

**ADDITIVE TECHNOLOGIES IN  
MECHANICAL ENGINEERING**

Zhuchkov R.O, student  
Alshanikov E. D., student  
Scientific supervisor – Beznis Y. V., senior lecturer  
English language department №1  
Belarusian National University of Technology  
Minsk, Republic of Belarus

Over the past decades, research in the field of foundry production has convincingly proved that innovative development and efficiency improvement require the active introduction of modern technologies such as nanotechnology, digitalization, computer modeling and prototyping. The digitalization of manufacturing and the introduction of CAD (computer-aided design) systems, combined with additive methods, have revolutionized the foundry industry. This has become especially important for such high-tech fields as aircraft manufacturing, space industry, nuclear energy and medicine, where high precision, uniqueness and reliability of products are required. Thanks to the integration of modern technologies, it became possible to produce small batches or even single copies of complex parts, which was previously economically impractical or technically impossible.

A striking example of the successful application of innovations is the Quick-Cast technology, as well as sand casting created by the method of layered synthesis. These technologies significantly optimize production processes, reducing the lead time from several months to several weeks or even days. Such methods open up new horizons for the manufacture of complex parts, including products made of rare and unique alloys, which previously presented significant technical difficulties. For example, the use of additive technologies makes it possible to create parts with internal channels, cavities and complex geometric shapes, which is impossible with traditional casting [1].

Modern CAD/CAM/CAE technologies have become the basis of the foundry's modernization. They provide an opportunity for a complete transition to «paperless production», when the entire cycle – from design to manufacture of the final product – is implemented in a digital envi-

ronment. This approach includes the use of a wide range of materials, which makes production more flexible and versatile. Digital technologies not only speed up the production cycle but also greatly minimize the risk of human errors, which is particularly crucial in the manufacturing of precision products. This advancement has facilitated the creation of high-precision equipment and enhanced production efficiency. The application of additive methods not only shortens production time but also reduces the weight of components, which is vital for improving aircraft performance.

Additionally, the evolution of layer-by-layer synthesis technologies, such as Selective Laser Sintering (SLS), has opened new avenues for the development of complex prototypes. This technique involves the layer-by-layer sintering of powdered materials with a laser, allowing for the creation of large and highly detailed products. Such models are commonly used in producing wax and polystyrene molds. Sintering enables the manufacture of items with high accuracy, ensuring detail and durability. These technologies continue to reshape the industry, fortifying its position and broadening opportunities for innovative growth [2].

In conclusion, it can be asserted that additive technologies and the digitalization of production are becoming integral to modern mechanical engineering and foundry operations. Implementing these solutions not only reduces costs and boosts productivity but also creates new opportunities for the development of advanced products. In the future, we can anticipate further advancements in these technologies, including the introduction of more sophisticated materials, faster production processes, and integration with artificial intelligence, significantly increasing their demand across various sectors.

## References

1. Provatar, A. G. Additive technologies in engine-building // Austrian Journal of Technical and Natural Sciences. 2015. №9-10. – URL: <https://cyberleninka.ru/article/n/additive-technologies-in-engine-building> (date of access: 21.03.2025).

2. Финогеев, Д. Ю. Аддитивные технологии в современном производстве деталей точного машиностроения // Вестник СГТУ. 2020. №3 (86). – URL: <https://cyberleninka.ru/article/n/additivnyye-tehnologii-v-sovremennom-proizvodstve-detaley-tochnogo-mashinostroeniya> (date of access: 22.03.2025).