

Fabrication and Testing of an Electric Oven

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ABSTRACT: *This research was carried out with the aim to fabricate and test an electric oven from locally available materials, with the objectives to fabricate electric oven for baking and cooking, electric oven that will be affordable compare to the ones obtainable in the market and to discourage deforestation in our communities. The materials used were metal plate 6.543mm, iron rod 12mm, welding electrodes, electric heat filament, mesh wires, connecting wires 4mm, temperature controlling device (analogue). The iron rods were used to construct electric oven frame in the form of a box with the provisions of inner walls where lagging materials was installed and finally electric welding was used to join the metal plates and the frame. The fabricated electric oven was tested and it was observed that it works with effectiveness and high performance from the result obtained.*

KEY WORDS: electric oven, electric welding, inner wall, frame, electric heat filament

INTRODUCTION

An oven is a thermally insulated enclosure used for heating, baking or drying of a substance. The different types of baking oven are Earth, Ceramic, Gas, Mansonry and Electric ovens. In science and Engineering laboratories, it is in form of a small furnace which is used in the removal of moisture from some Engineering materials in order to improve their physical properties such as ductility and hardness (Kumar, 2001). However, an Electric oven has several advantages over other baking ovens. It is easy to install, portable and has a very easy mode of operation, maintenance and high durability (Adegbola *et al.*, 2012).

Laboratory and commercial ovens are used in a broad variety of applications. From cooking to industrial processing (Mullinger & Jenklings , 2008).By considering their energy source they can be broadly classified into two groups, fuel and electric ovens (Mullinger & Jenklings , 2008; Trinks, Mawhinney, Shannon , Reed , and Garvey, 2004). Electrical resistance heating has various advantages over systems based on fuel consumption, such as increase in control accuracy and heating speed. Thus, electrical heating constitutes a suitable choice for developing laboratory instruments, especially those demanding small volumes and precise temperature control (Corona,

Maldonado & Oliva 2007; Devaraju, Suresha, Ramani Radhakrishnam, 2011; Gam, 1996; Merlona, Jacomini, Tiziani & Marcarino, 2007).

Electric baking oven has received a considerable attention over the decades, due to its durability, efficiency and availability. It is a heating chamber, thermally insulated enclosure, or small which is basically used for the extraction of moisture from some engineering materials to improve their mechanical properties such as hardness and ductility. It can also be used for material processing, heat treatment of engineering materials and sterilization of equipment and instruments for industrial use (Adegbola *et al.*, 2012; Therdthai *et al.*, 2003; Genitha *et al.*, 2014).

Generally, control of temperature and time can be realized in two ways; either using analogue designs or digital designs. Analogue designs generally make use of simple timers and thermostats to regulate the time and temperature respectively where as digital designs make use of components such as microcontrollers, sensors, integrated circuits etc. Digital designs generally offer the advantages of more precision and accuracy, cheaper cost, less susceptibility to noise and interference from the circuit, easy troubleshooting, more flexibility etc over analogue designs (Bany, 1984).

Oven can be used to preserve the perishable commodities, especially food stuff. The other functions are in heating, drying and baking of consumable materials. Hence there is an increasing need to design a compact, easy to transfer heating and drying system of acceptable standard that will meet certain essential requirements such as efficiency and cost effectiveness. Study of baking oven is important as it could lead to a more efficient process of baking favorable to energy efficiency and better product quality (Fellows, 2000).

Temitope & Oluwole (2018) carried out a research on development and performance evaluation of an improved electric baking oven; they were able to determine its effectiveness and functionality. The performance evaluation test shows that moisture content of 67.70% base on their finding the develop oven works well with the power of the heating element greater than or equal to 0.3745KW.

Cen –Puc *et al.*, (2016) worked on a dedicated oven for characterization of thermo resistive polymer nano composites; the oven was designed with a heating plate capable of reaching about 300°C with resolution of 0.3°C and an area of 3.8cm x 2.5cm. The oven was regulated with a discrete proportional integral – derivative controller. The oven was used for thermo resistive characterization of polymer mano composite manufactured from a poly sulfone polymer and multiwall carbon nanotubes

Akinfaloye (2018) carried out another research on designed, fabrication and performance evaluation of a domestic electric oven. It was designed and fabricated with an outer dimension of 430mm x 33mm x 220mm made with mild steel and inner dimension of 380mm x 280mm x 190mm made with Aluminum sheet. Silicon rubber and asbestos serve as an insulator and the electric oven was tested and observed that it function well.

Adegbola *et al.*, (2002) worked on designed, construction and performance evaluation of a low cost electric baking oven. The electric oven designed was tested and it was observed that its functionality and effectiveness through food steam was actually good. The electric oven designed has a good efficiency compared with the already existing ones.

The aim of this research is to fabricate and test an electric oven for domestic use, with the following objectives: (i) To fabricate electric oven from locally available materials (ii) To fabricate an electric oven with low cost compare to imported ones manufactured abroad and with easy mode of operations (iii) To discourage deforestation in our communities.

MATERIALS AND METHOD

Materials

The materials used for this research were Metal plate 6.543mm, Iron rod 12mm, Electrode stick Electric heat filament, Mesh wire, Connection Wires 4mm, Temperature controlling unit (Analog system), Fiber (Insulating materials), Flat bar (for handle and legs).

Method

The metal plate was cut into sizes 50cm and 49cm. The iron rod was used to construct the electric oven frame and the metal plate were used to cover the iron frame, the plate were double on each size (inner walls) and the insulating materials was in each of the wall of the plate before the electric full welding of the plate with iron frame to form the electric box oven. At the base of the plate there was provision for power connection with the electric heating filament in the course of the usage / utilization of the electric oven. The temperature controlling unit was installed at the base of the oven for the purpose of controlling the temperature of the oven base on the required temperature.



Plate 1: Picture of the completed fabricated electric oven



Plate 2: The picture of the electric oven showing the internal volume



Plate 3: Temperature controlling unit of the electric oven before installation

Test

The constructed electric oven was connected to power source and the cakes to be baked were placed in the oven. Each of the cake baked was 15kg in the baked pan; it was observed that the cake baked at 2hours 45minutes. The temperature regulatory system helps in controlling temperature of the system in order to avoid burning of the cakes.

DISCUSSION OF THE RESULT

From the above results, it was observed that the electric oven constructed works with high performance and effectiveness based on the result obtained. The operational principles of the electric oven were the processes of heat transfer. Heat is transferred by (i) Conduction (ii) Convection (iii) Radiation These three (3) phenomena may occur in a given system one at a time or simultaneously.

CONCLUSION

In conclusion, the constructed electric oven with locally available materials was tested for baking of bread, it was found that the electric oven worked effectively and functionally under the set time frame of baking and the oven can also be used for cooking. .

Recommendations

Base on the findings on this research, the fabricated electric oven will be useful in the laboratory and homes for domestics use. For further research, dual power such as gas and electric heating filament should be incorporated in the constructed electric oven for more effectiveness and functionality of the electric oven.

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