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INTRODUCTION OF ADVANCED TECHNOLOGY IN THE PROCESSES OF CUTTING TOOLS MANUFACTURING

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ВПРОВАДЖЕННЯ ПРОГРЕСИВНИХ ТЕХНОЛОГІЙ В ПРОЦЕСИ ВИГОТОВЛЕННЯ РІЗАЛЬНИХ ІНСТРУМЕНТІВ

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Additive technologies were developed due to the high speed of retooling of the production process. Production of a simple form of a prototype using traditional methods (casting, deformation, heat treatment, mechanical treatment) takes from several weeks to several months. At the same time, it is necessary to take into account the high costs of manufacturing the production machinery. When using modern methods of additive production, only the availability of equipment is required to print the products, and open software makes it possible to update the technological printing parameters for the selection of the most optimal modes.

Modern studies of powder materials, the development of mechanical and heat treatment processes allow to produce products with properties exceeding the properties of products obtained by traditional methods. They are able to receive products from metal powders with increased wear resistance, durability, corrosion resistance, while reducing labor content and metal-intensity of machines and mechanisms.

The traditional technology for manufacturing a tool from the ingots of high-speed steel alloys includes a list of technological operations requiring the choice of technology and modes at each stage (Fig. 1). Hot treatment allows to reduce the negative consequences of casting: inhomogeneity of the carbides distribution of and residual stresses in the finished material [1].

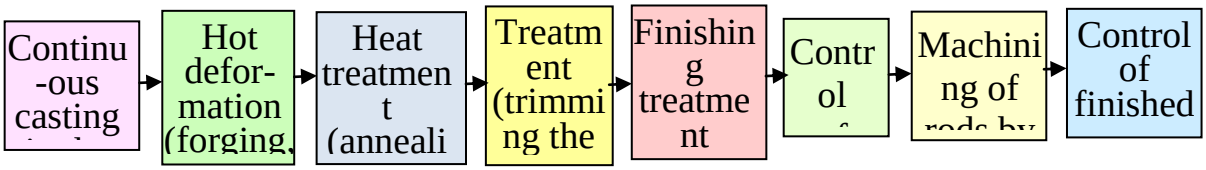

Figure 1 – Scheme of traditional technology for tool manufacturing from high-speed steel ingots

The resulting melt of high-speed steel grades, as a rule, is carried out in open melting induction furnaces. Continuous casting of ingots is performed by extracting the cooled melt through the crystallizer. Cutting on measuring blanks is carried out using a mobile gas cutter and/or metal saw.

For steels obtained by traditional technologies, a number of disadvantages are inherent: pimpling in the ingot, which is not disposed completely even after multiple plastic

deformation and significantly reduces the technological plasticity of the workpieces; deformation of the tool during thermal processing; bad grainability, etc.

The main differences between the traditional method from the method of powder metallurgy is to obtain a workpiece of high-speed steel for further machining by compacting the powder material by the method of hot extrusion or by means of hot isostatic pressing. This technological process (Fig. 2) has the following advantages: provides higher durability of the cutting tool; allows to receive the isotropic properties by cross section of the product and increased structural strength; higher level of technological properties.

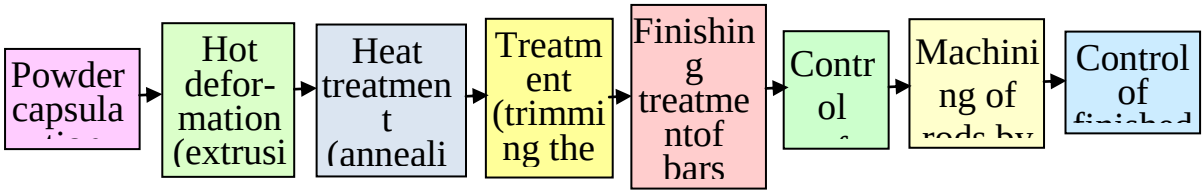

Figure 2 – High speed steel powder metallurgy tool making scheme

However, due to the low metal utilization factor and the high labor intensity of the deformation technology, mechanical and thermal treatments, the products from high-speed steels have a high cost. The additive method of production from the powder material allows to obtain the parts with closed geometry to the final form on the first operations [2]. Figure 3 demonstrates a scheme for the tool production from powder high-speed steel by additive technologies.

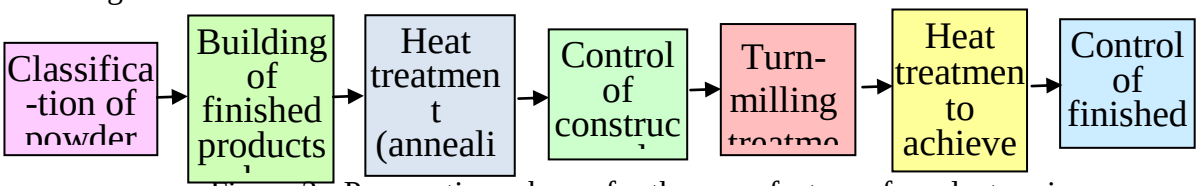

Figure 3 - Prospective scheme for the manufacture of products using the additive technologies

The basis of this scheme is the construction of the final geometry of the product by additive technologies. The choice of method depends on a number of factors: the chemical and fractional composition of the material; the presence of powder material yield; geometry of the final product; requirements for its physical and mechanical characteristics.

Additive methods of production make it possible to manufacture products with low anisotropy properties in cross section of the part. This is explained by the fact that in the process of 3D printing from the metal powder, a small amount of material is melted at a time. For alloys, segregation of alloying elements occurs much smaller than with the classic method of manufacturing casting parts. The use of additive production methods allows to obtain the equilibrium distribution of not only chemical elements, but also physicomechanical characteristics by cross section of the product.

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