THERMO-MECHANIC TREATMENTS INFLUENCE ON PLASTIC DEFORMATION STRENGTH OF HIGH SPEED STEEL

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Abstract: *In this paper is presented for the tool steel Rp_5 the evolution of the strength at deformation depending on two parameters (the temperature and the deformation speed). For the determination of equation what makes the connection between the strength at deformation and parameters it was used results of the experimental trials effected for different of temperatures but and for different speeds. On the basis of the experimental results and established equation, it was possible to be calculated the plastic deformation strength values for different temperatures and speeds. Knowing the strength at deformation may be chosen the deformation process with that is deformed the tool steel Rp_5.*

Key words: *thermo-mechanic treatment, deformation strength, high speed steel.*

1. Introduction

In this moment the weight of the production of the cutting tools is obtained an in totally through cutting processing, next following process is that to obtain from laminated semi-product. Due to the technical which were in progress for the past decades in the area of material science of as well as of regularize the technologies of obtain the sintered dusts, last in the lapse the production of the sintered components tools had a spectacular growth. With all the technological production support in domain of cutting tools, this area has in this moment a series of drawbacks.

A negative appearance meted in cutting tools is that of the big consumption of expensive high alloy steels that are practically convert in chips. Besides one antecedent presented it must added, the fact as the large amount of chips removal in the manufacture time of the cutting tools and from the other side is the big consume of the manual labour, aspect which corroborates with the first, conduct to increase the price of the tools. Because most cutting tools are made from molten semi-product, the large microstructure is present in cutting tools that are made and determines a behaviour bed.

Because of the material microstructure has influence on mechanical and technological property, of these depending the exploitation property of cutting tools, it began to search solutions for bettering, this in the sense her finish, because such material microstructure determine to superior mechanic and technological properties. The casting structure of tools isn't proper to manufacture of cutting, the molten ingots are processing through plastic deformation with the scope to finish of the structure and obtain of laminate

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semi-products that shall be used to the remaking of the cutting tools.

Due to the addition agents contained in the steels that are used in the building of the cutting tools, the operations of plastic deformation must effectuate to warm.

But deformation strength being raised for high alloy steel, often in time of plastic deformation the fissures appear, which fissures aren't always exteriorly these are hard to tracked down, the appearance negative impinging about quality of the tools.

Therefore the plastic deformation parameters must monitoring carefully in the sight eliminates on how much possible these drawbacks. The utilize method of operation by the plastic deformation are: forging of accuracy, extrusion and isotherm forging. The parts obtained through forging of accuracy in comparison with that are made by normal punching have the finite functional surfaces. This advantage is obtained combining the hot press with calibration. Beside the dimensional accuracy, the surface quality of parts obtained by accuracy forging is very good.

Another technological process which begins to often use in the plastic deformation of the tool steels is extrusion. Besides the decrease of the consumption of material, extrusion offers significant decreases of the cost through the elimination of chip removal processes for the punching parts, due to the high accuracy obtained.

The volume cold press scope was of achievement parts with superior mechanic property, dimensional and form raised accuracy and a good quality surface, having in same time a high degree of functional integration. Besides the optimization of the operations with results which can be visible, analyse whole the technological process becomes elemental. Here are found a lot of the efficacious possibility and of expectation for the improvement of the efficiency. A main direction is the growth of the deformation processes manufacturing accuracy, simultaneous with the decrease of chip removal processing.

Isotherm press is another method with raised efficiency. It is known that the formation of the part to outlines and definitive surfaces means the salving of labour and material.

When is necessary a raised resistant in company with a good tenacity, the material structures obtained through forging are still unsurpassed. In the case of the part with simple geometry, for obtains the shape approach of the definitive, the part must forging in many stages, with reheating before each stage. An application of the isotherm punching is represented by the isotherm forging that is a slow and uniform process of the material setting in shape. Because the material opposes with a slack resistant, the total force that the press machine must to develop is lower, frequently of 10 as far as 30 of either than is necessary in normal punching.

