POST-PROCESSING IN ADDITIVE MANUFACTURING

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Additive technologies (AT), or technologies for obtaining products by layer-by-layer addition of material is one of the most promising directions in the development of almost all branches of modern production.

One of the most important and at the same time least studied stages of the technological chain of layer-by-layer production (additive manufacturing - AM) is the post-processing of the obtained objects. Post-processing is aimed at improving geometric accuracy, reducing the "step" effect, which is typical for most AM methods, improving the surface quality, mechanical, operational, aesthetic and many other properties of the final products.

The degree of relevance of post-processing is different in various AM methods. For example, relatively high surface quality, physical and mechanical properties, homogeneity and isotropy of structure of products obtained by laser stereolithography (SLA) are due to peculiarities of this technology: identical conditions of uniform curing in each point; lower temperature as compared to technologies using melted thermoplastic polymers, etc.

On the contrary, the problem of post-processing in powder sintering technologies (SLS, SLM) is quite acute, where porosity of products is inevitable, rather high values of surface roughness are observed, incomplete polymer removal is fixed, especially when using initial composite materials.

The methods of post-processing are very diverse in their physical and chemical nature, method of implementation and application.

The most promising methods include the following: removal of the material of supporting structures (mechanical processes, electrical discharge machining, dissolution, use of combined technologies); infiltration (penetration of infiltrates which have a lower melting point than the base material into the pores of the product due to the capillary effect, which significantly increases the density of the resulting products); thermal, chemical-thermal, thermomechanical processing (for example, hot isostatic pressing); dimensional processing (traditional cutting methods – turning, milling, grinding, and hybrid processes based on a combination of additive technologies and dimensional machining); methods of creating functional protective coatings (chemical, galvanic, ion-plasma methods and their combination).

The above post-processing methods can be used either individually or as a sequential or parallel combination.

When selecting the optimal post-processing method, the following factors must be taken into account: the initial material and its physical and mechanical properties, the degree of complexity of the AM product, the type of plant used and its technical and economic characteristics, product quality requirements depending on its further application, process productivity and final product cost, environmental aspects, etc.