# INDUCTION HEAT TREATMENT OF THE COULTER

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***Abstract***

*This paper proposes an analisys of the induction hardening method of the coulter with specific software simulation. The heating analysis of the coulter needs solution in the thermal diffusion problems coupled with eddy currents case. For a better knowledge of the process in this case we need to make more simulation to be sure that the requirements parameter are the same in practice.*

***Key words***: Numerical simulation, Electromagnetic field, Electromagnetic field coupled with thermal, Coulter.

## INTRODUCTION

It is known that the coulter is important element of the plows.

Is the active body of the plow body that has the role of cutting the furrow horizontally and lifting it on the surface of the moldboard

It is made of manganese and silicon steel in several constructive variants.

In general the coulter must be have an homogeneous structure to respond of imposed requirements.

We know that the induction hardening simulation method is used for all kinds of geometry types of metal piece. This method consider the change of both parameters like the electromagnetic and thermal parameters. Both parameters is accourding with the temperature.

We must verify that the B-H relation is dependend on temperature, passing from iron-magnetic environment form to air. In this case, we observe that the eddy's current problems and thermal diffusion are strongly coupled in the Curie point zone.

As we know the B-H relation is linear and the magnetic permeability is adjusting according to the highest effective value of the magnetic induction (Leuca et al., 2007)

We adopt linear pattern (FLUX 2D – tutorial) and the B-H relation.

## MATERIAL AND METHOD

In the analysis of this case we must solve the electromagnetic problem with a parallel – plane structure. The magnetic field problem can be solved by reduced to the determination of a potential vector with a single component, which verifies an similar equation of the scalar potential.

The coupled of thermal diffusion problems with eddy currents is the main problem of every hardening method. For a better analysis of the results we need to find the result of eddy currents problem (power density) and temperature (thermal capacity and thermal conductibility) (Leuca 1997; Leuca et al., 2002;)

## RESULTS AND DISCUSSION

The numerical simulation with FLUX 2D software (FLUX 2D – tutorial) allows to determining accurately the relationship between the used frequencies, the power density, and also the desired treatment depth.

The desired treatment depth is very important to make a complete map of the hardening process.

The optimal frequency can be estimated. The frequency is depending by the penetration depth of induced currents.

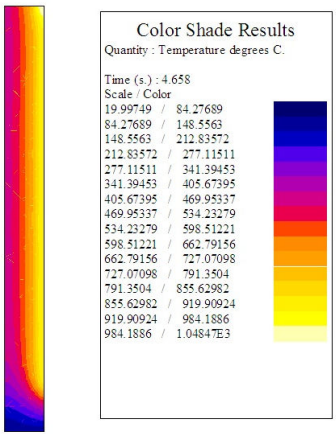


Fig 1. The temperature from hardening zone

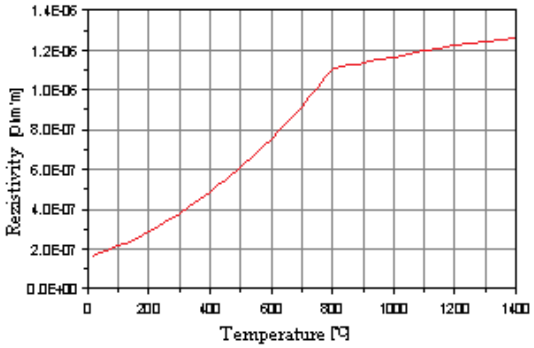


Fig 2. The rezistivity dependence with the temperature of the steel

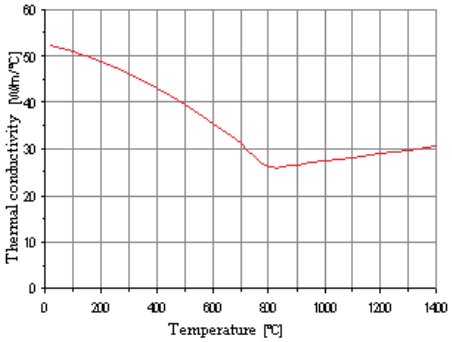


Fig 3. The thermal conductivity depencence with the temperature of the steel

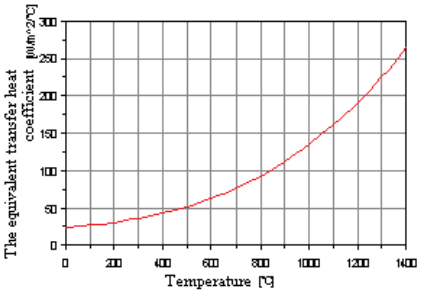


Fig 4. The equivalent transfer heat coefficient dependence with the temperature

**CONCLUSIONS**

The numeric simulation of the hardening process is a complex problem because the non-linear problems of eddy currents is provide from non-linear relation of **B-H.**

After the simulation process we observe that the coupled of two problems result from strong dependence of relation **B-H** with temperature.

The advantage of this simulation method with ELTA software is results from the possibility to have almost similar results in practice.

Through proposed heat treatment we get a homogenous structure for the coulter.

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