium silicate was used as a binder to make them bondable to the interior sections; the internal configurations were first lined with asbestos sheets measured 5 mm thick. With a less dense insulating refractory material. Fireclay refractory bricks were used for furnishing as they directly interfaced with the molten metal, while the flame blower was connected, assembled, and erected in the different segments. Financial analysis was performed to give a general overview of the cost of manufacturing and building a cupola furnace produced locally at N1, 467,266.00, which is relatively cheap compared to the imported ones. The technical details were given for the production processes. The raw materials used were sourced locally as they are readily available in quantum and are essential to the government policies on adding values to the production processes by using these materials to promote the addition of these materials for the creation of local content.

Keywords: Cupola Furnace Capacity • Bricks • E Sodium silicate

Description

The Cupola furnace is one of the melting devices used mainly for the manufacture of different grades of bronze and cast iron in foundry processes. The melting processes in the furnace continue which is capable of processing pig iron, crop ends, foundry returns, and addition of ferroalloys to make the chemical compositions in a case where there shortfall in the melting processes [1]. Metallurgical coke is the principal energy source for the operational procedure is one of the oldest cast-iron production methods; because of the simple operational processes it consumes a low amount of fuel and optimal technique [2]. The diameter of the cupola is expressed in terms of its height can be between 0.5 m and 4 m [3]. The furnace is cylindrical, and sections are arranged in a vertical position to withstand the three or four stands [3]. At the base of the cylinder, there is a drop opening that swings down and out. The top where gases escape can be opened or fitted with a cover to prevent rain from entering the cupola. A cap designed to pull gases into a gas cooling system and eliminate particulate matter to control pollution [4] can be equipped with a cupola. The cupola shell has a refractory brick and plastic refractory patching material covering it, typically constructed from steel materials. The bottom is similarly lined, but a clay and sand mixture ('Bod') can also be used, as this lining is temporary. Finely divided coal (seacoal) can be blended with the clay lining so that when heated, the coal decomposes and the bod becomes slightly friable, easing the opening of the tap hole. Squeezed against or rammed against the bottom doors is the bottom liner. Some of the cupolas have cooling jackets to keep the sides cold and oxygen-injected to make coke fire hotter [5]. The cupola is a counter flow vertical shaft furnace and, compared to batch type melters, has a high likelihood of good melting performance [6]. The research work was performed to encourage the fabrication and construction of this type or similar furnaces to rescue the moribund industries in Nigeria through the production of fast wearing spare parts. The processes will translate to the production of materials and solving the current rising unemployment rate. which has become more pronounced in the country leading to kidnapping, armed robbery, banditry, and other social vices in the country that have caused havoc and chaos in all the social being. The furnace was constructed through the usage of raw materials gotten locally which could improve the nation’s economic status, improve technological derives, and develop into skill acquisition and manpower development for the transformation of the country. The proceeds and products from the operations of the furnace will contribute to the sustainability of the industries for the production of spare parts and other components for the industrial operations cumulating to the products and skills. The research engineers will continue to advance their research to improve the quality of the products and create new materials [7].

Conclusion

A working cupola furnace with a molten cast iron capacity of 450 kilograms per hour designed and constructed for this study. The research work was based on the operationalization of a cupola furnace being operated at the foundry shop of the Ajaokuta Steel Company Limited, Ajaokuta; Kogi State. The significance in reproducing similar furnaces for the Department of Metallurgical and Materials Engineering, Federal University of Technology, Akure, Ondo State, Nigeria was borne out of the fact that the furnace can produce liquid metal continuously, effectively. Efficient and turning out quality cast iron. These assertions were hinged on the principle that the dexterity and skillful acquisition of the operators of the furnace was second

***Address for Correspondence:** Zinabie Degu, Department of Textile Engineering, College of Engineering and Technology, Wolkite University, Wolkite, Ethiopia, E- mail: zinabied@gmail.com*

Received: January 20, 2021; **Accepted:** February 03, 2021; **Published:** February 10, 2021

to none. In improving the quality of goods and producing new materials, the use of the furnace will accumulate, as continuous operational processes will offer many opportunities for improving the dexterity of aspiring researchers and engineers to develop their research and gain more operational skills for optimal and efficient service delivery.

References

1. Reichard, R. Ross. “Building small cupola furnaces, Marshall Machine and Engineering Works, Lopez IslandTechnologies Company.” Acta Neuropathologica (2020):1-6
2. Aghagoli, Ghazal. “Cupola Furnace - A Practical Treatise on the Construction. (1999).” Neurocritical Care (2020):1-10
3. Paniz, Mondolfi Alberto. “Central Nervous System Involvement by Severe Acute Respiratory Syndrome Coronavirus2 (SARSCoV2).” J Med Virol 92(2020): 699- 702
4. Cummings, John H and Mann Jim. “Possible Implications for Health of the Different Definitions of Dietary Fibre”. Nutr Metab Cardiovasc Dis (2009): 19(3); 226-229.
5. Dai, Fan-Jhen and Chi-Fai Chau. “Classification and Regulatory Perspectives of Dietary Fiber.” J Food Drug Anal (2017):25(1);37-42.
6. Phillips, Glyn O and Steve W. Cui. “An Introduction: Evolution and Finalisation of the Regulatory Definition of Dietary Fibre.” J Food Hyd (2011):25(2); 139-143.
7. Tungland, Bryan and Meyer Diederick. “Nondigestible Oligo And Polysaccharides (Dietary Fiber): their Physiology and Role in Human Health and Food”. Compr Rev Food Sci Food Saf (2002):1(3);90-109.

How to cite this article: Zinabie Degu."Cupola Furnace Design and Fabrication." J Material Sci Eng 10 (2021)