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FEA Simulation Thermal Analysis of Induction Hardening Process In Case of AISI 1040 Steel

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Abstract—a modeling system for analyzing the integrated induction hardening processes was developed based on a general-purpose finite element program, with the capability to analyze the whole process from electro-magnetic-induced thermal heating to final hardening. a coupled electromagnetic-thermal model was applied to study the induction heating process, which includes consideration of nonlinear material characteristics on temperature. also, arrangement of ac current density distribution was conducted to simulate practical induction coil structure and magnetic concentrator effects to achieve desired heating patterns for later quenching and thermal analysis.

***Index Terms*—ANSYS, AISI 1040 STEEL, THERMAL ANALYSIS, INDUCTION HARDENING.**

MAIN OBJECTIVES ARE

1. To Know About effect Of Higher Temperature on AISI 1040 Steel.

2. To Know About Induction Hardening Process by AISI 1040 Stell.

3. To Know About Modern Fea Analysis.

I. INTRODUCTION

The system is inevitably highly nonlinear due to the temperature-dependent material properties of the work piece. In the past, more attention was paid to numerical simulation than to modeling of specific aspects of the induction-hardening problem; little effort has been given to modeling the integrated process from heating to final hardening. n the present effort, an integrated finite element analysis(FEA) based modeling system has been developed with the capability to simulate the electromagnetic field induced heating process, austenite state holding processes, and severe quenching processes. Also the volume fraction of micro-constituents such as martensite formed in the quench cooling process, and final hardness distribution (pattern) in the work piece can be determined by using the model. Through proper arrangement of input AC current density distribution, the desired hardening patterns for special complex surface can be obtained. The goal of the modeling system is to guide the design of real induction systems.

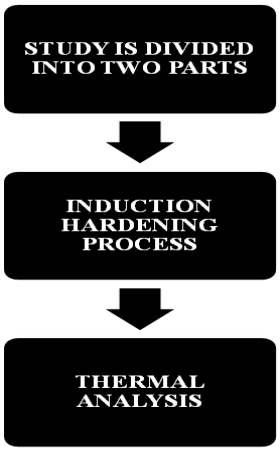
II. MODULES OF PROJECT

Modeling: 3D models of critical components of AISI 1040 STEEL RING are prepared using (SOLID WORKS). The detailed dimensions are taken from its 2D drawings. Importing 3d Model:- 3D model prepared 0using SOLID WORKS is imported into FEA software (ANSYS).

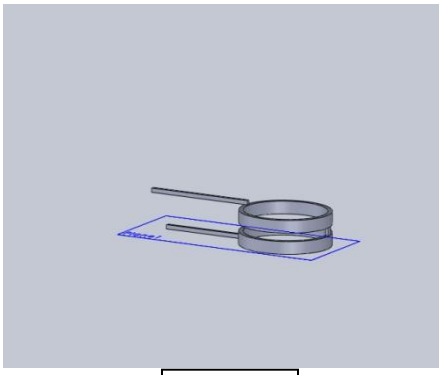
Preferences:

1. THERMAL analysis method is selected. Pre-processing:
2. DEFINE ELEMENT TYPE
3. APPLYMATERIAL PROPERTIES

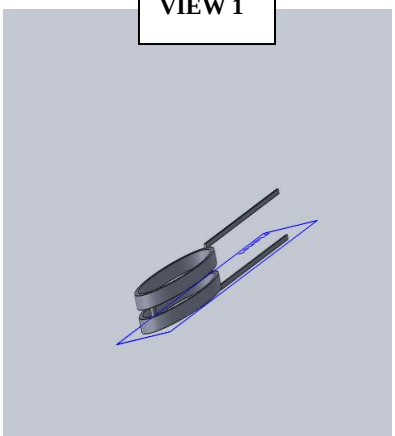
HERE MATERIAL IS AISI 1040 STEEL



DESIGN VIEW OF INDUCTION COIL IN SOLID WORKS



VIEW 1



VIEW 2

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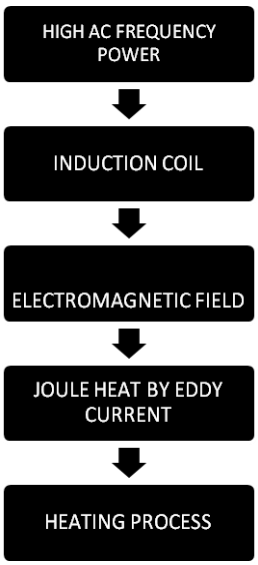
III. INDUCTION HARDENING PROCESS

FIGURE 3



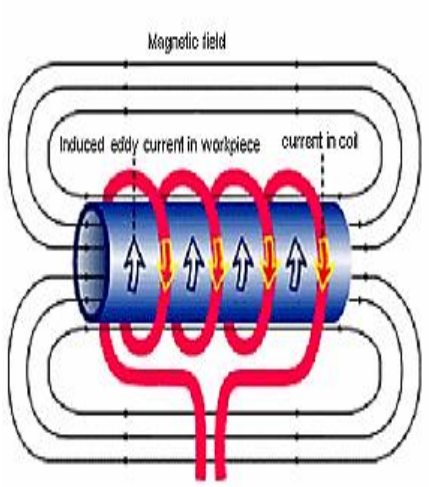
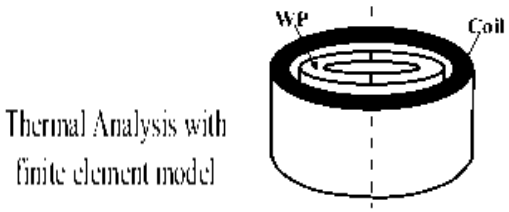
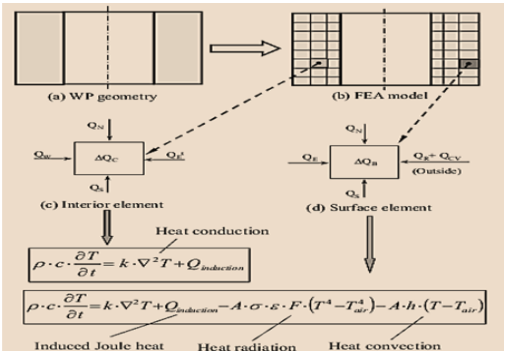


FIG 3 & FIG 4 SHOWING INDUCTION HARDENING PROCESS

IV. THERMAL ANALYSIS





Thermal Analysis is done in Anysys Software and Desired Results are obtained as

1. Total Temperature View
2. Total Directional Heat Flow
3. Total Heat Flux

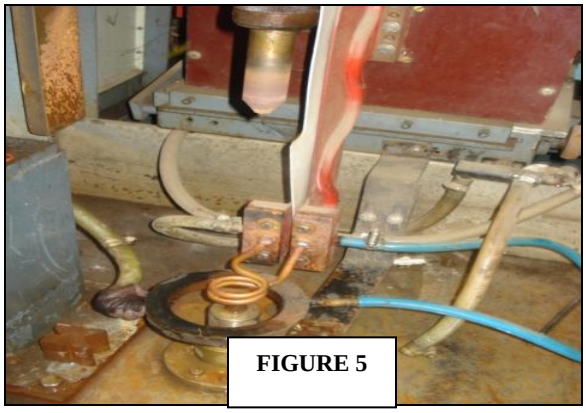


FIGURE 5

Fig 6

Fig 5 & Fig 6 Real Images of Induction Hardening Coil

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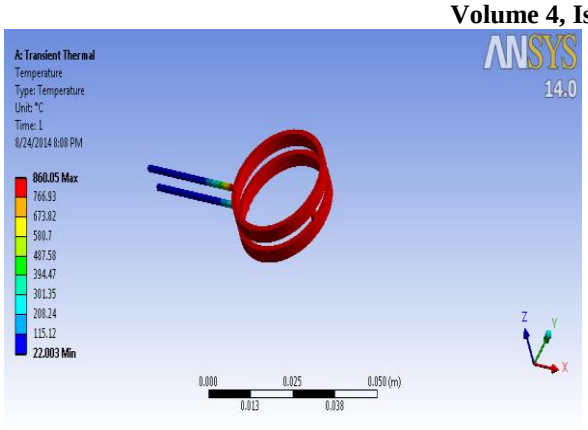

