The monitoring and controlling of sealed quench furnace engineering essay

This Project involves the Monitoring and controlling of sealed quench chamber. Sealed quench furnace is chosen because it is only has both heating and annealing (cooling) process. For other furnaces, Heating and cooling process is done at different furnaces. Sealed quench furnaces are used to eliminate skin decarburization of the work load surfaces after heat treatment and heat -chemical treatment process.

The monitoring and controlling of sealed quench furnace is done by using graphical software called Labview. The controlling and monitoring of furnace is done by using the parameters temperature, pressure, oxygen, Raw materials level and flow switch. The furnace is also known as Chamber.

CHAPTER – 1

INTRODUCTION:

BACKGROUND:

Any industry will have various parameters that are to be continuously monitored and controlled from a remote place. In most of the cases the use of manpower becomes almost impossible and therefore remote monitoring and control systems are extensively developed and used. In this project sealed quench furnace is monitored and controlled using Labview.

MOTIVATION:

The aim of the project is to study and design the prototype for sealed quench furnace using Labview. Sealed quench furnace is the only furnace has both heating and cooling (Annealing) process. For other furnaces, heating and annealing process is done at different furnaces. It is used to eliminate skin decarburization of work load surfaces after chemical treatment and heat

treatment process. The furnace is used for making bearings, engine parts and so on. The furnace has following features

Calculation based on mathematical model of furnace.

Function of technological diagrams (current profile of concentration of carbon, expected hardness profile after hardening, current state of the process on the diagram iron – carbon and iron oxidation).

Overhaul Programming.

Fully automated and process repeatability.

OBJECTIVE:

The objective of the report is to simulate Monitoring and controlling techniques using Labview. The Technique used in the project is monitoring and controlling of sealed quench furnace.

METHODOLOGY:

The controlling and monitoring in Labview is search on internet and read them. The books from national library is useful to get information about monitoring and controlling, Labview, and furnace. The project will also need help and suggestions from supervisors. The technical help is need and is get from national instruments and also attend seminars about Labview is very useful for doing this project. Digital library is also useful to get information about Labview and controlling of furnace.

SCOPE AND LIMITATIONS:

Labview is a virtual instrumentation that based on the computer. By using Labview can generate independent operation executable files.

The system will not interface to the work-in-progress system, nor will it be required to produce statistics for monitoring.

Scopes:

New atmosphere tempering furnace for scale-free tempering of steel.

The new plant is able to process batches of up to 1 ton per load under atmosphere with sealed quenching.

Components of up to 760mm can now be done vertically to minimize distortion.

Maximum component length of 1220mm can be heat treated under controlled atmosphere.

Computer-based order tracking, monitoring and management system introduced.

The system was designed in-house by P. H. Heat Treatment for commercial heat-treaters.

All of the above have resulted in greater competitiveness and improved customer service.

Limitation:

Controlling and monitoring is suitable for sealed quench furnace.

Temperature is limited to 1000ÌŠ C

STRUCTURE OF REPORT:

Chapter1 Reviews the introduction of sealed quench furnace and Motivation of project.

Chapter 2 Literature review of sealed quench furnace and Labview

Chapter 3 Overview of furnace system

Chapter 4 System design, testing and result discussions.

Chapter 5 Advantages, Disadvantages and Applications of sealed quench furnace.

Chapter 6 Gives the conclusions and future discussions

CHAPTER 2

LITERATURE REVIEW:

FURNACE:

Furnaces are used for different heat treating operations depending upon their heat treat requirements

1. 150 °-700° C used for nitriding, tempering, Annealing etc…

2. 650 °-1000°C- used for Hardening, Normalizing, annealing etc…

3. 0ver 1000°C -used for hardening of hot work steel, high speed steel, sinting etc…

Furnaces are divided into Batch type and continuous type. Depends upon Batch type the Quench sealed furnace is available as horizontal or vertical furnaces. It may use for annealing, hardening, carburizing, nitriding, nitrocarburizing etc… In these two types of chamber used Heat chamber, quench chamber. The heat chamber is used for heating of materials. Quench chamber is also call as Cooling chamber. The process used in this chamber is heat treatment. Heat treatment is the heating and cooling of metals to alter their physical and mechanical properties without changing their shape. Heat treatment is often associated with increasing the strength of material, but it can also be used to alter certain manufacturing properties such as improve machining, improve formability, and restore ductility after a cold working operation.

SEALED QUENCH FURNACE:

Sealed quench furnace as a name defines, provides quenching under protective atmosphere. The furnace comprises main heating chamber, inlet vestibule, oil quench tank and upper slow cool chamber. It is also known as Muffle or integral quench furnace.

In this project defines sealed quench furnace is chosen it has furnace has both heating and cooling process combined in one unit. The application of the furnace is industrial purpose.

In industry side the furnace is used for moulding of metals such as engine parts, gear, etc…

MATERIALS RELATED TO PROJECT:

LABVIEW:

Labview is a acronym for Laboratory Virtual Instrumentation Engineering Workbench. It is a graphical programming language. There is no text-based program code like other programming languages, but there is a diagrammatic view of how data flows through the program. Labview is loved tool for scientists and engineers because conventional programming language is built and the task is achieved. Labview is introduced in 1986 and developed by National instruments. It is easily learn programming language. It is chosen because it is faster than other programming languages. The development in Labview program is 4 times faster than other languages. The virtual instrument developed using Labview is, in short called a VI.

