An Approach to Check Hardness by using Heat Treatment Furnace

Ankur Kirpane[1] Nikhil Goikar[2] Vishal Kamdi[3] Anup Junankar[4]
[1,2,3]U.G. Student [4]Assistant Professor
[1,2,3,4]Department of Mechanical Engineering
[1,2,3,4]J.D College of Engineering and Management, Nagpur, India

Abstract— Heat treatment is the process of control heating and cooling of material to achieve certain mechanical property such as hardness strength, and reduction of residual stresses. Many heat treating processes require the precise control temperature over the heating cycle the research methodology based on the experimental work and the theoretical development of heat treatment furnace the new model take into account the real time furnace parameters determined from the experimental data account for the furnace detoriation and some of complex gradient and heating pattern that exist the furnace that is difficult model. Investigation carried out to study increasing hardness mechanical property of mild steel. Sample examined after heating at a certain respective temperature and soaked for respective time and respective behavior on sampled investigated.

Key words: Heat Treatment, Experimental Data, Research Methodology

I. INTRODUCTION

Heat treatment is a control process of heating and cooling of cooling of metals to alter their mechanical and physical properties without changing the product shape. The heat treatment process is defined as heating a metal at various temperature holding the for a various time duration and cooling at various rates, it helps to improve the machining, hardness, strength over a heating cycle.

The purpose of various heat treatment processes are as follows:

- To soften the material
- To improve machinability
- To improve cutting properties of tool
- To increase strength and hardness of material
- To improve various properties i.e. corrosion, resistance and heat resistance

Annealing, normalizing, hardening and tempering are the most important heat treatment processes lead to change in phase microstructure and desired mechanical properties in material.

The hardening treatment for most steels consists of heating the steel to a set temperature and then cooling it rapidly by plunging it into oil, water, or brine. Most steels require rapid cooling (quenching) for hardening but a few can be air-cooled with the same results. Hardening increases the hardness and strength of the steel, but makes it less ductile. Generally, the harder the steel, the more brittle it becomes. To remove some of the brittleness, you should temper the steel after hardening. Many nonferrous metals can be hardened and their strength increased by controlled heating and rapid cooling. In this case, the process is called heat treatment, rather than hardening. To harden steel, we cool the metal rapidly after thoroughly soaking it at a temperature slightly above its upper critical point.

II. METHODOLOGY

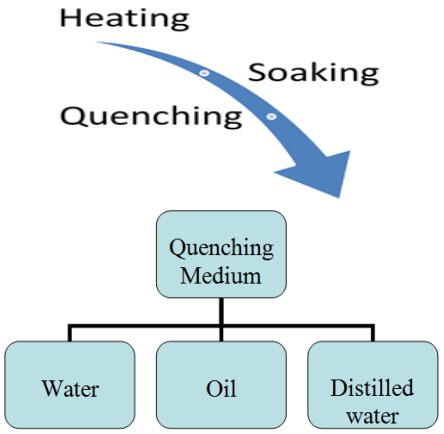

Fig. 1: Methodology

First we remove the moisture which is present in the furnace. After that some samples of metals i.e., of mild steel are inserted into a furnace. Then we heat the metal samples at required experimental temperature i.e., 450^0c, 500^0c, 550^0c.Here the group of three metal samples heated at a time in furnace. And after the heating of a first group i.e., three samples of metal then are soaking at a certain period of time i.e., 10min, 12min and 15min respectively. After soaking procedure we take off the samples from the furnace and immediately deep into the quenching medium for the purpose of cooling. In this heat treatment process we use three different quenching medium. These quenching mediums are water, oil and distilled water. The reason of using different quenching medium to understand how the hardness of same metal sample get changed. And finally after that we get the changed hardness values of metal samples.

III. OBSERVATION TABLE

COOLING MEDIA	SR.NO.	HT	ST	HBT	HAT(C-GRADE)
DISTILLED WATER	1	450	10	8	40
	2	500	12	8.9	30.70
	3	550	15	8.2	23.20
OIL	1	450	10	9	25.9
	2	500	12	8.9	19.5
	3	550	15	9.1	15.6
WATER	1	450	10	8.7	37
	2	500	12	8	25.3
	3	550	15	8	17.9

Table 1: Observation Table

Where,

- HT=Heating temperature
- ST=Soaking time
- HBT=Hardness before testing

– HAT=Hardness after testing (C-scale load).

IV. THEORETICAL DESCRIPTION

The above observation table depicts the different cooling media which were used during the heating of a particular material. Here cooling medium are used viz. distilled water, oil and water. As stated above the materials are being heated as in the form of heating temperature like as 450,500,550 degree Celsius. Respectively

1) Firstly the material is examined as far as its hardness is concerned; its hardness before testing is notified. This sort of procedure is being followed for each and every nine materials as stated above.
2) Secondly the material is heated at a specified temperature i.e. 450 degree Celsius.
3) Its soaking time is noted. And its hardness after heating is checked under Rockwell hardness testing machine.
4) Like else the procedure is carried out for the three materials under the supervision of heating temperature as in the order of 450,500 and 550 degree Celsius. The cooling media for the first three materials used is distilled water.
5) As stated above, same procedure is carried out for the next three materials under the supervision of heating temperature as in the order of 450,500 and 550 degree Celsius. The cooling media used during this procedure is oil.
6) Similarly for the next three materials the cooling media used is water.

V. ANALYSIS OF THE DATA

The data that has been observed above table is analyzed and the result that we get is optimum .Hence in every aspect of material there is a vast difference in the hardness as far as it's before condition and after condition is concerned.

VI. RESULTS AND CONCLUSION

The heat treatment process carried out here in a way to achieve maximum hardness .Hence we observed that at every aspect of heating temperature there is a constant change in the properties of the material.

REFFERENCE

[1] ''Evaluation and improvement of heat treatment furnace model" by Radhakrishnan Purushothaman
[2] ''Effect of Tempering Behavior on Heat Treated Medium Carbon (C35Mn75) Steel" by V.K.Murugan, Dr.P.Koshy Mathews
[3] "Temperature Measurements Using Type K Thermocouples and the Fluke Helios Plus 2287A" Datalogger Artmann, Nikolai; Vonbank, R; Jensen, Rasmus Lund
[4] "Thermal Imaging Control of Furnace and Combustors" David M. Rue, Serguei Zelepouga - Gas Technology Institute, Final Technical Report for U.S. Department of Energy, GTI Project-61118.
[5] D. O. Marlow, "Modeling Direct-Fired Annealing Furnaces For Transient Operations," Appl. Math. Modeling, 20, 35-40 (1996).
[6] K. S. Chapman, S. Ramadhyani, "Modeling And Parametric Studies Of Heat Transfer Fired Batch

