4. Циганок К., Череп А. Альтернативні джерела енергії як засіб ресурсоефективності. *Миколаївський національний університет імені В.О. Сухомлинського*. 2018. № 22. С. 688-691. URL: http://global-national.in.ua/archive/22-2018/130.pdf (дата звернення: 13.05.22)

5. Skuibida O. The evaluation of occupational health and climate risks from energy choices. *Man and environment, trends and prospects.* 2020. P. 326-329. URL: http://eir.zntu.edu.ua/bitstream/123456789/8266/1/NS_Skuibida.pdf (дата звернення: 12.05.22)

**Oleksandr Kurashkin**
*Dmytro Motornyi Tavria State*
*Agrotechnological University*
o.kurashkin@gmail.com
**Language advisor: Lemeshchenko-Lagoda V.V.,**
Teacher, Department of Foreign Languages

## IMPLEMENTATION OF ADDITIVE TECHNOLOGIES IN MANUFACTURING

In 2022, the industry of our country faced financial and logistical problems that have an extremely negative impact on the productivity of domestic producers. In connection with the need to manufacture products, as well as maintenance and repair of equipment for many, especially small enterprises, the issue of finding components is acute. If it is not possible to purchase ready-made solutions, the option of self-manufacturing a certain proportion of the necessary parts may be considered.

The traditional manufacturing method is mechanical processing. It consists in changing the physical parameters of the workpiece (usually metal) in accordance with the requirements of technical documentation by mechanical action (cutting, plastic deformation, etc.). This method is not applicable for most enterprises, as it requires machine park, appropriate equipment and qualified personnel. Third party fabrication services are prohibitively expensive and should only be used in case of emergency. It

is also worth noting that some of the parts required in the production will not experience heavy loads during operation and its strength, made of metal, will be excessive.

Additive manufacturing, also known as 3D printing, is the synthesis of an object by building up material layer by layer based on a 3D computer model. The production equipment is a 3D printer. Its acquisition can make it possible to manufacture such parts from plastic as: pulleys, supports, gears, clamps, impellers, conveyor funnels and chutes, frame elements, belt tensioner rollers, flexible cable channels, fasteners, spacer rings, washers, dampers, etc. [1]

There are several main methods of additive manufacturing: Binder Jetting, Material Extrusion, Powder Bed Fusion, Sheet Lamination, Vat Polymerization, Material Jetting. Extrusion 3D printing method (FDM) is the most common and affordable. Its use involves the layer-by-layer fusing of a quick-hardening material due to its extrusion through the nozzle of a 3D printer print head (Fig. 1). The print head (extruder) is positioned and driven in three dimensions by the operation of limit switches and stepper motors. The movement of stepper motors is controlled by a microcontroller through the appropriate software [2, 4].

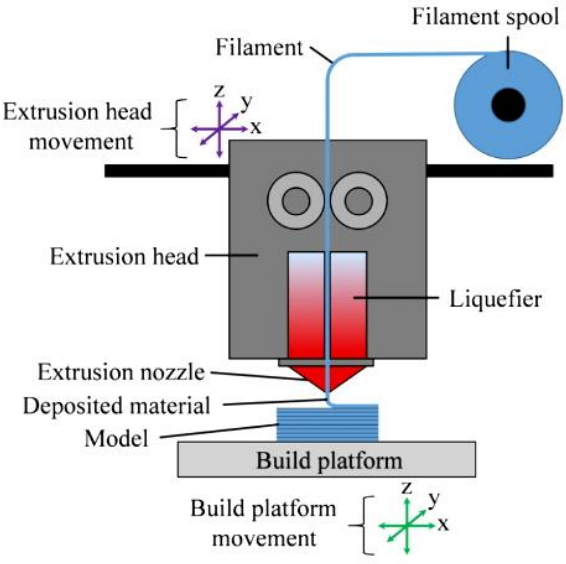


***Fig. 1. The key parts of a FDM 3D printer***

A consumable in extrusion 3D printing is a filament made of a thermoplastic – polymeric material that can change into a highly elastic or viscous state when heated. The most common thermoplastics in 3D printing are acrylonitrile butadiene styrene (ABS) and polylactide acid (PLA) [2].

For the manufacture of the above parts, the most technologically advanced

and high-quality is ABS plastic. Among its advantages are: non-toxicity, impact resistance, moisture resistance, high alkali resistance, wide range of operating temperatures (-20…+80 °C).

The main disadvantage is that some types of ABS plastic are prone to destruction due to prolonged exposure to sunlight and ultraviolet radiation. However, under production conditions, this drawback is insignificant due to the frequent closeness of production facilities from direct sunlight [2, 4].

The main advantages of additive manufacturing are [3]:

1. the ability to create complex geometric shapes;
2. small amount of production waste;
3. relatively low cost of production;
4. high availability, in comparison with machine tools;
5. possibility to print investment casting models, if it's need to replicate the certain part.

The main disadvantages should also be noted [3]:

1. limitation on the printing working area, usually 200x200x200 mm;
2. the need for cleaning and grinding parts, in some cases;
3. the need to design with the provision for thermal shrinkage of the hardening material.

Summing up, we can conclude that implementation of additive technologies in production should not be considered as a full-fledged replacement for machining, however, the use of 3D printing can bring invaluable benefits in case of the need to quickly produce plastic parts that are not expected to operate under high loads.

**References**

1. Babu S. S., Goodridge R. Additive manufacturing. *Materials Science and Technology*. 2015. Vol. 31, No 8, P. 881-883.

2. Zhang Q., Wong J., Davis A., Black M., Weber R. Characterization of particle emissions from consumer fused deposition modeling 3D printers. *Aerosol Science and Technology*. Vol. 51, No 11. 2017. P. 1275-1286.

3. Stögerer J., Baumgartner S., Rath T., Stampfl J. Analysis of the mechanical anisotropy of stereolithographic 3D printed polymer composites. *European Journal of Materials*. 2022. Vol. 2, No 1. P. 12-32.

4. Karagol B. 3D Printing: What does it offer and for whom. *Science and Technology Policies Research Center*. Ankara. 2015.

**Anastasia Lakosina**
*Dmytro Motornyi Tavria State*
*Agrotechnological University*
lakosina4949@gmail.com
**Language advisor: Gladkykh H.V.,**
Teacher, Foreign Languages Department

## ANALYSIS OF ENERGY EFFICIENCY IN UKRAINE

**Introduction.** Energy efficiency is not just the use of resource-saving technologies, recuperation, installation of energy-efficient windows, for example, or wall insulation. It is a comprehensive approach from the design stage to the commissioning and operation of a facility or equipment. In other words, it is the achievement of economically justified efficiency of the use of such material resources as natural gas, river and sea water, wind, oil, coal, etc., with the current level of technology and compliance with environmental requirements. **Problem formulation.** Today, the problem of improving the efficiency of the energy structure of our state requires a comprehensive modernization of all its components. Improving the energy efficiency of energy infrastructure can be carried out both for individual technologies (technological modernization), object-by-object (object modernization), and the whole system (system modernization). Finding the optimal configuration of opportunities in the face of existing economic, environmental and social constraints in energy policy is a complex challenge and challenge for modern civilization [4].