VPLYV MAZIVA NA ŽIVOTNOSŤ PRETLAČOVACIEHO NÁSTROJA PRE TVÁRNENIE ZA TEPLA PRI VÝROBE BEZŠVOVÝCH RÚR

LUBRICANT INFLUENCE ON THE EXTRUDING PUNCH LIFE FOR HOT FORMING PROCESS OF SEAMLESS TUBES PRODUCTION

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Abstract

Príspevok sa zaoberá zvyšovaním životnosti pretlačovacieho nástroja pre tvárnenie za tepla pri výrobe bezšvových rúr. Je zameraný na výskum vplyvu maziva na životnosť nástroja a kvalitu vnútorného povrchu výlisku. Uvedené sú v ňom aj prínosy dosiahnutých výsledkov pre výrobnú prax. Cieľom experimentov bolo sledovanie vybratých vhodných druhov maziva a ich vplyvu na kvalitu vnútorného povrchu výlisku a na opotrebovanie hlavy pretlačovacieho tŕňa.

The contribution deals with the extension of the extruding punch life for the hot forming process of seamless tubes production. Its aim is to study the impact a lubricant has on the punch life and on the inner surface quality of the pressed piece. It presents also some contributions of the achieved results for production experience. The experiments were aimed to study some chosen suitable kinds of lubricant and their impact on the inner surface quality of the pressed piece and on the wear of the extruding punch head.

Key words

hlava pretlačovacieho tŕňa, voľba maziva, životnosť pretlačovacieho nástroja

extruding punch head, choice of a lubricant, extruding punch life

1. INTRODUCTION

In terms of technology and economy, the forming technology is of a respectable economic importance and it plays an important role during the manufacture of semi-finished and finished products. The manufacture of thick-walled small diameter hot rolled tubes is a necessary part of various industries operation e.g. engineering industry, automotive industry, power industry and some others.

The tests are aimed to observe the impact of various kinds of lubricant on the degradation rate of the piercing punch head surface, the preventive impact of the lubricant on adhesive scabs creation during the starting stage of the punch and on forming tools wear. The tests results should contribute to a correct choice of the lubricant to be used for the starting of the extruding punch.

2. RESEARCH OF THE LUBRICANT IMPACT ON THE EXTRUDING PUNCH LIFE

2.1 Description of the task solution

Two kinds of lubricant were chosen to be tested: Phosphatherm 901 and Phosphatherm 3999 (see picture n^{o}. 1). The lubricant was sprayed onto the head of the extruding press punch and into extrusion die during the extruding of 50 pressed pieces. After this quantity had been punched, the punch was removed. There was one test per one kind of lubricant. Both kinds of lubricant are designed for max. operation temperature 1250^{o}C.
1. Phosphatherm 901 – the lubricant was tested by extruding 50 pcs of blocks, each of length 860 mm. No problems occurred during the extruding. The loading of the press was the same as the one used in case of graphite lubrication.
2. Phosphatherm 3999 - the lubricant was tested by extruding 50 pcs of blocks, each of length 860 mm. No problems occurred during the extruding. The loading of the press was increased by 10 – 20 bars, compared with the graphite lubrication.
3. Phosphatherm 901 – this test was performed to verify whether the lubricant is suitable to be used for extruding a bigger number of the pressed pieces. Due to a failure of the spraying device the test covered only 325 pcs of blocks, each of length 930 mm. The lubricant (5% solution of Phosphatherm 901 in water) was evenly sprayed onto the head of the extruding press punch and into the extrusion die. The loading of the extruding press and its production speed remained unchanged.

Picture n^{o}. 1 *Lubricant, Phosphatherm 901on the left, Phosphatherm 3999on the right*

2.2 Surface status of the extruding punch heads

The head of the extruding punch n^{o}. 1 (Phosphatherm 901 - 50 pcs of the extruded blocks)

The surface defects of the extruding punch head are shown in picture n^{o}. 2a. The whole surface of the extruding punch head n^{o}. 1 is covered by a scale layer (of varying thickness) which is stuck on the surface. Locally, this scale layer is partially scaled off. The scale layer, which is stuck within the field R20, is partially scaled off. The scabs are a potential source of particles that might get loose during the extrusion and create scratches. By means of light microscopy, some scale layers and adhesive scabs were identified on the active surface of the extruding punch head. Within the fields with the scabs, the tool surface was badly deformed (see picture n^{o}. 3a).

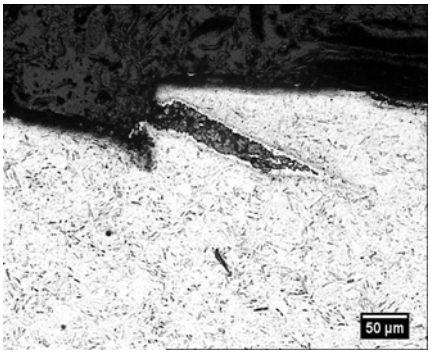
The head of the extruding punch n°. 2 (Phosphatherm 3999 - 50 pcs of the extruded blocks)

The surface defects of the extruding punch head are shown in picture n°. 2b. The whole surface of the extruding punch head is covered by a scale layer (of varying thickness) which is stuck on the surface. This scale layer is partially and incompletely scaled off. The radius field R20 is covered by a nearly continuous and compact scale layer. By means of light microscopy, some scale layers and a nearly continuous interlayer were identified on the active surface of the extruding punch head (see picture n°. 3b). No scabs are created on the surface of the extruding punch head from the material of the block. Plastic deformation of the surface of the extruding punch head is insignificant.