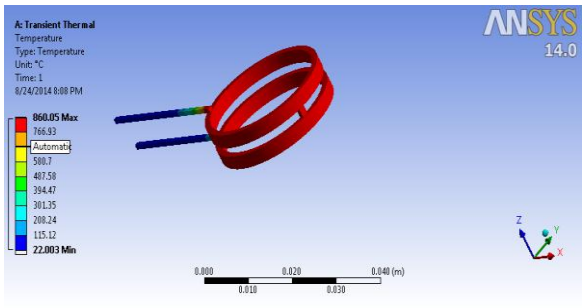

Fig 7 and Fig 8 Shows The Temperature Bearing Area Of Coils the Amount of Temperature is 860c.

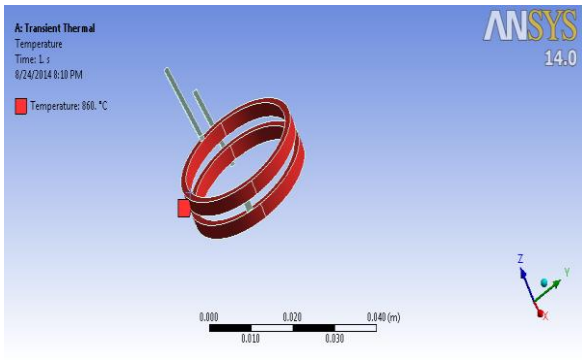

Fig 9 Just Shows the Temperature Selection for Analysis

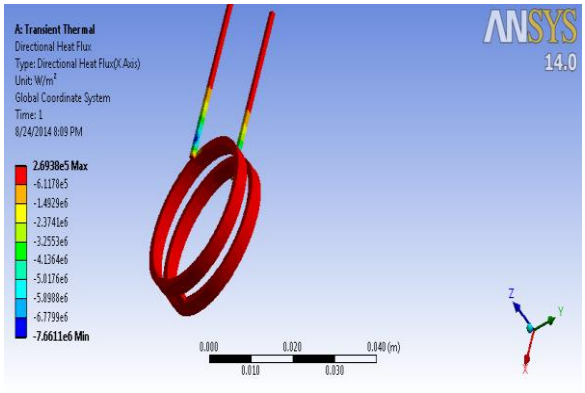

Fig 10 Shows the Directional Heat Flux Flow in Coil

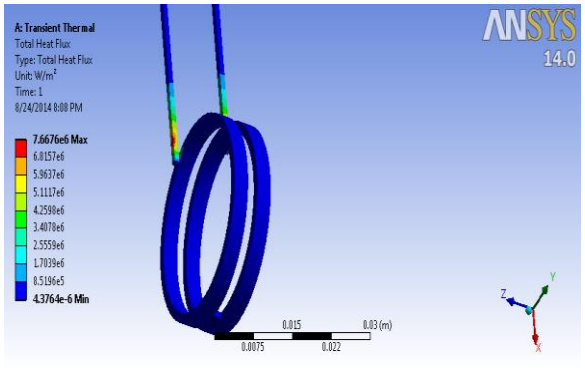

Fig 11 Shows the Total Heat Flux of Coil

V. CONCLUSION

1. It Has Been Shown That How Fea Tools Help In Analyzing Induction Coil Bahaivour in Different Temperature Conditions
2. Behaviourof Aisi 1040 Steel Material Under Higher Temperature Condition Is Analyzed.

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