Uses of Labview:

Faster programming:

Hardware integration

Advanced Analysis

Multiple targets and OS

Multiple Programming Approaches

Professional User Interfaces

Multicore Programming

Saves time and money

Increased Flexibility

Applications of Labview:

Acquiring Data and processing signals

Automating test and validation systems

Designing Embedded systems

Instrument control

Industrial measurements and control

Academic Teaching and Research

Polymer Technology

Civil and Structural Engineering

Defence

Textiles

Bio-medical Engineering

Metallurgy

http://cnx. org/content/m15428/latest/ Labview

Industrial Applications:

It is used in Aircraft industry for making of aircraft engine components such as oil pumps, clutches, pinions, yokes, pins, manometer pistons, aircraft carriages etc.

It is used in Bearing Industry: bearing rings

It is used machine building industry drive axis, gear axles, gear wheels, toothed rings, hydraulic and pneumatic elements, bolts etc

It is used in Automotive industry for making of gear box components and drive axles (shafts, gears etc.)

CHAPTER 3

SYSTEM OVERVIEW:

BLOCK DIAGRAM:

labview1

Figure 2. 1 Sealed quench furnace with control system

The block diagram of sealed quench furnace is shown in figure 2. 1. It consists of Labview control system, Endo gas, Carrier gas, Air supply module, and Air pipe.

Figure 2. 2 Overview of sealed quench furnace

The sealed quench furnace has two chambers separated by refractory lined door which can be opened to allow hot charge to be transferred from heat chamber to cool chamber. In order to determine the systems requirements, the parameter using to control the furnace are Temperature, Pressure,

Oxygen level, Flow switch and raw materials level. The temperature of the furnace is monitored by thermistor. The first process is in heat chamber is the heating of materials and is controlled by atmosphere, LPG, Indo gas, Nitrogen. Nitrogen is used for safety purpose because use of LPG and indo gas. Indo gas and nitrogen forms carbon potential manage the raw materials used in the furnace. The control valves pressure and oxygen is monitored by sensors. Temperature sensor is used for the actual process held in the furnace.

The second process is in the Quench chamber is cooling of materials. In this controlling valves are used for controlling of the furnace. The flow switch is used for level maintenance.

In this Labview control system, it has monitor and control of the furnace, with inputs of temperature, oxygen, Endo gas, and pressure. The temperature of the furnace exists the predefined limit it automatically increases the air level and reduces the gas enter in the furnace. The pressure of the furnace is increases the above the set limit immediately out the air from the furnace. When temperature of the furnace reduces the set limit automatically increases the gas enters into the furnace.

CHAPTER 4

SYSTEM DESIGN:

Step1:

Labview 8. 6 version is installed and activating on the system.

Step2:

Figure 4. 1 Front screen of Labview

Open Blank VI for new project design. In this two windows are opening 1) Block diagram and

2) Front panel

Step 3:

Press " CTRL+E", " CTRL+T" for both windows shows parallel. It gives flexibility and designer can see the both screen simultaneously. It is shown in figure

Figure 4. 2 cascade windows of Labview

Step 4:

In this deigning the monitoring and controlling of furnace, includes the five screens as follows screen Main screen, Report screen, Run screen, Setup screen and About us screen.

MAIN SCREEN:

The main screen has About Us, Report, Run, Setup, Exit and login icons. The run icon interconnects to the run module. The setup icon interconnects to the setup module screen. The Report icon interconnects to the report screen. The about us icon interconnects to the about us screen.

Figure 4. 3 main screen front panel

Figure 4. 4 Block diagram of main screen

Step 5:

Setup screen:

In set up screen the settings of furnace are listed.

Figure 4. 5 Setup screen front panel

Figure 4. 6 setup screen block diagram

Step 6:

Report screen:

Figure 4. 7 report screen front panel

Figure 4. 8 report screen block diagram

Step 7:

Run screen:

Figure 4. 9 run screen block diagram

Step8:

About Us screen

Figure 4. 11 About us screen front panel

Figure 4. 12 About us screen block diagram

CHAPTER 5

TESTING AND EVOLUTION:

Problems Arise:

The Labview is the latest programming tool and there are not enough reference books are available.

Labview is latest design tool how to use this software

The designing of setup screen

Problem solution:

Labview information is get from internet source and some books are getting from national library.

Attend the seminar at national instruments, Singapore for using of Labview.

CHAPTER 6

Advantages, Disadvantages and Applications:

1. Advantages of sealed quench furnace:

Less distortion

Process repeatability

Minimal pollution

Fully automated,

Avoids manual errors

Systematic analyzing

Wastage minimized and cost saving

Consistency in case depth and surface hardness.

2. Disadvantages of sealed quench furnace:

Very fast quench

Corrosive quench tank

Fixtures and fitting

High cost

High safety need

Limitation of weight (750 / 1000 kgs)

Power consumption high

Use only special gases

Repeated process not applicable

Only used hot quenching oil (oil cost high).

3. Features of sealed quench furnace are shown below

Re-carburizing.

Controlled atmosphere annealing

Bright annealing

Carbonitriding

Normalizing

Hardening

Carburizing-hardening

Carburizing

4. Application:

The sealed quench furnace using applications are shown below

Industrial Applications

Gear making

Engine parts

Stainless less steel materials

Making of tools

Making of steels

Making of machine parts, etc……

PROJECT MANAGEMENT:

CHAPTER 7

CONCLUSION:

The monitoring and controlling of sealed quench furnace using Labview is designed and tested with valid parameters. The Monitoring and controlling of sealed quench furnace is successfully tested and meets all the objectives required to function accordingly. The problems arise were encountered, it is manageable and solved with technical guidance.

The conclusion from the performance results are

Graphical programming is flexible and easy.

Program design can be changed easily based on the customer requirements.

Overall the system is efficient

RECOMMENDATION:

The prototype was successfully developed to meet its objectives but it could be further improved based on hardware design.