ANNALS OF FACULTY ENGINEERING HUNEDOARA
– INTERNATIONAL JOURNAL OF ENGINEERING
Tome X (Year 2012) – FASCICULE 3 (ISSN 1584 – 2673)

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# EVALUATION OF ANTI-CORROSIVE MATERIAL AFTER AGEING

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**ABSTRACT:** *The ageing of material in many cases can cause failure or disaster of mechanical parts of machines before the time of product life. It means the great waste for producers and firms. The contribution deals with the evaluation of applicability of anticorrosion material stressed in deformation background and thermal ageing. The applicability of material in mentioned surroundings was tested by principal mechanical tests for one–axis tension and by metallographic evaluation. The contribution deals with the evaluation of applicability of anticorrosion material NICRO 52,6 stressed in deformation background and thermal ageing.*
**KEYWORDS:** *anticorrosion material, ageing, mechanical testing*

## INTRODUCTION

*The product increasing of engineering industry, development of mechanical products, materials force the producers to accelerate the production and to utilize new technologies and materials. However, it is necessary to keep the high quality of finished products, it means the exact shape and dimension, required used properties and minimised the waste. It is very important to control the quality of input semi-product with exact chemical compound, required mechanical and physical properties.*

*The contribution deals with the evaluation of applicability of anticorrosion material NICRO 52,6 stressed in deformation background and thermal ageing.*

*This contribution was made with cooperation with production firm KRONOSPAN SK, s.r.o.*

## DEFORMATION AGEIN DURING BENDING OPERATION OF STRIP MATERIAL

*During the forming operation the forces influences on material. They deform the metal material and after overrun of limit loading they destroy the material. The deformational hardening appears during plastic deformation and the non-homogeneity of plastic material occurs (2). The most important parameters as temperature, deformation rate, strain are influenced on material during the ageing. Others parameters, which influence on deformation process are: chemical structure and physical state of material, degree of deformation at forming process, external friction, on contact surface of tool and forming metal. [1].*

*The failure of material occurs by deformation in forming process by arising of rifts or by destruction of some parts. We can divide the failure as follows:*

- *Brittle failure, whom precedes elastic deformation and micro-plastic deformation,*
- *ductile fracture, whom precedes macroscopic deformation, .[2].*

*The effect of deformational ageing in our case of anti –corrosion material occurs in forming of chipboard on anti-corrosion strips keep on adjustable steel cylinders according to required finished shape of formed chipboard.*

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*The values of ultimate strength Rm and ratio Re/Rm are increased after ageing, the plastic material properties are worse. It means that with increasing of values of mechanical properties of material, the ability of material is decreased for using in forming operation for multiply bending. The decreasing of ductility and contraction (reduction of area) are occurred. It is also changed the hardness of material and the values of impact test are decreased (3). When we shape the chipboard, there is the contact between chipboard, anti-corrosion material and cylinders. The impression and hardening are occurs in sheet in defined place. The deformation of material causes the changes of strain states, local excessive heating during bending operation and tightening on cylinders and following cooling operations of chipboard after forming, it means after finishing of works. It causes the hardening changes in material and changing of structure of material (directed grains, lines in material).*

## EVALUATION OF TESTING MATERIAL

*The contribution deals with problem of evaluation of anti- corrosion material, steel NICRO 52,6. The material used for experiments was delivered by firm Kronospan, a.s.:*

- *3 sheets with dimension - 1,8 x 300 x 300 mm, used, deformation aged and cracked,*

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- *1 sheet with dimension – 1,8 x 300 x 300 mm, new one, protected by plastic foil from one side.*

*For material analysis were used following methods:*

- *metallographic evaluation of sheet by standard STN 42 0462,*
- *determination of mechanical properties, one axis tensile test according to standard STN EN 10002-1.*

*In the Fig. 1 is shown the chosen places of each taking off of testing samples, where were the most often brakings, dints and failures of materials.*