The head of the extruding punch n°. 3 (Phosphatherm 901 - 325 pcs of the extruded blocks)

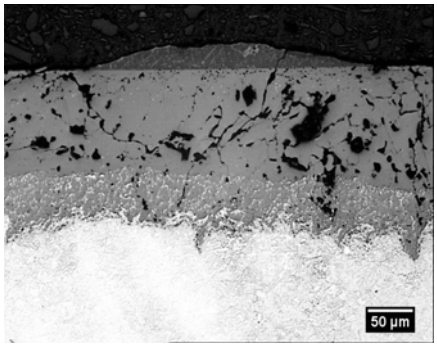
The surface defects of the extruding punch head are shown in picture n°. 2c. The surface of the extruding punch head is covered by a scale layer (of varying thickness) which is stuck on the surface. The scale layer is partially scaled off. The R20 field surface of the extruding punch head is partially worn. An observable scale layer is stuck on the surface of the transitional area between cylindrical part of the punch head and the area of R20 radius. The scale layer creates a little broken projections of various lengths. There is a visible change of geometry within the area of R20 radius. The scale layer stuck within the area R20 is massive, partially scaled off and it is a potential source of particles that might get loose while the block is extruded. By means of light microscopy, some scale layers and adhesive scabs were identified on the active surface of the extruding punch head. The scale is pressed in to the surface layers, the plastic deformation occurs (see picture n°. 3c).

a)



a)

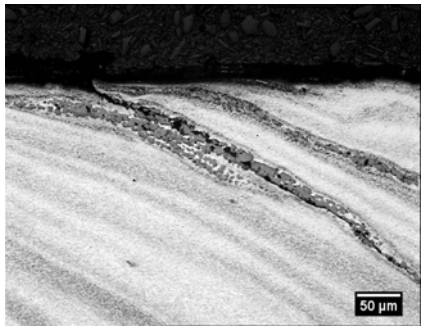
b)



b)

c)

Picture n^o.2 *The extruding punch head, close-up of the face, R20 radius and side surface of the punch head*



c)

Picture n^o.3 *Metallography of the punch heads, the tool surface within the R20 radius*

3. CONTRIBUTION OF THE ACHIEVED RESULTS FOR PRODUCTION EXPERIENCE

The contribution of the achieved results is of a great importance for the production experience, particularly in terms of:
- extension of the extruding punch life,
- decrease in number of dead time periods,
- increase in quality of the inner surface of the pressed piece,
- improvement of the work place quality in hot rolling mill,
- elimination of powdered graphite.

3.1 The impact of lubricant Phosphatherm 3999

The analysis results in the statement that Phosphatherm 3999 is the most suitable lubricant. The application of the correct lubricant Phosphatherm 3999 (see pictures n^o. 4 and 5) will abolish the high dust nuisance that is caused by the powdered graphite flying up when using a standard lubrication, thereby improving the work place quality. Moreover, the choice and application of the correct lubricant influences the reduction of the punch head wear and degradation, as well as reduction of number of scratches on the inner surface of the pressed piece.

The innovation of the extruding equipment (so that it could evenly cool and lubricate the tools of the extruding press) would exclude human factor and its impact on the quality of the manufactured tubes during the extruding process.

Picture n^o.4 *Phosphatherm 3999, powdered state*

Picture n^o.5 *Phosphatherm 3999, fluid state*

4. CONCLUSION

The analysis was aimed to verify the impact of various kinds of applicable lubricant on the extruding punch life and on the quality of the inner surface of the pressed piece.

Choice of a lubricant

The head of the extruding punch n^{o}.1, material 19 678.

Continuous application of lubricant Phosphaterm 901 in the system "extruded block – extruding punch head" resulted in creation of sporadic scabs. Within the fields with the scabs, the surface of the tool was badly deformed.

The head of the extruding punch n^{o}. 2, material 19 678.

Continuous application of lubricant Phosphaterm 3999 in the system "extruded block – extruding punch head" didn't result in creation of the scabs (made of the block material) on the surface of the extruding punch head. The plastic deformation of the surface of the extruding punch head is insignificant.

The head of the piercing punch n^{o}. 2, see picture 2c, material 19 678.

Continuous application of lubricant Phosphaterm 901 in the system extruded block – extruding punch head resulted in degradation of the face surface, R20 radius and the cylindrical part of the punch head, similar to that which could be seen on the extruding punch head that had been lubricated by graphite.

When comparing both applied kinds of lubricant after 50 pieces were pressed we can state, that the application of lubricant Phosphaterm 3999 with added 10 % of emulsifier (having an anti-abrasive and anti-adhesive effect) resulted in relatively better quality of the extruding punch head compared to that achieved by application of lubricant Phosphaterm 901. Moreover, this conclusion was confirmed by the inner surface quality of the corresponding extruded piece.

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