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Using 3D printing technology to make aerodynamic models

A new approach to the manufacture of aerodynamic models using 3D printing is proposed.

3D printing system.

3D printing is a tool that allows you to move from the concept (3D-model) to the direct materialization of the object, regardless of the shape of the object, reducing the time between conceptual design and product manufacturing.

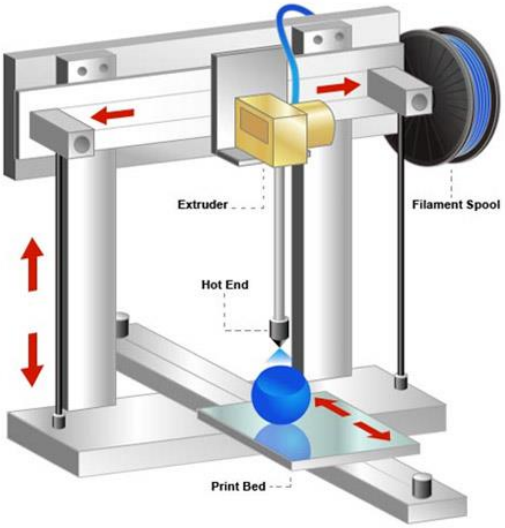

Fig. 1. Typical scheme of a 3D printer

Technology to create 3d solid objects from digital file is three-dimensional printing or additive manufacturing.

Adaptive processes create 3D printed objects. To create an object, you need to stack a layer of specific material until the object is ready. Each layer can be considered as a cross section of a 3D model.

The opposite of 3D printing is cutting on a milling machine products made of metal, wood, plastic and more.

With the help of 3D-printing allows you to make complex shapes and spend less material than traditional methods of making the object.

The aviation industry uses 3D printing in various ways. An example is the production of 3D printing: GE Aviation has printed 60,000 cobalt chrome fuel injectors for its LEAP aircraft engines. The company reached this stage in October 2020, and given that the company produces 600 parts a week on forty 3D printers, this is probably higher than it is now.

Previously, it was necessary to weld together about twenty separate parts, they were combined into one printed 3D-component, its weight decreased by 25% and five times stronger. LEAP engines are the best-selling engine in the aerospace industry, 3D printing has achieved a high level of efficiency and saves $ 3 million per aircraft by 3D printing of fuel injectors, thanks to 3D printing, this one printed 3D part brings financial benefits to hundreds of millions of dollars.

The Boeing 787 Dreamliner has fuel injectors that have been printed, but this is not the only part that is printed in 3D in the 787. There are some more details that are printed.). Norsk has chosen to specialize in titanium parts because this material has a very high ratio of strength to weight and is quite expensive, ie reducing waste through 3D printing has a greater financial impact compared to cheaper metals, where the cost of material waste is easier to absorb. Their technology is that instead of laser metal sintering, as in most metal 3D printers, Norsk Merke 4 uses a plasma arc to melt the a metal rod which in the process is called rapid plasma deposition which can cause up to 10 kg of titanium per hour. For a 2 kg titanium part, you will usually need 30 kg of titanium block from which it will be processed, forming 28 kg of waste, but for only 6 kg of titanium wire is required to make the same part on a 3D printer.

Since its introduction of 3D-printing use solar widely different fields such as biotechnology and the life sciences robotics, engineering, art and food sciences. At present, the use of 3D printing is spreading rapidly in all areas of research and production. This book discusses the use of 3D printing in all major areas of the chemical sciences: analytical, pharmaceutical, physical and synthetic chemistry, biochemistry and chemical education. The relative popularity of different three-dimensional printing methods in different branches of chemistry is shown in Figure 2, with the most popular being the inexpensive and easy-to-use FDM.

SLA technology (stereolithography). SLA 3D printing is based on the effect of a projector or laser on a liquid photopolymer. The laser beam is directed to the area where the walls of the model will be located. Under the influence of the beam, the liquid solidifies, after which the finished layers rise above the liquid level. The process is repeated until the entire model is printed.

SLS technology (selective laser sintering)

Using this technology, materials are sintered with a powerful laser. Layer by layer using a laser is built on the surface of the powder projection of the model in section. Under the influence of a laser beam, individual particles of material are sintered, due to which a whole model is formed.

With this technology you can work with plastics, ceramics, glass. In the case of metals, a mixture of metal powder and special glue is sintered through a laser. After 3D printing with metal, the finished model is placed in an oven, in which the metal particles are finally fused and the bonding adhesive is fired.

This printing technology is ten times more expensive than FDM, because the price of components, consumables and printers is much more expensive. But at the same time printing accuracy is 4-5 times higher than in FDM technology.

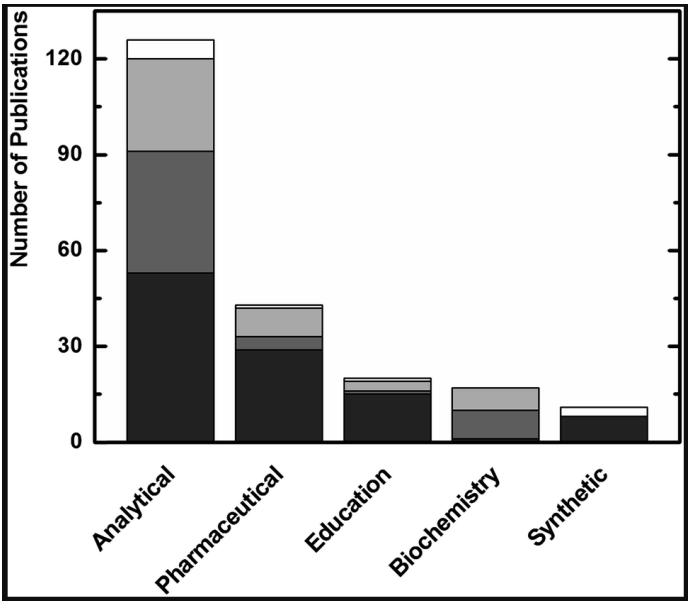

Fig. 2. Classification reports highlighted in the book, their application in various fields of chemistry (analytical chemistry, pharmaceutical chemistry, chemical education, chemistry and synthetic chemistry) and printing technique that was used. Dark gray - FDM, gray - SL, light gray - and white inkjet printing - SLS / M.

And so using 3D-printers can significantly improve the process. Thus saves resources and time. This is especially true for engineering and many other industries. Analysis was created using 3D-modeling helps to find flaws in the designs are under development

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