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THE REVIEW OF STEELS AND IRON ALLOYS STRUCTURAL AND EXPLOITATION ANALYSIS RESULTS

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A large range of iron-based materials, the structure of which was developed in various processes: by compacting loose materials, casting, heat treatment, plastic deformation, thermomechanical treatment, induction welding, laser welding were analyzed in this work. The parameters of the investigated materials were evaluated by microstructure analysis, hardness measurements, evaluation of mechanical properties (along with their anisotropy), aerological features and rheological parameters. The final parameter assessed was the exploitation properties, including wear mechanisms.

The tested materials were, i.a.: ferro-bearing dust briquettes; steels: IF, DC03/1.0347, DC04/1.0338, DC05/1.0312, DD14/1.0389, 12X, S235JR, 22MnB5, 4130, 4340, 20Cr4/1.7027; cast steels: G200CrNiMo5-3-3, GX40MnCr12, GX110MnCrMo13-4, GX120MnCr12-6, GX120MnCrMo13-5.

Research on the compaction of loose materials concerned a new approach to the assessment of the structure and properties of briquettes. The compaction method used for all tested materials did not cause the briquette to defragment in half along the plane of mutual closure of cavities on both rollers [1].

Laser welding is widely used in many industries, including the automotive industry. Tailored Blanks are used as structural parts for car bodies to improve vehicle performance. A new concept of the role of critical deformation in the formation of structural notch in the HAZ of a laser-welded joint was proposed.

HAZ is an area where structural changes occur as a result of temperature, which makes structure not homogeneous and can be divided into different subzones - coarse-grained, fine-grained, intercritical and subcritical. A quantitative determination of the microstructural changes that occur in the welded joint during its production was performed. Model of such changes was created basing on both quantitative and qualitative microstructural documentation of the materials connections created during the IWC process [2].

Based on the flow stress curves for steel 4340, processing maps for intermediate deformation steps were developed and correlated with the microstructures in the bulked samples [3].

A comprehensive analysis of the hot deformation behavior of the tested steel 4130 in various temperature ranges and strain rates is also presented. The flow-stress curves obtained from the compression tests were used to develop processing maps developed on the basis of various plastic flow stability criteria for various amount of deformation. The behavior of the tested steel for a range of strain rates corresponding to the characteristics of most machines used in industrial forging conditions was also investigated [4].

The analyses of the microstructure of steel and the protective coating of B-pillar produced by hot stamping, as well as deformations of steel sheet during forming were also carried out [5].

The resistance of selected deep-drawn steel sheets to erosion wear was also analyzed. Deep-drawing steel sheets were examined. In the framework of the research concerning the resistance

to erosion wear of sheets selected mechanical properties, microstructure and chemical composition were investigated. Wear mechanisms and microstructural changes in the tested steels were also discussed [6].
The parameters of the rolling process can cause high stresses on the surface of the roller, potentially damaging it. Depending on the selected charge material, different wear mechanisms are observed. New knowledge concerns the role of shaping the microstructure of metallurgical rolls in the process of their wear during hot rolling of steel [7].
The analysis of the wear of briquetting rollers made of 20Cr4 steel allowed for new insights based on 3D geometry analysis, macroscopic observations, microscopic studies using light and scanning electron microscopy and hardness measurements [8].
The correct chemical composition of the special cast steels is crucial for obtaining the expected results. In properly cast and supersaturated cast steel, strong strengthening by micro-twining takes place. The influence of the chemical composition on the wear of chains used to remove crushed stone from railroad embankments was analyzed. The research was focused on the mechanisms of wear, susceptibility to hardening during operation and hardness in the surface layer. The mechanisms of wear of chains made of high manganese alloys and their surface hardening resulting from the chemical composition of the alloy were also discussed [9].
In the analyzed case, excessive wear of fan mill beater made of the Hadfield steel was found. The cause of their unsatisfactory wear resistance was determined. A methodology for testing the material's ability to strain hardening was also proposed and the role of cementite-manganese net in the mechanisms of wear due to the coincidence of the interaction of carbon fractions with intensive deformation microtwining was also presented [10].

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