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Development and computer simulation of a new combined energy-saving technological process of production of high-quality wire with sub-ultrafine-grained structure

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ABSTRACT

Typically, metal materials after traditional methods of processing by pressure have a sub-grain structure. However, it is known that their sub-ultrafine-grained analogues have higher strength properties coupled with high ductility. Already known some results of application of methods of severe plastic deformation (SPD) in mechanical engineering, medical industries, wide application, they did not find, as obtaining such patterns of most known methods are labour and energy consuming, and impose restrictions on the geometrical dimensions of the resulting product, which significantly reduces their performance. The continuity of the process, by combining such methods of intensive study of the structures such as equal channel angular extrusion and drawing into one combined process, will allow to reduce energy consumption while greatly enhancing the manufacturability and performance of the process. But the inclusion in this technological scheme of radial-shear rolling for the purpose of receiving the source rod for the combined process of “equal channel angular pressing – drawing” allows to obtain sub-ultrafine-grained structure in fewer cycles that will reduce energy and labor costs in the production of metal with sub-ultrafine-grained structure. All this opens up the possibility for the industrial production sub-ultrafine-grained products with improved properties.

In this paper, the results of modeling in the software package SimuFact of new combined process of production of high-quality wire are presented, studied the stress–strain state in the implementation of this process, and investigated its influence on the evolution of microstructure.

KEYWORDS: computer simulation, energy-saving, combined process, ECAP-drawing, radial-shear rolling