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SIMULATION OF COMBINED PROCESS OF ROD EXTROLLING IN THREE-ROLL MILL USING Deform-3D

Abstract. In the article, using the Deform 3D program, a computer simulation of the combined screw rolling process and pressing of the billet in the continuous pressing device was performed and the calculated values of the stress-strain state of the metal ponds are presented. An analysis of the stress-strain state of a metal during deformation in a continuous-pressing device with different drawing coefficients has been made. It is noted that in the first stage of deformation in the continuous pressing device, the stress and deformation intensities are localized on the surface of the workpiece, and in the subsequent stages of pressing these values are concentrated in the central zones of the workpiece.

It is shown that when compressing in a new device, due to the reversal of zones with the maximum stress and deformation intensities along the section of the workpiece, the macro-shear deformations are developed intensively, and as result they cause deep changes in the structure of the metal, due to transgender sliding.

Key words: computer simulation, combined process, equipment for continuous compaction, stress-strain state, shear deformation, fine-grain structure.

Introduction. The demand for technology of pressure treatment enabling the arrangement of cost-effective production of small- and medium-batch items has grown up in recent times. Herewith the essential requirements are accuracy of forms, cross-sectional dimensions and establishment of regulated structure in raw materials.

The production of round long half-finished product in metallurgic and metal-processing plants by screw rolling serves as an example of such technology.

It should be noted that the combined processes of pressure metal treatment (PMT) are used widely in aforesaid producing operations in current times [1]. The significant engineering of material structure and manufacture of items with high mechanical and performance properties is peculiar to combined processes of pressure metal treatment.

It is known that the designing of combined processes of pressure metal treatment is related to solution of such technical and process tasks as selection of temperature-speed rates of deformation and power processing parameters, assessment of the impact of strain distribution on structure and properties of resulting product as well as design engineering of instrument [2]. Despite the engineers aiming to process engineering with uniform distribution of stress-strain state (SSS) throughout deformable raw part, the uniform distribution of SSS fails to be achieved in real PMT processes. This leads to non-uniform work up of material structure, its uneven-grained structure and mechanical anisotropy.

According to the authors of works [3,4], the deformations during rolling in cross-rolling mills has a complicated nature, so much the more it is hard to anticipate the nature of SSS ofraw part during concatenation of screw rolling and compaction processes. For this reason, the study of severe plastic deformation (SPD) impact on metal structure of rollable product and determination of SSS nature and its impact on quality of resulting rods in rolling mills of “cross rolling and compaction” combined process is a relevant object.