



ORIGINAL RESEARCH PAPER

Management

OVERVIEW OF 3D PRINTING TECHNOLOGIES

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ABSTRACT

This article is devoted to an overview of various 3D technologies. It solves the properties of each technology and describes the various advantages of individual 3D printing technologies, but also the creation of 3D models using CAD programs, which nowadays have a wide market presence. This article also describes the importance of 3D printing, which is nowadays an integral part not only of the automotive industry but also of the medical industry, where it can create implants replacing parts of the human body. 3D printing is used in almost every industry that is under the influence of human leadership. The 3D model is used mainly in the field of architecture and home design, in the 3D implementation of the future model. Thus, it is possible to describe models made of gypsum composite. It is therefore a fact that 3D printing facilitates and simplifies a number of complex and very expensive processes and thus contributes to their further innovation.

INTRODUCTION

There is a stigma around 3D printers that makes uninformed people think that 3D printing is not practical and that its purpose is to create unnecessary models and figures. That is far from true. The development of modern production processes is closely linked to inventions, such as professional desktop 3D printers, which make it possible to reduce costs and production time to a minimum. With modern 3D printing technology, it is possible to create objects using various technological procedures. 3D printing can be understood as an additive production, a process during which a model is produced from electronic data in physical form by gradual layering of material. These materials include gypsum composite, various types of plastics, waxes, resins, metals, glass, but also ceramics [1].

The most common ways to create an electronic model are CAD systems, 3D scanning using 3D scanning devices. This also includes technical data used in medical imaging systems. The model, which is created in a computer program, needs to be divided into thin horizontal layers and the modified model is ready to be sent as information to a 3D printer. 3D printing is used in almost every industry that is under the influence of human leadership. The 3D model is used mainly in the field of architecture and home design, in the 3D implementation of the future model. Thus, it is possible to describe models made of said gypsum composite. 3D printing has not escaped the art industry either. It will be appreciated, for example, by restorers, for whom the 3D model will be used to display an irreversible artifact of culture. It also serves as an aid to doctors or medical students for the thorough preparation of the operation, or as an opportunity to study individual parts of the human body. It is therefore a fact that 3D printing facilitates and simplifies a number of complex and very expensive processes and thus contributes to their further innovation [2].

3D PRINTING TECHNOLOGIES

By 3D printing itself we mean the additive production process, gradual application of material, its joining until the

creation of a programmed model. Today's 3D printer models use a full range of 3D printing technologies.

Fused deposition modeling (FDM)

This technology makes it possible to build objects with production thermoplastics. Models are made by heating a thermoplastic fiber to a given melting point and extruding the thermoplastic layer by layer (see Fig. 1).

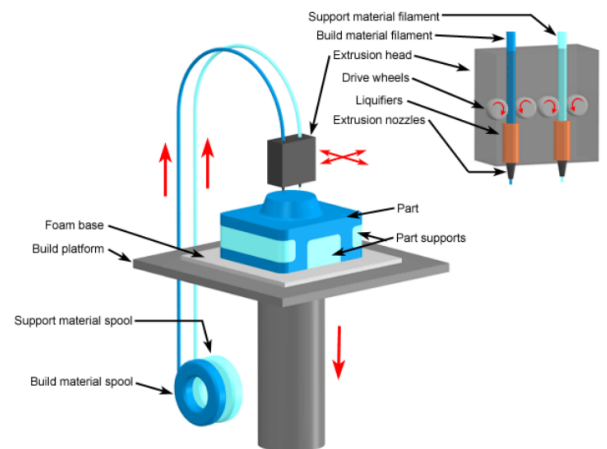


Figure 1: Scheme of FDM technology

Special techniques can be used to create more complex structures. For example, the printer may print a second material that will be a support material for the object being printed during the first printing process. This support material can later be removed or dissolved. This is the most widespread and affordable technology that is often used in the presentation of prototypes and product samples. The printer produces solid and stable models suitable for exactly these purposes [3].