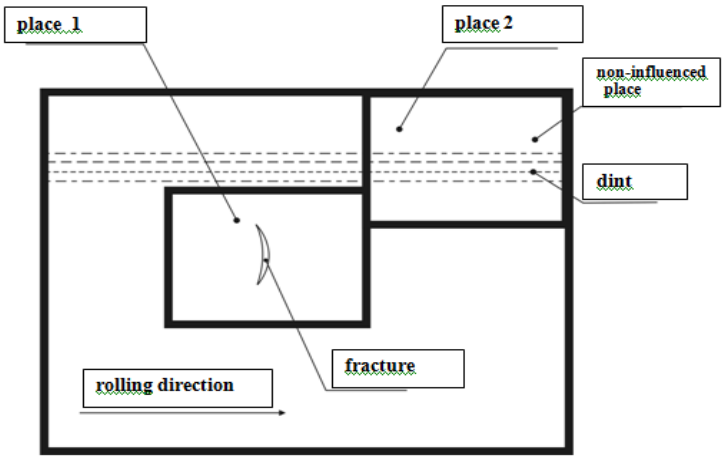


*Figure 1. The scheme of drawing off the samples*

*In the Fig. 2 are shown the examples of damaged bending belts.*

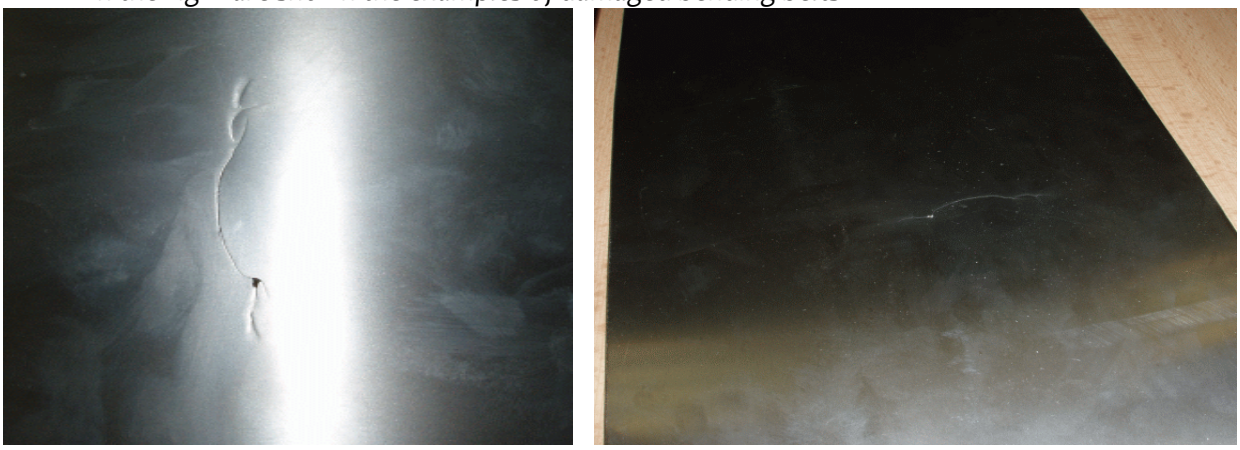

*Figure 2. The examples of fracture of bending belts*

*From the place 1, according to Fig. 1 were taking off the sample of non-influenced material , as it is shown in Fig. 3 and Fig.4, the structure of material is balanced .The decomposition of carbides grains of material is balanced. The Fig. 5 and Fig.6 show the thermal influence of material, where the chipboard and sheet have a contact by drawing of chipboard into machine. In the Fig. 6 is shown the detail of arising of inter-granular corrosion.*

*In the Fig. 7 is shown the detail of crack propagation at magnification 100x. The crack is spreads under 45 $^{o}$ angle according to direction of loading, it means movement of strip.*

