

## DISERTATION SUMMARY

Theoretical and experimental analysis of the multistage drawing of galvanized wires  
from C42D steel

The subject of this doctoral dissertation was the analysis of the process of drawing multistage galvanized wires from C42D steel. The drawing process of a wire rod with a diameter of 5.5 mm into a wire with a diameter of 2.2 mm was carried out in industrial conditions. The wires were drawn in conventional dies with the angle of the working part of the dies  $\alpha = 3, 4, 5, 6, 7^\circ$  and in hydrodynamic dies of an angle  $\alpha = 5^\circ$ , with a drawing speed of 5, 10, 15 and 20 m/s.

The multiparameter analysis of the issue included theoretical and experimental analysis of the energy and force parameters of the drawing process, mechanical and technological properties, surface roughness and residual stress tests as well as testing the lubrication conditions and the thickness of the zinc coating. A metallographic analysis of the wire surface layer and its coating using scanning electron microscopy (SEM) and corrosion resistance testing of galvanized steel wires complemented the research.

The tests carried out have undoubtedly demonstrated the significant influence of the angle of the dies working part, the speed and drawing method on the lubrication conditions, the thickness of the zinc coating and the properties of the wires. The results of the research have also made it possible to study the structural changes in the zinc coating after the drawing process. The relationship between drawing technology and corrosion resistance of the steel wires has also been demonstrated.

Comprehensive analysis of the drawing process of galvanized steel wires has shown that when drawing at speeds above 15 m/s there is a significant deterioration of the lubrication conditions, combined with the softening of the zinc coating and its adhesion to the drawing dies and drums.

Taking into consideration the strength parameters of the drawing process, the state of the wire surface layer and its mechanical and technological properties, the optimal drawing angle of galvanized steel wires from C42D steel is  $\alpha = 5^\circ$ , and the use of hydrodynamic presses in the drawing process largely reduces the negative effect of high drawing speeds on the process of drawing and the properties of the galvanized steel wires.

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