Selective Laser Sintering (SLS) a Direct Metal Laser Sintering (DMLS)

It is a process based on baking metal or polymer powder in layers using a laser to the desired model. The models from these printers are very accurate. The actual operation and procurement of these printers is often very expensive. The portion of the powder material that does not undergo sintering can be used to form the support structure, and this material can be removed after the article itself has been manufactured for reuse. This technology can be encountered mainly in the automotive and engineering industries, but also in medicine.

Electronbeammelting (EBM)

Construction of models by melting metal powder (titanium alloy) in layers using electron beams in high vacuum. The biggest advantage of this technology is the exceptional accuracy and excellent technical properties of printed products. The technology is used in the automotive, engineering and medical industries, but the production of products using this method is very expensive (see Fig. 2).

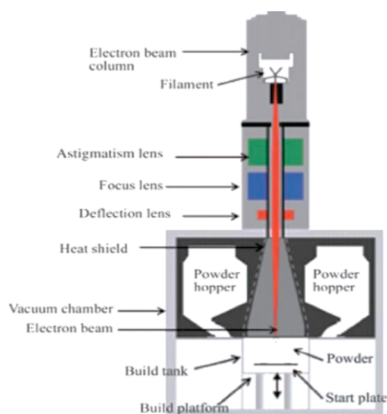


Figure 2: Scheme of EBM technology

Inkjethead 3D printing

Creating a model by applying a thin layer of powder (gypsum or resin) and printing a bonding adhesive from the print heads (similar to an injection molding machine). Available and economically advantageous technology for use in model making, architecture and design. Full color printing can also be used with this technology.

Laminatedobjectmanufacturing (LOM)

Gluing layers of adhesive paper, plastic or metal foil on top of each other and subsequent shaping with a knife or laser. It creates very precise models with a quality surface and the costs of its acquisition are not too high. This method is currently in decline and is used mainly in architecture and geography [4].

PolyjetMatriX

Extrusion of the photopolymer by the print heads and subsequent curing (drying) using a UV lamp. It creates models with a very high quality surface and is suitable for creating details. Most often used in the automotive industry, electronics, medicine, but in the manufacture of clothing.

MultiJetModelling

Extrusion of wax by print heads. Models created with this technology are accurate and detailed, but their disadvantage is that they are too fine and therefore difficult to handle. The use of products produced by this method is mainly in design offices to create smaller samples.

Stereolitografia (SLA)

It uses a liquid plastic / composite (photopolymer) as the starting material and transforms this plastic into a 3D object layer by layer. The resin is placed in a vat that has a transparent bottom. Subsequently, the UV laser follows a trace of liquid resin from the bottom of the vessel to cure and solidify the resin layer (see Fig. 3).

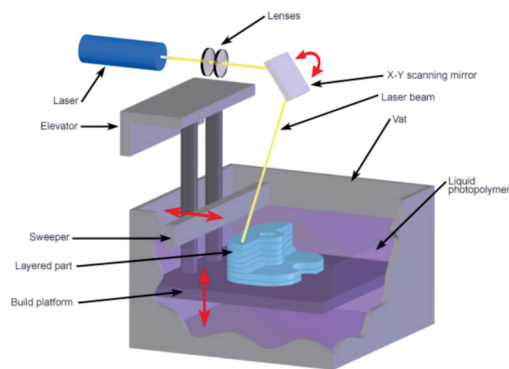


Figure 3: SLA technology scheme

The reinforced structure is then pulled upwards by the lifting platform, while the laser creates a different pattern for each layer to create the desired shape of the 3D model. The result is accurate models with a smooth surface. With this technology, it is possible to create mostly larger models. The disadvantage of this method is the limited choice of material [5].

CONCLUSIONS

Using the latest technologies, the 3D printer can apply liquid material layer by layer. Subsequently, the layers gradually harden until they are joined together to form the final product. This process takes several hours. The time of this operation depends on the material, the method of production and the complexity of the model for production. However, new technologies are trying to minimize this process. In the future, the 3D printer will be an important machine for any production. The growing popularity of 3D printers is due to the fact that in a relatively short time it is possible to produce almost everything from various industries, such as home design, mechanical engineering, or the aforementioned healthcare.

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