For the another side many cutting tools aren't inadequate, because the thermic treatment was incomplete, reasons therefore the parts of tool has hardness enforced of technology, what means a normal wear and the low tenacity, but another zones are a low hardness than is desirable. Some of the appearances presented hereinbefore determine either a quick wear or tearing of the cutting parts, this makes as to the tool become out premature from ordinariness. From one presented, is detached the conclusion as with all the technological progress registered, the production of cutting tools must still to solve a series of which his problems drives to the lift quality.

2. Theoretical Considerations

As a result to experimental tests effectuated to warm it can establish the evolution of the deformation strength depending on

temperature for the steel mark Rp5. These determinations they accomplished only that with different speeds of deformation. For each deformation speed it established the deformation equation that permits to determine the deformation strength equation depending on temperature.

These equations have next form [1]:

$$R_d = a \cdot e^{bt}, \tag{1}$$

where:

R_d - plastic deformation strength;

a, b - equation coefficients;

t - deformation temperature.

In order to whole the image of the evolution of the deformation strength must as this for a large interval of the deformation speeds as part of area of the hot plastic deformation. With the help of the equations determined it can establish form of the equation that permits to determine the deformation strength depending on two parameters that are temperature and the deformation speed.

Taking count of the equation form's (1), the result is that form of equation of two variables shall be of course an exponential equation [3]. The equation shall have next form:

$$R_d(v,t) = a \cdot e^{bt+cv}, \tag{2}$$

where:

R_d - plastic deformation strength;

t - deformation temperature;

v - relative deformation speed;

a, b, c - equation coefficients.

With the help of equation value coefficients that was established to constant relative deformation speed it may possible to calculate the (2) equation coefficients. Following the calculus, the equation of the deformation strength depending on temperature and relative deformation speed has next form:

$$R_d(v,t) = A \cdot e^{B \cdot t + C \cdot v}. \tag{3}$$

Utilizing the program $PROGR_d$ written in the Visual Basic language it was determined the deformation strength for different values of the temperature and speed [2]. The temperature interval for which was calculating the deformation strength is contained between 900 and 1200^o C, and relative deformation speed has the values contained between 60 and 180 s (what corresponds to a deformation speeds of 1.2…3.6 m/s. This means that is possible to utilize equipments from the mechanic press or hummer category.

3. Conclusions

The realization through plastic deformation of the cutting tools begins to more and more used-up.

The development of this technological process was possible for the next advantages:

- it is done saving until 60% high steel alloy;
- it is eliminated the operations of chip removal;
- upper cutting tools microstructure in comparison with microstructure realizing by the traditional technologies;
- the hardness of the cutting tools increases;
- mechanical resistant of the cutting tools is enlarged.

The determination of the deformation strength for a large range of the relative deformation speeds as well as for a sufficient interval of temperatures permits an easy choice of deformation parameters (see the Figure 1).

The optimization of the deformation process shall drive besides material saving, to a homogeneous and fine microstructure which shall cause increase of the mechanic and technological cutting tools properties, for the next cutting tools generation.

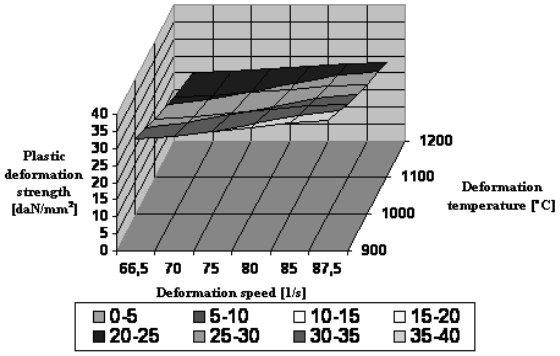

Fig. 1. *Plastic deformation strength in function of deformation speed and temperature*

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