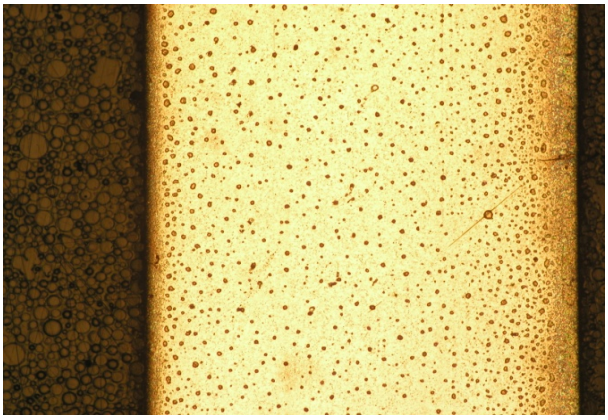

*Figure 3. Balanced structure, ext.50 x*

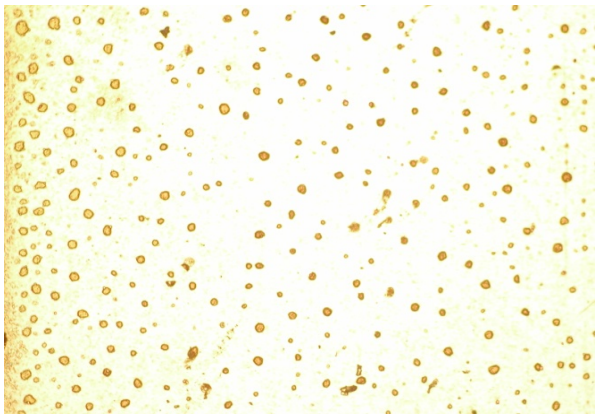

*Figure 4. Balanced structure, ext.100 x*

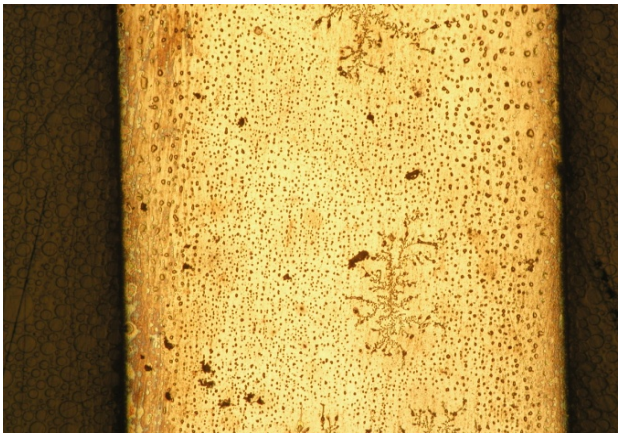

Figure 5. Intercrystalic corrossion,ext. 50x

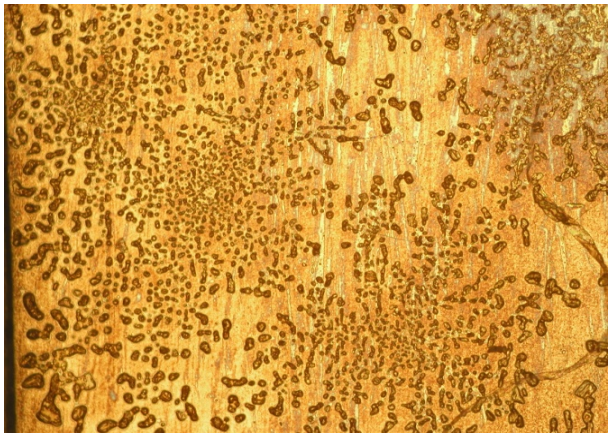

Figure 6. Detail of intercystalic corrosion, ext.100

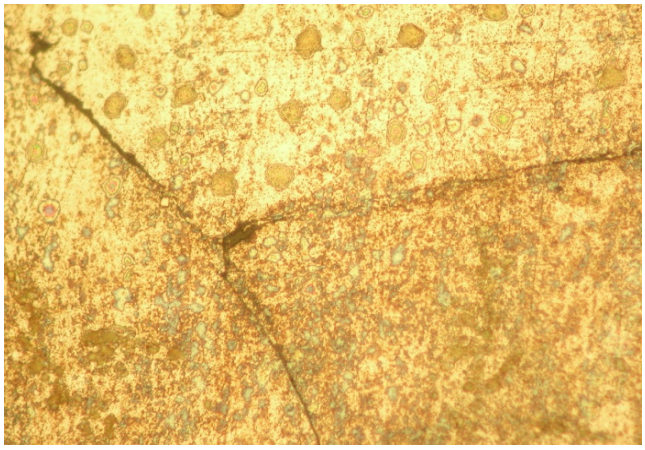

Figure 7. The nucleus of crack propagation of material, 100x

*The mechanical test was made according to standard STN EN 10002-1. The tensile test was realised in testing apparatus of type TIRA-test 2300, VEB Thűringer Industriewerk, Germany.*

*There were used 15 testing samples according to delivered material. The samples were chosen and tested for each rolling direction 0 °, 45°, 90°.The measured longitude of samples was 80 mm The samples were removed according to standard STN 42 0305.*

*Evaluation of measured results:*

- *The testing samples from new, non-used materials had measured values of $R_m$ = 1370 MPa to 1399 MPa. The materials were not used in production process.*
- *The testing samples from delivered and used materials have had higher values of $R_m$ = 1370 MPa to 1539 MPa. These materials were used as bending strips for bending of wooden plates. The strips were bent round three cylinders.*
- *The ductility values from delivered and used materials had low values of $A_{80}$ = 1,60 % to 1,80%.The testing samples used from the rolling direction 45°, had the values of $A_{80}$ around 6%, which is a bit higher values. These in general low $A_{80}$ values mean that material was deformedly aged and can produce the danger of rupture of bending belts.*

## CONCLUSIONS

*The testing materials in the working conditions are ageing during the bending around the work cylinders. This reason causes the progressive degradation of plastic properties of material by influence of starting up plastic deformation by alternating of sheet bending.*

*The cyclic sheet loading also with small plastic deformation can cause graded attrition of its plastic properties. The sheet is exposed to the temperature above 200°C according to working conditions. This temperature causes the decay of non-stabile chemical bounds in material and in connection with deformation with chipboard. It causes the strain ageing of material. This reason makes considerable increasing of ultimate tensile strength of material and creates the surface of sheet material from strain cylinders and also the cracks after deformation.*

*The rough surface causes the non-integrity of mentioned material surface and the expectation of creation and formation of crack and its widespread is expected.*

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**ACKNOWLEDGEMENT**

*This work was supported by the Ministry of Education of the Slovak Republic under grant VEGA No. 1/0396/11*

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